Bank specific and Macroeconomic Determinants of Distance-to-Default; Evidence from listed Banks of Pakistan.

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CERTIFICATE

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I wholeheartedly dedicated this thesis to my loving mothers and my respected supervisor and other teacher whose continuous motivation and support made it possible for me to complete my thesis.

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Abbreviation

DTD	Distance to Default	**SBP**	State Bank Of Pakistan
Size	Bank Assets Size	**PSX**	Pakistan Stock Exchange
MGT	Management Efficiency	**PD**	Probability of default.
Tier 1	Tier1 capital	**ABL**	Allied Bank Limited
Tier 2	Tier 2 capital	**AKBL**	Askari Bank Limited
REGCAP	Regulatory Capital	**BAFL**	Bank Al-Falah Limited
NPL'S	Non-Performing loan	**BAHL**	Bank Al-Habib Limited
MRP	Market Risk Premium	**BOK**	Bank Of Khyber Limited
PROFI	Profitability Index	**BOP**	Bank Of Punjab Limited
LeqI	Liquidity Index	**BIPL**	Bankislami Pakistan Limited
TurnI	Turnover Index	**FABL**	Faysal Bank Limited
LevI	Leverage Index	**HBL**	Habib Bank Limited
I	Interest rate	**HMB**	Habib Metropolitan Bank Ltd.
EX	Exchange rate	**JSBL**	JS Bank Limited
IPI	Industrial Production Index	**MCB**	MCB Bank Limited
SMBL	Summit Bank Limited	**MEBL**	Meezan Bank Limited
UBL	United Bank Limited	**NBP**	National Bank Of Pakistan
SNBL	Soneri Bank Limited	**SBL**	Samba Bank Limited
SCBPL	Standard Chartered Bank Ltd.	**SILK**	Silk bank Limited

Abstract

This study aimed to investigates distance-to-default and its responsible bank-specific and macroeconomic determinants by selecting 20 banks listed on the Stock Exchange of Pakistan. Using the balanced panel data covering the period 2009-2018, the empirical findings of the random effects model reported that the bank asset size, market risk premium, regulatory capital, liquidity index, and leverage index were a positive and significant effect on distance-to-default; however, the non-performing loan and turnover index was a negative and significant effect on distance-to-default. Similarly, the management efficiency, Tier-2 capital, and profitability index were a negative but insignificant effect on distance-to-default; whereas, the Tier-1 capital was a positive but insignificant effect on distance-to-default. The findings also reported that the interest rate had a negative and significant effect on distance-to-default; whereas, the exchange rate and the industrial production index were a negative but insignificant effect on distance-to-default. The results highlight the significance of utilizing a market-based default risk model and the underlying accounting, financial ratios, and macroeconomic variables in predicting the default risk for the banking sector of Pakistan. The study recommended that the risk management department of banks should take into account these accounting and financial determinants to reduce default risk in the future. The study also recommended that the monetary authorities of the central bank should increase the bank rate to attract investment at a large scale; consequently, the probability of default will be reduced.

Keywords: Distance to Default, default risk, Management efficiency, Interest rate, Pakistan.

Chapter 1

Introduction

In the last five decades, financial institutions that have distinct debt structures as well as the peculiar regulatory environments are mostly not emphasized in the research studies utilizing standard market-based default prediction models (Schenck, 2014). It is paramount to understand the role of financial institutions in the country as well as in the global economy, for it helps in understanding the standard default model that predicts the Default of banks. The banking industry is directly related to the entire economic system. Being a depository financial institution, the banking sector provides opportunities for lending and borrowing. It plays the role of intermediary between savers and borrowers. The household unit and business unit are highly dependent on banks. The individuals take funds for their household needs, and the corporate sector is highly dependent on banks for the commencement of new projects, transfer of payments, letter of credit, technological innovation, and loss bearing, etc.

During this exchange of loanable funds, banks always encounter various risks, such as default risk. According to Coccorese and Santucci (2019), bank liability is a single debt requiring payment at a certain maturity, and if a bank's total asset value is smaller than the value of debt, the Bank will be termed as Default. A bank will default due to insufficient resources to fulfil its debt obligation. The increase in default tendencies during financial crises is due to the improper risk assessment by the banks. Assessment of risk has become extremely important and challenging in today's advanced world due to rising uncertainties and their accompanying risks.

The regular challenges which are faced by the financial system are in the form of globalization, increased competition, financial liberalization, financial integration, and

continuous innovation (Zahra, 2016). These challenges are the major cause of increasing risk and uncertainties for banks and other financial institutions e.g. insurance companies. In today's world, risk management is more challenging as compared to the past. The measurement of default risk is very important for banks. Whenever banks default, it financially affects their shareholders, deposit guarantee scheme, and clients. The Default creates a disturbance in credit flow, circulation of funds, money supply reduction, and the loss of the real economy.

Default risks are very important for any given bank's stability. Whenever a bank defaults, it will create instability in the whole banking industry, which can consequently have negative repercussions for the entire economic system (Zahra, 2016). Quantifying default risk is of immense importance to all credit risk managers, regulators, and investors. There are a number of techniques that have been developed in the last five decades to measure the default risk of banks. These techniques are classified on the basis of three categories, such as accounting-based techniques, market-based techniques, and external rating (Allen and Powell, 2011). The first accounting-based technique consists of Altman's Z-score, Non-performing loan (NPL) analysis, and Ohlson O-score. Some external credit rating agencies such as Fitch, S&P and Moody's Investors are falling under the category of credit rating. However, the most contemporary and sophisticated method is market-based indicators, which include Merton's DTD, VaR (Value at risk), and CreditMetrics™.

Among these indicators, the present study utilizes market-based indicators such as Merton's DTD that measure Distance-to-default. DTD gauge how borrower will be unable to pay its debt obligation (Dar & Qadir, 2019). According to Duan and Wang (2012), "DTD is a powerful indicator for measuring the financial leeway a limited-liability firm has before getting defaulted".

By using market-based indicators for measuring Default has various benefits. First, normally banks are listed in the stock market, and their equity prices are easily available at high frequencies. Second, if the market is proficient, then the stock price reflects an investor's expectation. Third, there is no confidentiality issue, and the Data, which is easily available to the public, and everyone can check the transparency and verifiability of the data. By using the DTD, which is a market-based indicator instead of accounting, reliable results are obtained because the market-based indicator shows investor expectation and forward information whereas accounting-based indicator relies on past information, which in some cases may not be accurate

There are some other certain bank-specific factors that also increase the tendency of Default. The factors include management inefficiency, increasing operating costs, increases in non-performing loans, capital adequacy ratio, Size, tier 1 capital, tier 2 capital, liquidity ratios, profitability ratios, turnover ratios, leverage ratios, etc. Schenck (2014) found that total asset value, net interest margin, operating efficiency, tier 2 capital, and non-performing asset ratio are significant determinants of DTD. Rashid and Abbas (2011) also found Earnings before interest and tax (EBIT) to current liabilities, sales to total assets, and cash flow ratio are significant predictors of Bankruptcy. The results of Muvingi et al. (2015) confirm that EBIT to current liability and market value of equity to long-term debt are significant predictors of Default. Hu and Sathye (2015) study results also indicate that the Gross profit rate, current ratio, and debt to total asset ratio are significant predictors of Default. Waqas and Md-Rus (2019) also identified some financial ratios, which are income to total assets, retained earnings to total assets, EBIT to total assets, a current asset to total liabilities, working capital to total asset, a current asset to a current liability and cash flow from operation to the sale are significant indicators of default risk.

There are certain macroeconomic factors that affect the Default of banks. These factors include interest rate, exchange rate, and industrial production index, which affect the economy through various dimensions. For instance, the interest rate increases the financing cost of the firm and ultimately reduces investment. If the central bank raises interest rates, people deposit their money into banks for the sake of earning a higher return. But in contrast, borrowers will not borrow because it increases the cost of their debt. If the interest rate is decreased, people would withdraw their deposits and try to invest for the sake of higher returns. The fluctuation of the interest rate affects the bank lending channel. (Gunji & Yuan, 2017; Khalid & Khan, 2017). Moreover, many studies examine that interest has significantly affected default risk (Khemraj & Pasha, 2009; Louzisa, vouldis, & Metaxas, 2011; Andrei, 2017). The increase in interest rate also increase cost of capital for non-financial firm. The re-pricing gap of interest rate helps to identify financial institution exposure to interest rate. The bank act is intermediary between saver and buyers the borrow funds at one rate and advance these loan at high rate. The gap between these rate is profit.

The exchange rate also affects banks because most of their funds are in the form of foreign currency. Andrei (2017) found that the exchange rate has extensive influence over default risk. The study of (Khemraj & Pasha, 2009) also examines that the exchange rates have a significant impact on credit risk. The industrial production index is also very important for bank lending and borrowings. If an industry is to perform efficiently, certain funds are required. The Bank provides funds to the industry, and efficient borrowing and lending channels take place between them. Adebola, Wan Yusoff, and Dahalan (2011) found that the industrial production index has a long-run positive impact on default risk.

1.1 Problem statement

The increase in the default probability of banks is slightly different across the world. Every country has its own economic system, which affects banks differently on the basis of their economic conditions. For example, the default tendencies of US and European banks are slightly higher than that of the Australian Banks.[1] The default tendency in the US has declined slightly from 2010, but in the case of Europe, many countries' banks still face distress and extreme pressure[2]. The financial position of the US improves due to flight to quality work in financially troubled periods.[3] The banking system of Asia across the world shows distinguished results because the default tendency is significantly low[4]. Every country has its own unique features due to some macroeconomic factors which try to stable their economic system.

DTD is a measure of firm default risks. Whenever the default tendency is low in the industry, it implies that the industry is stable. When the industry is stable, it corresponds to a stable economic system. But surprisingly, in Pakistan, there is a dearth of studies present in other dimensions that predict Default with the help of accounting measures such as Z-score and O-score that explores bank-specific and macroeconomic variables effect on Default and credit risk.

This study will address the phenomenon of DTD by using the KMV Merton model, a modified form of the Merton (1974) model. This study identifies the default risk of banks and also comprehends how bank-specific and macroeconomic determinants will affect the DTD, which will help the potential investor while making the deposit in banks. It will also help the bank regulators to consider these factors to overcome default risk. Furthermore, it will assist

[1] Zahra 2016 in his MS thesis dissertation
[2] https://www.foreignaffairs.com/articles/united-states/2009-08-17/default-power
[3] Systemic Sovereign Credit Risk Lessons from the U.S. and Europe by Andrew Ang& Francis A. Longstaff , 2012.
[4] Zahra 2016 in his MS thesis dissertation

policymakers to consider these monitory variable impacts, which could lead the Bank to Default."

1.2 Research Questions

The following are major research questions that we will try to answer in this study.

1. Do bank-specific factors affect Bank DTD?
2. What is the effect of macroeconomic variables on DTD?

1.3Objective of the study

Below are the main objectives of the study.

1. To investigate the effect of bank-specific determinants on DTD
2. To study the effect of macroeconomic variables on DTD that will help policymakers to identify those factors that create Default in the banking sector.

1.4 Significance of the study

A bank will default due to insufficient resources to fulfil its debt obligation. The default bank creates a disturbance in the circulation of credit, funds, money supply reduction, and the loss of the real economy. Another problem from the investors' point of view is that they prefer low risk and high return for their investment. But, in the case of banks, it is not easy to identify which banks have a higher tendency of Default.

The present study contributes to the existing literature about DTD and its accounting, financial, and macroeconomic determinants in the context of Pakistan. First, the study provides useful insight into how to measure DTD. The DTD can be measured through a very comprehensive model in the study, such as the KMV Merton model. Then the study further tries

to investigate the effect of Bank specific determinants on DTD, which will help the Management and shareholders to consider these factors and try overcoming these problems, which ultimately lead banks to default. Management should consider DTD value for prediction of Default also consider internal factors such as bank size, non-performing loan, regulatory capital and management efficiency, profitability, liquidity leverage, and turnover ratios to overcome default risk. The study also inspects the effect of monetary variables on banks, which helps the policymakers to consider those factors which affect the banking industry. The study also helps the investor to identify high Default and low default risk firms for their investment. Investors should consider DTD value and avoid investment in those banks that are close to Default. According to the best of the author's knowledge, this is the first study that identifies the effect of Bank specific and monetary determinants on DTD by using a very comprehensive model of Merton KMV.

The study will determine the highest contributing factor in DTD prediction, and it will recommend to the policymaker to tune the factors that can reduce or decreases DTD in the banking sector.

1.5 Research gap

For the last five decades, many researchers are trying to identify the default risk of financial institutions. Researchers try to identify what factors influence firm default risk. There are four main models that measure firm DTD, the Market value proxy model by Brockman and Turtle (2003), the volatility restriction method by Ronn and Verma (1986), the KMV-Merton iterative method, and the data transformed Maximum likelihood method by Duan (1994) and all

these model are modified version of Black and Scholes (1973): Merton (1974) option pricing model.

Schenck (2014) identifies accounting determinants of DTD. The study examines that Non-performing assets and operating efficiency are found to be statistically and economically significant for both DTD measures. Tier 2 capital ratio, Net interest margin, and asset size have a statistically significant correlation with both measures where Tier 1 capital is insignificant. Similarly, Rashid and Abbas (2011) use 24 financial ratios for bankruptcy prediction for non-financial firms. Among these ratios, sales to total asset ratio, EBIT to current liabilities, and cash flow ratio are significant predictors of default risk. In addition, Ijaz, Hunjra, Hameed, Maqbool, and Adnan (2013), suggest that z-score and current ratio are a significant predictor of Default. Elahi, Mehmood, and Awan's (2014) analysis predict the Default risk of Non-financial firms with Macroeconomics dynamics. The results of the analysis indicate that GDP growth, interest rate spread and the exchange rate have a negative effect on EDF, while unemployment has a positive relationship with EDF. The study of Ayub and Javeed (2016) investigates the effect of capital adequacy ratio on the financing behaviour of Islamic banks. The analysis suggests that there is a negative effect of capital adequacy ratio on the financing behaviour of Islamic banks. The study further explains that the Islamic Bank tends to allocate their portfolio in secured investment. Waqas and Md-Rus (2019) explore financial distress predictors for Pakistani non-financial firms. The result identifies Current Assets to Total liabilities, Working capital to Total Assets, and a current asset to current liability are significant for the prediction of financial distress. Cash flow from operation to sale is also significant for the prediction of Default.

The study would have an important contribution to the existing literature. First, it adopts and extends the work of Schenck (2014) DTD and their accounting determinants for developing countries like Pakistan. Second, the study adopts financial ratios and macroeconomic variables used by Rashid and Abbas (2011), Ijaz et al. (2013); Elahi et al. (2014); Ayub and Javeed (2016), and Waqas and Md-Rus (2019) for the banking sector of Pakistan. According to the author's knowledge, the study is a novel extension to the existing literature that investigates accounting, Financial and macroeconomic determinates of DTD for the Pakistani banking sector. Therefore the study provides a significant contribution to the existing literature by filling the gap by utilizing Moody's KMV Merton model for the prediction of default risk and their determinates.

1.6 Organization of the study

The study is organized as follows: the first section comprises the introduction of default risk and DTD. It further discusses DTD measures and problem statements of the study, research questions, research objective, and research gap of the study. Section two provides an overview of theoretical and empirical literature regarding DTD and its determinants. Section three provides information regarding data and the methodology used in the study. Section four provides results and their interpretations. Section five consists of a conclusion, policy recommendations, and future research direction.

Chapter 2

Literature Review

This section provides a detailed overview of the DTD model; it's the theoretical and empirical background. It also discusses new developments and modifications of Distance to the default Model. It also examines bank-specific determinants and macroeconomic determinants of the default risk.

2.1 Theoretical Background

"DTD is the expected variance between the asset value of the firm relative to the default barriers, after correcting and normalizing for the volatility of assets" (Chan-Lau & Sy, 2006).

"DTD is an essential default risk measure. It is an estimate or probability that the borrower will be unable to pay its debt obligation" (Dar & Qadir, 2019).

2.1.1 Option pricing theory

"The objective of the option pricing theory is to gauge the likelihood that the option exercise in money. The theory use five main variables stock price, Exercise price, volatility, risk-free rate, and time to maturity [5] (Black & Scholes, 1973; Merton, 1974).

Most of the corporate default models are based on option pricing theory (Black & Scholes, 1973). Black and Scholes (1973) posit that if we priced options correctly in the market, it should not be possible to gain exact profit by creating a portfolio of both short term and long

[5] Investopedia.com

term options and their underlying stocks. By using this statement, an empirical model for the valuation of option pricing is developed.

In addition, Merton (1974) examines the structural model, which is fit for almost every type of financial instrument. The method is mainly used to value risky discount bonds to predict the risk-structure of interest rates. The basic assumption of the model is that all financial debt is payable on a single future date; also, the model refers to shareholder's interest in the company's equity as a call option on assets.

Similarly, Smith (1976) discusses in his review paper several modifications and development in the equilibrium option pricing theory. Further, he also discusses the empirical justification of the model. Additionally, he also discourses numerous application of the model of the Merton i.e., that how we find financial equity of a levered firm, the risky-structure of Interest rates, the effect of corporate policy and dual-purpose funds.

Besides that, Merton (1977) examines another application of modern option pricing theory. The idea behind this application is that every loan requires a guarantee of payment by a third party. For example, a parent company takes a guarantee of a loan made to its subsidiary company or government guarantees of the loan made to a private organization, etc. These guarantees impose a certain cost on the guarantor. In this research study, a modified model is derived from accumulating these costs.

Furthermore, Nielsen (1992) explains and interprets cumulative normal probability $N(d_1)$and $N(d_2)$ used in the Merton Model. The author concludes that $N(d_2)$ is the risk-adjusted probability that the option will be exercised. The approximate value, calculated by means of risk-

adjusted probabilities, for getting the stock upon expiration of the option will be based upon the option finishing in the money is $N(d_1)$. Therefore $N(d_1)$ is the factor by which the existing value of contingent receipts of the stock exceeds the current stock price.

Another contribution made by Duan (1994) develops an estimation method that makes use of observed prices of derivatives contracts to calculate maximal probability factor for an unobserved asset's value. The model have a potential to originate a numerically calculated probability based on the value of the financial derivatives. The approach is also helpful for difficult financial contracts, such as embedded options.

The model is modified in several ways for the valuation of financial instruments. But many authors and organizations modify the model for finding DTD. There are four main methods that used a modified version of the option pricing theory model for the valuation of DTD or probability of Default (Black & Scholes, 1973; Merton, 1974).

- The Market-value proxy model.
- The volatility-restriction method.
- Merton KMV model.
- The data transformed Maximum method

In a recent study, Coccorese and Santucci (2019) suggest a framework induced from a theory of option of Merton (1974) to the financial risk analysis. According to the author, the modified version for DTD, in contrast to an option definition of call and put, is to consider a bank's liability as a single debt that requires payment at a certain maturity than the Bank will pay its liability only if the value of it's total assets will be greater than the value of debt. Suppose the

value of an asset is lower from debt the firm Default. In addition, in maturity time, if the difference between asset value and debt positive, the will survive, and this difference represents bank equity; on the basis of these assumptions, a new model is developed from option pricing theory.

2.2 Literature review

Default, Financial Distress, and Bankruptcy are three terms used in the literature from past decades (Dichev, 1998). Default risk is the probability that the company and individuals unable to pay their required debt obligations. This situation refers to the firm's failure to meets its financial obligation in the long term. The definition of Default differs across the countries due to different accounting treatment and rules. Although various model exists in the literature that predicts default risk, that is DTD, probability of Default, Z-score, O-score logit, and DTD spread model are widely used in the literature (Aziz & Dar, 2006; Bharath& Shumway, 2008; Harada, Ito, & Takahashi, 2010; Duan & Wang, 2012; and Schenck, 2014).

The DTD and the Probability of Default (PD) are used for the prediction of Default in several studies. The study of Bharath and Shumway (2008) examines Default by using two different techniques, the probability of default model given by Merton and the z-score functional forms. The data sample contains 1449 firms' data from 1980 to 2003. Correlation analysis, out of sample forecasting, credit default swap regression, bond yield spread regression, and Cox-semi parametric hazard model was used for estimation. The results from the hazard model and the Merton DTD Model do not provide sufficient statistics for Default. The naive approach proposed by the author significantly captures the functional form of the Merton DTD probability. The author concludes that structural-models predict Default significantly.

In addition, Wong and Choi (2009) empirically examine the default barriers of large industrial firms. The data sample consists of 10-years daily data from the period 1993 to 2002 of 13317 firms. Brockman and Turtle's (2003) Approach, Maximum likelihood estimation approach, and Monti Carlo simulation method is used for data analysis. Theoretically, the paper shows that using some of the book value of liabilities and market value of equity as a proxy for the Market value of assets produces an upward bias in the estimation of default barriers. The results from the analysis indicate that most of the firm has a positive default barrier which is less than the corporate value of the liability. The asset volatility is also unrealistic, and the corporate asset value is also overstated by the proxy approach. From the analysis, the author argues that while an estimation of the parameter, we spell out the risk of using proxies. Further, the author appeals to the researcher to be aware of this risk of the wrong estimation of a parameter.

Similarly, Harada, Ito, and Takahashi (2010) investigate the movement of DTD in failed Japanese Banks in order to calculate the prediction power of the DTD. The data used in the analysis from April 1, 1985, to June 1, 1992. The author first measure DTD than DTD spread. Also, a comparative analysis is done for six months between DTD failed banks and Benchmark Banks. The result reveals that DTD is a good measure for estimating Bank distress.. The DTD spread is also a good measure. But for some Banks, neither DTD and nor DTD spread predict the Bank's failure. The author argues that the absence of transparency in financial statements and disclosed information make our result partly. Further, the study concludes that many studies identified Bank failures through different techniques but based on my analysis DTD is a reliable measure for predicting Default.

Another contribution by Duan and Wang (2012) introduces a popular credit risk measure known as DTD (DTD). Also, compare the default model with four very popular models of Default. The Market value proxy model, the volatility restriction method, the KMV-Merton iterative method, and the data transformed Maximum likelihood method. The analysis is carried out on panel data of nine firms. The author pays special attention to the financial firms (banks and insurance companies) because of their uniqueness in the capital structure. The financial firms typically have highly leveraged than non-financial firms. The author argues that the popular method of KMV is not useful for these category firms. If blindly apply KMV, it will cause serious distortion to credit analysis. On the basis of theoretical and empirical evidence, the author concludes that the DTD method, which was introduced in the study, is superior to other methods.

In early studies, financial ratios are used to predict the Default and financial health of the firm. The financial ratios are selected on the basis of their easy availability in the financial statements of the firms, which are commonly easily available to the general public. The use of financial ratios to evaluate distressed and health firms start in the mid-1930s with the work of (Winakor& Smith, 1935). A lot of studies use Financial ratios for the prediction of Default Beaver (1966), Altman (1968); Rashid and Abbas (2011); Waqas and Md-Rus (2019). Altman (1968) examines that financial ratios like profitability, liquidity, and solvency ratios are significant predictors of Default. The study of Altman (1968); Beaver (1966); Ohlson (1980); Shumway (2001); Rashid and Abbas (2011); and Waqas and Md-Rus (2019) find a significant negative relationship between profitability and Default. Hence from the literature, there is a negative relationship exists between profitability and Default. Although some researcher uses financial leverage ratios to predict Default, namely total liability to total assets, Earninig before interest and tax to interest expenses, Cash flow to liability, EBIT to total liabilities, Equity to long term liability, and total

equity to total liabilities Bauer and Agarwal (2014); Choe and Her (2002); Altman (1968); Shumway (2001), and Rashid and Abbas (2011). The analysis of prior literature showed a significant impact of financial leverage ratios on Default.

Similarly, the study of Beaver (1966) argues that cash flow ratios are used to evaluate the survival of the firms. The cash flow theory suggests that the firm will be strong; it can generate a lot of funds, and the firm will fail if it is unable to generate adequate cash flows. Researchers such as Beaver (1966), Ohlson (1980), and Rashid and Abbas (2011) examine that cash flow and predicting Default is an inverse relationship.

Most of the studies use these financial ratios to predict Default. Rashid and Abbas (2011) Explore financial variables that differentiate "Healthy" companies from financial "troubled" companies and develop a model which have the ability to predict the financial health of a company and discriminate between the bankrupt and non-bankrupt company. Fifty-two non-financial sector data was collected in which twenty-six are bankrupt, and twenty-six are not for the period 1996-2006. Twenty-four ratios are used, namely Liquidity ratios, profitability ratios, Turnover ratios, and leverage ratios. The discriminant analysis formed a parsimonious model of three indicators, namely sales to total asset ratio, EBIT to current liabilities, and cash flow ratio. The estimation provides evidence that the company has a Z value below zero that falls into the "Bankrupt" while the Z value above 1 indicates non-bankruptcy. The model achieved 76.9% prediction accuracy while using it in forecasting. The Wilk,sLimbda 0.647 at 99% level of the confidence interval, which shows that the model has the potential to be applied practically. The author suggests that the regulatory authorities in Pakistan keep three financial variables for measuring and assessing the financial health of their company.

In addition, Ijaz, Hunjra, Hameed, Maqbool, and Adnan (2013) empirically investigate the financial status of sugar sector companies listed in the Karachi stock exchange by using Altman's z score and current ratio. The Total sample consists of 35 companies for a two year period from 2009 to 2010. The analysis results reveal that the z-score and current ratio are significantly different between failed and non-failed banks. The study suggests that using the z-score and current ratio is a good predictor of assessing Default.

Similarly, Elahi, Mehmood, and Awan's (2014) analysis predict the Default risk of Non-financial firms with macroeconomics dynamics. Also, empirically investigate whether Moody's KMV model captures the default probability of a speculative market like Pakistan. The expected default frequency of Pakistani non-financial firms is calculated. The sample is consisting of 307 firms in detailed 12 industries for a period of 8 years from 2004 to 2011. GMM was used to check the effect of macroeconomic variables on stock market volatility. The major findings of the analysis indicate that GDP growth, Interest rate spread, the exchange rate has a negative effect on EDF, while unemployment is a positive relationship with EDF. The study concludes that Empirical estimation results of EDF show that EDF trend analysis actually portrays the events that impact the Pakistan economy. i.e., Global financial crises 2008, stock market crashes due to artificial bubbles, 2005 earth quick, death of Benazir Bhutto, and War against Terrorism.

In addition, Schenck (2014) investigate the accounting determinants of DTD measure before and during the 2008 financial crisis and also compare two DTD methods, Data transformed maximum probability estimation and naïve approach. The data sample consists of 10-year data from 2000 to 2010 of 22 US large banks whose total assets exceed $50 billion. The results from the cluster analysis indicate that NPA (Non-performing assets) and OP (operating

efficiency) are found to be statistically and economically significant of both DTD measures. Tier-2 capital ratio, Net interest margin, and asset size have a statistically significant correlation with both measures where Tier 1 capital is insignificant. The spread between two measures is an alternative measure of default risk. The spread is negative during the period 2001-2002 and 2008-2009, which indicates an economic downturn.

Another study by Muvingi, Nkomo, Mazuruse, and Mapungwana (2015) investigate the best predictor of Default between market-based models (KMV) and accounting-based models (Z-score). The data sample consists of 3-year data from 2010 to 2012. Multivariate discriminant analysis is used for estimation. The independent variables consist of twenty-two financial ratios. The result from the analysis indicates that the z-score accounting model is superior to KVM because it has a higher accuracy ratio of 0.959 relative to a market-based model of 0.57. The study further concludes that EBIT to Current liabilities and Market value of equity to long term debt is a significant predictor of default use to explore the bankruptcy risk in Zimbabwe.

In addition, the study of Hu and Sathye (2015) investigates the financial distress of the Hong Kong market. The Data is collected from GEM for a period of 10-year from 2000 to 2010. Three types of variables are used financial variables include gross profit rate, Current Ratio, and Debt to total assets. The non-financial variable consists of the frequency of firms changing their auditor and the frequency of auditor report qualified report or explanatory paragraph. Macroeconomic include business climate index. The results from logistic regression and jackknife method, which are used to test the predictability of the various models, indicate that the firm's specific financial, non-financial, and Macroeconomic variable is a better predictor of Default.

Similarly, Kabir, Worthington, and Gupta (2015) investigate the credit risk of 156 conventional banks and 37 Islamic banks across 13 countries from 2000 to 2012. Merton DD and two accounting measures such as z-score and the non-performing loan is used for measuring credit risk. Results of the study revealed that while using the Merton DD model shows that Islamic banks have significant and lower credit risk than conventional banks. On the opposite side, using Z-score and NPL'S Islamic banks shows a much higher credit risk. The overall findings of the study suggest that Merton market-based DTD model provides a reliable result for measuring credit risk.

Another contribution made by Waqas and Md-Rus (2019) explores financial distress predictors for Pakistani firms. The data used in the analysis are 290 listed non-financial firms of Pakistan for a period of 10-year from 2007 to 2016. The Variables used in the analysis are financial ratios means profitability, liquidity, leverage, and cash flow ratios. Also, two important factors include the Size and idiosyncratic standard deviation of each firm's stock return. The result indicates that Income to total assets (ITA), Retained earnings to total assets, and EBIT to Total Assets are a significantly important predictor of Financial Distress. Results from liquidity ratios specify that Current Assets to Total liabilities, Working capital to Total Assets, and a current asset to current liability are significant for the prediction of financial distress. Cash flow from operation to sale is also significant, while Market ratios are insignificant. The result from the logit regression and holdout Model predicts the accuracy of 92%, which is higher than Rashid and Abbas (2011), who report the accuracy of 76.9 and less than Ijaz et al. (2013), who report the accuracy of 95%.

Saha, Ahmad, Eam, and Yeok (2019) examine the financial stability of domestic banks for the period of 2001 to 2014 by using DTD. First, the study investigates the DTD of individuals banks then further identifies the influence of individuals banks towards Systematic risk. DTD frameworks clearly reveal that in the face of the specious strength of banks at all levels, the banking system faced stress post-financial crises. The study concluded that it would be the first study that would attract the attention of the researcher that engaged in financial stability. Furthermore, Dar and Qadir (2019) investigate which parameter between Distance to Default and probability of Default is the best predictor of default risk. The main objective of the study is to inspect the effect of four variables such as assets value of the firm, debt value of the firm, interest rate, and assets volatility on DTD and PD by using one period data. To estimate DTD and PD Black Scholes model was used, whereas: to investigate the effect of four variables on DTD and PD, the study used Taguchi's L27 orthogonal array by using Minitab software. Analysis of variance (ANOVA), and analysis of mean (ANOM) was also used. Findings of the study identified that DTD and PD have an inverse relationship with each other. DTD is maximum while PD is minimum. Based on the analysis, the study suggests DD is the best predictor of default risk.

In addition, Nagel and Purnanandam (2019) examine DTD by using the structural model of default risk. The study uses an assumption that the structural model is not suitable when the firm has a log-normally distributed assets value. Results of the analysis revealed that using a simple DTD structural model does not capture all properties of default risk. Extension in the model DTD RNPD captures all the properties such as liquidity problem, up and down the value of assets, the maturity of debt, and implicit and explicit support of the government.

Another contribution made by Guo and Li (2020) investigates a new version of DTD, namely "Stressed DTD," that measure time-varying default risk in the situation of systematic risk. The analysis examines that "stressed DTD" is powerful and superior in predicating Default during the 2007-2009 crises as compared to ordinary DTD and PD. The analysis further investigates the relationship between S&P credit rating and stressed default risk under uncontrollable risk scenarios. The result of the analysis examines that Stressed DTD explains a larger portion of the variation in S&P rating stressed DTD better reflects the credit stability. However, Silva and Kimura (2020) inspect the existence of sectorial differences in the prediction of PD of 1520 North American infrastructure Companies from 2006 to 2018. Logistic regression with binary dependent variables is used for analysis. The results of the analysis showed that the oil and gas sector shows lower sensitivity to DTD while other companies were showed higher sensitivity when DTD is used to explain the Default of these companies.

Zhang, Ouyang, Liu, and Xu (2020) investigates determinants of business default risk in china. The data sample consists of 981 listed firms for the period 1998-2013. The variable used in the analysis is liquidity, leverage and firm Size is the key Bank internal factors while interest rate and stock return are used is a macroeconomic factor. Multinomial logistic regression results revealed that liquidity has a positive relationship with DTD means that high liquidity firms fail to overcome DTD because a financially constrained small firm requires inadequate cash to prevent financial distress. Where financially unrestrained firms are capable of mitigating financial distress. The study further investigates the significant negative relationship of Intrest rate with DTD while the stock return is a positive relationship with DTD.

The study of Kenc, Cevik, and Dibooglu (2020) investigate default risk parameters by using a model that is capable of volatility clustering. The study used 138 US commercial banks whose assets value exceed 1 billion at the end of 2006, covering 73% of the sample of the banking industry for the period 2000 to 2013. The results from the analysis indicate that the NGARCH option pricing model better predicts Default that the Merton option pricing model. Further, the study uses the GARCH option pricing model and Merton model for the finding of in-and out-of-sample forecasting performance of the estimated default probabilities. Results revealed that the GARCH model outperforms while the Merton model offers a good parameter in calculating Default. The instability or default in banking sector has far reaching effects for the global economy, therefore, many researchers have tried to find the early warning signs of distress in banks (e.g. Schenck, 2014; Rashid & Abbas, 2011; Muvingi et al. 2015). The profitability of banks has also been a well-researched area (e.g. Short, 1979; Berger, 1995; Adusei, 2015. However, there are quite a few studies in the literature that address the linkage between the profitability and stability of banks (e.g. Martynova et al. 2015). The results of the studies show mixed evidence. Most of the studies that address the linkage are conducted in a multi country context (e.g. Arena, 2008), which restricts the policy implications as the results are difficult to generalize given the country wide differences (Ali, 2015).

2.3 Hypothesis development

The main aim of the study is to identify and investigate those determinants that affect DTD. These Determinants are divided into two main categories, with one representing Bank specific determinants, and the other represent macroeconomic determinants. According to the literature, both determinants have a significant impact on DTD.

H1: Size is positive effect on DTD.

H2: Management Efficiency has negative effect on DTD.

H_3: Tier-1 capital has negative effect on DTD.

H_4: Tier-2 capital has negative effect on DTD.

H_5: Regulatory capital has positive on DTD.

H_6: Non-performing assets has negative effect on DTD.

H_7: Market risk Premium has positive on DTD.

H_8: Liquidity has positive effect on DTD.

H_9: Profitability has negative effect on DTD.

H_{10}: Turnover has negative effect on DTD.

H_{11}: Leverage has positive effect on DTD.

H_{12}: Interest rate has negative impact on DTD.

H_{13}: Exchange rate negative impact on DTD.

H_{14}: Industrial production index has a positive effect on DTD.

Chapter 3

Data Description and Methodology

This chapter briefly explains data collection techniques and methodology, which are used to find out determinants of DTD**.**

3.1 Data Description:

3.1.1 Population and sample

This empirical study tries to investigate the determinants of DTD and the relationship among those determinants by considering annual time series covering the period from 2009 to 2018 of the banking industry of Pakistan. The Pakistan banking sector consists of 46 banks[6], of which 36 are commercial and Islamic while 10 are microfinance banks. The commercial banks are further classified into eight foreign banks[7], 5 Islamic banks in which two banks are lies in the category of foreign banks. Local commercial banks are 25, of which 18 banks are private, and seven banks are public sector banks (State Bank of Pakistan, 2020). The sample size of this study comprises 20 listed banks in Pakistan stock exchange for a period of 10 years from 2009 to 2018. The sample period is selected on the basis of the availability of data. Daily stock prices data are collected from Pakistan stock exchange, KHI stocks, and the data source for other variables is State Bank of Pakistan, Banking statistics of Pakistan, Global economy, Open doors for all and annual reports of banks.

[6] http://www.sbp.org.pk/ecib/members.htm
[7] https://www.export.gov/article?id=Pakistan-US-Banks

Table 3.1 Sources of Variables

Name of variable	Extracted from
Bank size, Profitability ratios, Liquidity ratios, Turnover ratios and leverage ratios, Tier 1 and Tier 2 ratios, Regulatory capital	State Bank of Pakistan
Share price and return on the market portfolio	Pakistan Stock Exchange
The risk-free rate, Interest rate	Open door for all.
Industrial production index and exchange rate	Global Economy.
DTD	Authors own calculation

3.2 Model specification

In the theory of econometrics, the data set comprises time series, and the cross-sectional unit is called Panel data. It is also called pooled data or longitudinal data. Basically, Panel data is the combination of time series and cross-section data (Asteriou & Hall, 2011; Studenmund & Johnson, 2016; Wooldridge, 2012; Gujarati, 2004). For analysis purposes, the study uses Panel data regression, but it is important to know the model of panel data. The panel data are further classified into three different models, such as the fixed effect method, common constant method, and Random effect method.

3.2.1 Common constant model

The common constant method is also called the pooled OLS method. The method is purely based on the assumption that there are no differences among the intercept α of cross-sections. In another world, it assumes constant intercept α for all cross-sections. The prior assumption of common constant that the Data is prior homogenous and intercept α is the same

for all cross-sections (Asteriou & Hall, 2011; Studenmund & Johnson, 2016). In general, the model can be written as:

$$\boldsymbol{Y_{it} = \alpha_o + \beta_1 X_{it} + \varepsilon_{it}} \quad \textbf{(1)}$$

3.2.2 Fixed effect model

This method is made on the postulation that intercept α is varying for all cross-sectional unit but still assume that slope coefficient β is constant for all cross-sections (Gujarati, 2004). We can write the model;

$$\boldsymbol{Y_{it} = \alpha_o + \beta_1 X_{it} + \varepsilon_{it}} \quad \textbf{(2)}$$

The subscript I with α show that intercept varies for all cross-sections. If the intercept of the cross-sectional unit does not vary over time, it is time-invariant, and if it varies over time, it is time-variant. It is also assumed that the slope coefficient β of the cross-sections do not vary across the individuals or over time. To show the extent of variation in each cross-section unit a differential intercept dummies are included in this method (Gujarati, 2004; Asteriou & Hall, 2011; Wooldridge, 2012; Studenmund & Johnson, 2016). We can write the model as:

$$\boldsymbol{Y_{it} = \alpha_1 + \beta_2 X_{2it} + \beta_3 X_{3it} + \ldots\ldots\ldots \beta_k X_{kit} + \varepsilon_{it}} \quad \textbf{(3)}$$

While including dummies to estimate the fixed effect in the model is also refers as least square dummy variable (LSDV). These dummies variables permit us to take dissimilar group-specific estimates for each of the constants for each different group. By considering all categories of dummy variables at the same time and space create the problem of multicollinearity. However, all the dummy variables will form an exact linear-relationship with the intercept term(β_0). In the econometric theory, this situation is called the dummy variable trap. By using less number of

dummy (n-1) use avoid falling into the dummy variable trap means to avoid the case of perfect collinearity. If there is variation in data and the intercept α is different for each cross-section unit, then the best method for estimation is the fixed-effect method (Asteriou & Hall, 2011). If the calculated value of F-statistic is more than the F-critical value, we scrap the null hypothesis that the intercept would be the same for all cross-sectional units (Asteriou & Hall, 2011).

Ho $= \alpha 1 = \alpha_2 = \ldots\ldots = \alpha_n$

The fixed-effect method is applied; otherwise, a common constant method will be applied for estimation.

3.2.3 Random-effects model.

The assumption for random effect model is that intercept α for each cross-sectional unit is drawn from a distribution that is centred on a mean intercept. Therefore each intercept is drawn from "intercept distribution," and the error term is independent for any observation. The random effect model has more degree of freedom as compared to the fixed-effect model. The method estimates the parameter that entitles the distribution of intercepts. The method assumes that the coefficient of the explanatory variables is not meaningful because it follows a random path. The main disadvantage of the model as, it assumes the unobserved impact of omitted variables is uncorrelated with the explanatory variables (Studenmund & Johnson, 2016). The model of the random effect as:

$$\boldsymbol{\alpha_i = \alpha + V_i}$$

Where V_i is a zero-mean standard random variable. Therefore the general model for random effect as:

$$Y_{it} = (\alpha + V_i) + \beta_1 X_{1it} + \beta_2 X_{2it} + \cdots + \beta_k X_{kit} + \mu_{it} \quad (4)$$

3.2.4 Principal Component Analysis (PCA)

"The principal component analysis (PCA) is a statistical package method that uses an orthogonal transformation to produce linearly uncorrelated variables called principal component from a set of observations of possibly correlated variables. The main objective of PCA is to reduce the number of variables and cluster those variables into a stingier group. This group is also known as the component factor, and each component contains interrelated variables. PCA is extensively used in multivariate statistical process control. PCA transforms original measured data into a new uncorrelated variable called the principal component. The original measured Data is treated as an independent variable, and each principal component is a linear combination of original variables. If there are n numbers of variables, then the number of principal components is n-1 in Principle component analysis.

The study uses four different sets of Financial Ratios the Liquidity, Profitability, Turnover, and Leverage Ratios, which have several proxies. The use of several proxies creates correlation highly. To reduce the Size of several proxies and transform them into a set of uncorrelated variables called principal components, PCA will be used.

3.3 Econometric Model

In this section, we develop an Econometric model for our analysis. The general model for panel data estimation is:

$$Y_{it} = a_o + \beta_1 X_{it} + \varepsilon_{it} \quad (5)$$

In Equation (5), Y_{it} is the dependent variable where the subscript i and t represents the cross-sectional and time-series units, respectively. α_o is the intercept term and β_1 is the slope term of the model, which needs to be empirically estimated. X_{it} are a set of the independent variable for i cross-section and t times. To check the effect of the macroeconomic and bank-specific variable on DTD, we can modify the Equation:

$$\begin{aligned} \boldsymbol{DTD_{it}} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1 size_{it}} + \boldsymbol{\beta_2 MGT_{it}} + \boldsymbol{\beta_3 Tier1_{it}} + \boldsymbol{\beta_4 Tier2_{it}} \\ + \boldsymbol{\beta_5 REGCAP_{it}} + \boldsymbol{\beta_6 NPL_{it}} + \boldsymbol{\beta_7 MRP_{it}} \\ + \boldsymbol{\beta_8 LeqI_{it}} + + \boldsymbol{\beta_9 ProfI_{it}} + \boldsymbol{\beta_{10} TurnI_{it}} + \boldsymbol{\beta_{11} LevI_{it}} \\ + \boldsymbol{\beta_{12} IPI_t} + \boldsymbol{\beta_{13} IR_t} + \boldsymbol{\beta_{14} Ex_t} + \boldsymbol{\varepsilon_{it}} \end{aligned} \quad \textbf{(6)}$$

In Equation (6), the DTD is the measure of DTD for different banks. DTD is a measure of firm default risk, which shows how a firm is far away from Default. The intercept term is β_0 and the slope coefficients are from $\beta_1$toβ_{15}. The independent variables are Bank Size for all i banks and t times. Nim is the net interest margin for i banks and t time. MGT is the Management efficiency for ith banks and time t. Tier 1 and Tier 2 capital for ith banks and t times. REGCAP is the regulatory capital ratios for ith banks and t times. NPL is the Non-performing loan ratio. MRP is the market risk premium. $LeqI_{it}$is liquidity index, $ProfI_{it}$ is profitability index, The turnover index is $TurnI_{it}$ and Leverage index is $LevI_{it}$.

Three macroeconomic variables is used as independent variables in the analysis. The IPI is used as a proxy for the industrial production index, which further indicates economic growth, IR is the

interest rate that is in percentage form, and EX is the Exchange rate of the country, where the exchange rate is the value of PKR in term of USD.

3.5 Variables description

3.5.1 Dependent variables

3.5.1.1The KMV Merton Distance to Default

Merton's DTD is one of the most popular and efficient techniques among all the market-based techniques to measure default risk (Harada, Ito, & Takahashi, 2010). In 1993, Moody's KMV modified the Merton structural model (1974) for the estimation of the firm probability of Default at a specified point of time. These techniques are applied to both financial as well as Non-financial industries. According to Merton's KMV approach, if the market value of any of the firm assets declines in such a way that it becomes less than the book value of debt, then the firm will be termed as Default (Coccorese & Santucci, 2019). If the value of debt is subtracted from the market value of equity upshots in default probability. Consequently, if the resulting value is divided by the firm's esteemed volatility, then the end value is called DTD. The DTD shows that how far a firm is away from Default.

The Merton (1974) structural model is the foundation of Moody's KMV model. The option pricing theory and structural model of Merton are considered in the context of banking firms in the setting of the current study then we consider equity of a bank is call options on Bank's asset, which provide that right that shareholders have the residual claims on firm's assets after the settlement of all liabilities. The book value of the bank debts is referred to as the strike price of a call option. Now in line with Merton's hypothesis, bank liability is single debt demanding payment at a certain maturity T. The Bank will meet its obligation only if the bank asset value is greater than the value of debt. The Bank will survive if the value of the total assets is greater than

the value of debt; otherwise, it will default. And the difference between bank assets value and bank liability is the equity of a bank. Similarly, if the bank asset value falls below bank debts, then bank equity will be zero. (Crosbie & Bohn, 2003; Bharath & Shumway, 2008; Allen & Powell, 2011; Duan & Wang, 2012; Coccorese & Santucci, 2019).

There are two important assumptions of the DTD model. First, the total market value of bank assets follows a geometric Brownian motion:

$$\boldsymbol{dV_A = \mu V_A dt + \sigma_A V_A dW} \quad \textbf{(7)}$$

In the above Equation, V_A is the value of the total assets of the banks, μ is the expected compounded return on bank assets V, σ is bank asset volatility or standard deviation of bank assets, dW is the standard Weiner process.

The second utmost important assumption of the Merton model is that a firm will issue only one discount bond for the maturity of T time periods. Also, consider firm equity as a call option on the underlying value of firm assets. The equity strike price is V_A, which is equal to the face value of bank liability and time to maturity T. If V_E represents the market value of equity, then according to the option pricing formula of Black and Scholes (1973):

$$\boldsymbol{V_E = V_A\, N(d1) - Xe^{-rT}\, N(d2)} \quad \textbf{(8)}$$

In Equation (8), V_E is the market value of the firm's equity, X is the face value of the firm's debt, r is the risk-free rate, N(d1) and N(d2) is the cumulative normal distribution function.

$$\boldsymbol{d1 = \frac{Ln\left(\frac{V_A}{X}\right) - \left(r + \frac{1}{2}\sigma_A^2\right)T}{\sigma_A\sqrt{T}}} \quad \textbf{(9)}$$

In Equation (9), d1 is the cumulative normal probability.. $\boldsymbol{\sigma_A^2}$is the volatility of bank assets.

$$\boldsymbol{d2 = d1 - \sigma_A\sqrt{T}} \quad \textbf{(10)}$$

d2 is the risk adjusted likelihood that the option will be done. (Nielsen, 1992).

The value of the firm equity and volatility of equity is required to calculate the value of DTD. The Eq (8) express the value of firm equity. The second portion of the Equation tells us the volatility of the firm's value to the volatility of the firm's equity. So, according to another assumption of the Merton model in the banking industry, equity value can be regarded as a function of the value of a firm and time,

$$\boldsymbol{\sigma_E = (\frac{V_E}{E})\frac{\partial E}{\partial V}\sigma_A} \quad \textbf{(11)}$$

However, $\frac{\partial E}{\partial V}$ = N(d1). So that according to Merton model assumptions, the volatilities of the firm and its equity can be shown:

$$\boldsymbol{\sigma_E = (\frac{V_E}{E})N(d1)\sigma_A} \quad \textbf{(12)}$$

Thus, we can write DTD is:

$$\boldsymbol{DTD_t = \frac{ln\left(\frac{V_{At}}{X_t}\right) + \left(\mu - \frac{1}{2}\sigma_A^2\right)T}{\sigma_A\sqrt{T}}} \quad \textbf{(13)}$$

In equation (13) DTD shows DTD,$V_A$are the value of the assets, μ is the expected return on assets, σ_A^2 is the volatility of the assets, T denotes the time period and X_t is the face value of debt.

For instance, the value of liabilities is concerned; the value of liabilities is considered as the terminal value of assets in Merton's model. But, Moody's KMV has modified Merton's model

(1974) by assuming the default point as the summation of the short term plus half (.5) of the long term liabilities. This modification is proposed after observing a large sample of firms when their assets and liabilities value is too much high than if the asset value declines to a critical point which lies somewhere between the value of total liabilities and short term liabilities, the firm termed as Default.[8] We can calculate the default probability is:

$$\boldsymbol{PD = N(-DD)} \tag{14}$$

Where in Equation (13), N denotes cumulative probability distribution.

The value of the volatility of equity can be required to estimate Equation (14). The volatility of equity can be calculated by using the daily stock price return of public listed companies in the stock market. The return is calculated by the methodology proposed by (Hull 1999).

$$\boldsymbol{R_i = \ln(P_t - P_{t-1})} \tag{15}$$

Where, (i = 1, 2, 3, 4, . . .,n).

We can calculate annual volatility by using this Equation,

$$\boldsymbol{\sigma_E = \frac{1}{\sqrt{\frac{1}{n}}}\sqrt{\frac{1}{n-1}\sum_{i-1}^{n} r_i^2 - \frac{1}{n(n-1)}\left(\sum_{i-1}^{n} r_i\right)^2}} \tag{16}$$

In Equation (16), n represent a number of the trading day in a year. From the above Equation, the study calculates the value of the volatility of equity. Now after inserting the market value of equity (VE), which is the product of share prices and the number of outstanding shares,

[8] https://www.moodys.com/registercomplete.aspx?lang=en&cy=global&from=Nav_Reg&ls=en

the value of liabilities ($X_{),}$ which as short term debts plus half of the long term debts the study use this indicator because banks have different capital structure some banks are large in terms of market capitalization and some bank are small that why the study use this indicator, risk-free rate (r) as return on treasury bills in Equation (8) and Equation (12) the asset market value, volatility and expected drift are estimated from these. Further, these values are used in Equation (13) to estimate the value of DTD.

Whenever the default distance score is high, it shows that the bank values are further from the default point and ultimately lower be the default probability.

Table 3.2 Distance-to-default variables definitions and sources of data.

Variables	**Definition**	**Description and data source**
σ_E	Volatility of Equity	Annualized volatility of stock prices with daily frequency.
V_E	Value of equity (Market capitalization)	Stock price × Number of outstanding shares (DataStream, KHI stocks, Pakistan stock exchange)
X	Total liabilities	Short term debts + half of the long term debts (financial statements of the banks)
R	Risk-free rate	Treasury bill rates (per annum) (IMF website)
V_A	The market value of assets	Author's own calculation
σ_A	Assets volatility	Author's own calculation
μ	Expected return on assets	Author's own calculation

3.5.2 Independent variables

3.5.2.1 Size

Following Tajuddin, Shahimi, and Hamid (2009); Ahmad (2004), Size is calculated under:

$$\boldsymbol{Size = Natural\ log\ of\ Total\ Assets} \qquad \textbf{(3.5.1)}$$

3.5.2.2 Net interest margin

Net interest margin (NIM) is a ratio that gauges how an effective firm invests its funds in Better avenues as compared to its expenses in the same avenue. A negative interest margin value shows us that the firm has not made an optimal decision because interest expenses are more than the amount of return generated from the investment. It is a profitability indicator for a firm, that how much the firm earns interest from loans and mortgages (Chen, 2019). It can be calculated by the formula:

$$\textbf{Net interest Margin} = \frac{(\textbf{Total Interest Income} - \textbf{Total interest Expences})}{\textbf{Total Assets}} * \textbf{100} \qquad \textbf{(3.5.2)}$$

3.5.2.3 Management Efficiency

MGT is a measure that shows how efficiently the firm utilizes its funds. Actually, it is the ratio of earning assets to total assets (Ahmad, 2004; Ahmad & Ariff, 2007; Tajuddin, Shahimi, & Hamid, 2009). The formula is as follows:

$$\textbf{MGT} = \frac{\textbf{Earning assets}}{\textbf{Total assets}} \qquad \textbf{(3.5.3)}$$

Whereas,

Earning assets = Total assets – (cash + Fixed asset + non-earning deposit).

Whereas, Non-earning deposit is revenue income generated from the non-core activities by the banks and financial institutions such as account opening charges, loan processing fee, late payment fee, credit card charges, service charges, Penalties etc.

3.5.2.4 Non-performing loan (NPL)

Those loans are advances that are considered in the form of Default or in arrears. In some cases, debt will become non-performing when a loan payment is not recovered in 90 days. It can be calculated as Non-performing Loans divided by total assets (Ahmad, 2004; Tajuddin, Shahimi, and Hamid, 2009; Schenck, 2014). The formula for this measure as follows:

$$\mathbf{NPL's} = \frac{\mathbf{Non-performing\ Loans}}{\mathbf{Total\ Assets}} \qquad \mathbf{(3.5.4)}$$

3.5.2.5 Tier 1 capital

According to the Basel 11l Accord, tier-1 capital is the core capital composed of equity capital and retained earnings (Schenck, 2014).

Tier-1 = Equity capital + Statutory and general reserves as disclosed on the balance sheet + unappropriated profit + non-controlling interest – (book value of intangibles – shortfalls in provisions – reciprocal cross-holdings by banks – 50% investment in equity or other regulatory capital)

3.5.2.6 Tier 2 capital

According to Basel 11l Accord, the capital that includes 100 per cent of tier 1 capital plus loan-loss reserves in contradiction of unidentified losses, hybrid debt capital, and subordinate debts (Schenck, 2014).

Tier 2 capital = Revaluation reserves + Hybrid capital instruments + Subordinated term debt + general loan loss reserves + undisclosed reserves. **(3.5.5)**

3.5.2.7 Regulatory capital Ratio

Regulatory capital or capital adequacy ratio measure those amount that the Bank or other financial institution must have required and imposed by its financial regulators. Actually, it is the percentage of risk-weighted assets. It is the ratio of tier 1 capital to the total loan (Ahmad, 2004; Ahmad & Ariff, 2007; Tajuddin, Shahimi, & Hamid, 2009). Its formula as under

$$\mathbf{REGCAP} = \frac{\mathbf{Tier\ 1\ capital + Tier\ 2\ Capital}}{\mathbf{Risk\ weighted\ assets}}$$

(3.5.6)

3.5.2.8 Market risk premium.

MRP is the difference between returns on the KSE-100 index and returns on treasury bills (Schenck, 2014).

$$\mathbf{MRP} = \mathbf{R_m} - \mathbf{R_f} \qquad \mathbf{(3.5.7)}$$

Whereas,

R_m is the Return on market portfolio, and R_f is the risk-free rate.

3.5.2.9 Liquidity index ratios

Liquidity ratio is the measure that shows a firm ability to pay off its required short-term debt obligation. Rashid and Abbas (2011) predict the Bankruptcy of the non-financial firm on the basis of these measures. The study uses PCA analysis to make an index of different proxies of variables into one principle component to avoid multicollinearity. But the study uses the Liquidity index in the context of the Financial sector subject to availability of data. The variables included in the liquidity ratio is as followed:

Table 3.3 Variables that represent liquidity ratios.

Name of the variables	Measurement	References
LCACL **Current assets to current liabilities**	CACL = current assets divided by current liabilities.	(State Bank of Pakistan,2020)
LCCTA **Cash and Balance with Bank to Total assets**	$\frac{cash\ and\ balance\ with\ banks}{total\ assets} * 100$	
LITA **Investment to total assets**	$\frac{Total\ investment}{total\ assets} * 100$	
LDATA **Total deposits to total assets**	$\frac{Total\ Deposits\ and\ other\ accounts}{Total\ assets} * 100$	

3.5.2.10 Profitability index Ratios

A class of financial metrics that assess a company's ability to generate revenue from efficient utilization of its existing assets. Profitability ratios show us a firm ability to generate revenue and value for its shareholders. Various studies use profitability ratios for predicting Bankruptcy or financial distress of non-financial firms (Rashid & Abbas, 2011; Waqas & Md-Rus, 2019). The profitability ratio can be calculated using the following parameter.

Table 3.4 Profitability ratios include the following parameters.

Name of the variable	Measurement	References
PSR **Spread ratio**	$\frac{Net\ markup / interest\ income}{Markup / interest\ earned} * 100$	(State Bank of Pakistan,2020)
PROA **Return on assets**	$\frac{Net\ profit\ after\ tax}{Total\ Assets} * 100$	
PNIM **Net interest margin**	$\frac{(Total\ Interest\ Income\ -Total\ interest\ Expences)}{Total\ Assets} * 100$	
PROE **Return on equity**	$\frac{Net\ profit\ after\ tax}{Shareholder\ equity} * 100$	
PNITA **Non-interest income to total assets ratio**	$\frac{Total\ non-interest\ income-markup}{Total\ assets} * 100$	

3.5.2.11 Turnover ratio index

Turnover ratios represent the number of assets or liabilities that the company expressed in the form of its sales. It also shows how efficiently a business utilizes its assets. It means how

quickly a firm receives its funds, how much inventory is on hand. The study of Rashid and Abbas (2011) use these variables for predicting Default.

Table 3.5 ***Variables include in turnover ratios***

Name of variables	**Measurement**	**References**
TSTTA **Sale to total assets**	Sales / total assets Sales = Net mark-up/Interest Income + Non mark-up/Interest income	(Rashid & Abbas, 2011)
TWCTS **Working capital to sale**	Working Capital /sales	(Rashid & Abbas, 2011)

3.5.2.12 Leverage ratios index

Leverage ratio is composed of financial metrics that show how much capital is composed of debt financing or the ability of a company to pay off their required debt obligation. The ratio is also used for measuring a company's mixture of operating expenses to get the knowledge of how much change in output will affect operating income. There are various leverage ratios used by the scholarly authors in their respective studies to predict Default. The name of the variables and their measurement are given in table 5.

Table 3.6 Leverage ratio variables

Names of variables	Measurement	References
LCLTA **Current liability to total asset**	Current liabilities/ total assets	(Rashid & Abbas, 2011) and Authors own calculations
LCR **Capital ratio**	$\frac{Total\ Share\ holder\ equity}{Total\ assets} * 100$	
LDER **Deposits to Equity ratio**	$\frac{Total\ Deposits}{Total\ shareholder's\ equity}$	
LTDTA **Total debt to total assets**	Total debt / Total Assets	

3.4.3 Macroeconomic variables

The current empirical study has also considered three major variables, such as the interest rate, exchange rate, and economic growth (IPI).

3.5.3.1 Interest rate

The interest rate has much influence on the cost of credit; for instance, if the interest rate rises, it increases the cost of the borrower's on debt payment. Various studies use the interest rates as a macroeconomic determinant of default risk or credit.

3.5.3.2 Exchange rate

The exchange rate is the price or purchasing power of the home currency in terms of foreign currency (Waqar & Khan, 2017). The study collects data on the exchange rate from the state bank of Pakistan website (2020). A lot of studies use the exchange rates as determinants

of Default and credit risk (Lu, Thangavelu and Hu, 2005; Moinescu and Codirlasu, 2012; Zeitun, 2012; Andrei, 2017).

3.5.3.3 Industrial production index

Industrial production index is an economic indicator that measures the real output of production, manufacturing, services, mining, electricity and gas, oil exploration industries relative to a base year. Adebola, Wan Yusoff, and Dahalan (2011) used IPI as a determinant of credit risk. The IPI data is also available on the state bank of Pakistan website (2020).

Table 3.7 Expected sign of Variables

Variables Name	**Expected Sign**
Banks Assets Size	+
Management Efficiency	-
Tier -1 Capital	-
Tier 2 Capital	-
Regulatory Capital Ratio	+
Non-performing loan	-
Market Risk Premium	+
Profitabity Index	+
Liquidity Index	-
Leverage Index	+
Turnover Index	-
Interest Rate	-
Exchange rate	-
Industrial Production index	+

Chapter 4

Results and Discussion

This chapter introduces the descriptive statistics of the data, results of the correlation analysis, and the results of panel data analysis followed by an interpretation and discussion of the empirical results. Further Section 4.1 introduce the descriptive statistics of the Data, which provides the overall summary of the given data. Section 4.2 investigate co-relation among variables in order to check multicollinearity. Section 4.5 explain the overall effect of independent variables on DTD and their level of significance.

4.1 Descriptive Statistics

Descriptive statistics is a summary statistics that describe the nature and overall behaviour of the data. These statistics provide a summary of the sample data under consideration. For instance, it includes the mean value that provides information about the average value of the examined data. Similarly, the standard deviation statistic shows the dispersion or deviation of the data from its mean value. Another key statistic is known as skewness, which measures the degree of distortion or asymmetry in the set of given data and similarly, kurtosis is another statistic that measures whether the data under examination are heavy-tailed or light-tailed in comparison with the normal distribution. Table 1 shows the overall summary of the descriptive statistics for the considered Data, which is comprised of 200 observations of each variable. The descriptive statistics provide information about the dependent variable, which is the DTD and its bank-specific and macroeconomic determinants. The bank-specific variables c include the Size of management efficiency, TIER1, TIER 2 capital, regulatory capital ratio, non-performing loans, market risk premium, and profitability ratios. Profitability ratios are net interest margin,

spread ratio, return on assets, return on equity, and non-interest income to total assets ratio. The dataset also includes liquidity indicators which consist of LCACL (liquidity and current assets to current liability ratio), current assets to total assets ratio, deposit to total assets ratio, and investment to total asset ratio. The leverage ratio is comprised of capital ratio, deposit to equity ratio, total debt to total equity ratio, and current liability to total assets ratio. Similarly, turnover ratios include sales to total assets ratio and working capital to total assets ratio. And finally, the macroeconomic variables include Further Section 4.1 introduce the descriptive statistics of the Data, which provides the overall summary of the given data. The interest rate and exchange rate.

Table 4.1 Descriptive Statistics

T	**Obs**	**Mean**	**Std.Dev**	**Min**	**Max**	**Prob.**
Banks Assets Size	200	1.41	2.80	-8.79	12.51	0.000
Management Efficiency	200	19.64	1.073	16.98	21.83	0.06
Tier -1 Capital	200	0.31	0.10	0.1447	0.8072	0.01
Tier 2 Capital	200	34262	34571.85	-4248.68	135871.5	0.00
Regulatory Capital Ratio	200	8022.81	10522.08	-832.833	47110.56	0.00
Non-performing loan	200	0.08	0.044	0.016006	0.298122	0.00
Market Risk Premium	200	25138052	27017970	741680	128277000	0.00
Profitabity Index	200	0.087	0.21	-0.22657	0.345123	0.00
Liquidity Index	200	1.60	1.0002	-6.054	2.19	0.00
Leverage Index	200	1.00	1.003	-3.22	5.31	0.00
Turnover Index	200	3.5	1.001	-1.21	2.21	0.00
Interest Rate	200	3.5	1.001	-0.77	13.022	0.00

Exchange rate	200	0.093	0.02	0.0575	0.14	0.00
Industrial Production index	200	98.41	11.42	81.71	121.82	0.00
Banks Assets Size	200	.0293	.031	-0.033	.0798	0.00

Note: '' The descriptive statistics are calculated for all variables from 2009 to 2018, where DTD is distance-to-default, Size is the bank asset size, MGT is Management efficiency, Tier 1 and tier 2 capital, REGCAP is a regulatory capital ratio, NPLs are Non-performing loans, MRP is Market risk premium, ProfI is profitability Index, LeqI is liquidity Index.. LevI is Leverage Index. TurnI is Turnover index. The symbols I and EX stand for the interest rate and exchange rate variables, respectively.*

Table 7 reports that the average value of DTD is 1.41, which is a positive value, showing that, on average, Pakistani banks stay stable for ten years. The maximum value and minimum value for DD are 12.511 and -8.79, respectively, with a standard deviation of 2.80. The probability value of the Jarque-Bera statistic for DD indicates that the variable follows a normal distribution. The mean value of the independent variable (i.e., Size) is 19.64 with a standard deviation of 1.073. The maximum and minimum value for Size is 16.98 and 21.83. The average value ProfI is 1.60 with standard deviation of 1.001. Similarly the mean value for TurnI is 3.5 with a standard deviation of 1.00. . The mean value of the interest rate variable is .093, with a standard deviation of 0.027, whereas, the average value of the exchange rate variable is 98.419 with a standard deviation of 11.42. The calculated probability value of all variables is less than 5%, showing that variables under examination are normally distributed.

4.2 Correlation Analysis

The correlation analysis is specifically used to check for the issue of multicollinearity among the variables under analysis. Basically, multicollinearity describes a situation whether two or more than two variables are highly correlated to each other or not. In other words, this phenomenon describes the strength of the relationship between the set of variables. To check for multicollinearity in the dataset, we have applied the correlation analysis, and the analysis has

been carried out with the help of the correlation matrix. The correlation matrix guides us about the nature and strength of the relationship between the classes of different variables. The correlation value shows the magnitude or extent of the relationship between any two variables, whereas the correlation sign shows the nature of the relationship between the two variables. If the calculated value of the correlation matrix for two variables is 1, meaning that the two variables appear to have the case of perfect multicollinearity. The positive sign of the correlation matrix for two variables shows a positive or a direct relationship, meaning that both the variables are moving in the same direction. On the other hand, the negative sign of the correlation matrix indicates that both the variables are not moving in the same direction; if one variable is increasing, the second variable is decreasing. The study of Malhotra (2007) reported that when the correlation coefficient between the two variables exceeds from 0.75, it means that we have the case of high multicollinearity. Similarly, the study of Kennedy (2008) reported that multicollinearity has occurred when the relationship between any two variables exceeds from 0.7, leading towards the biased results. If the value of correlation analysis is zero, it indicates that there is no association between the two variables and hence, we can say that the variables are independent. However, if the correlation coefficient is -1, indicating the negative perfect multicollinearity. Table 2 reports the findings of the correlation analysis for the variables under consideration. The analysis reveals that DD is positively correlated with bank Size, Tier-1, Tier-2 and MRP with a correlation coefficient of 0.36, 0.37, 0.22 and 0.31, respectively. The correlation of Bank DTD with management efficiency, regulatory capital, non-performing loan, profitability index, leverage index and liquidity index is positive with the value of 0.09, 0.13, 0.01, 0.39, 0.28 and 0.05, respectively. DD is negatively correlated with turnover index with the value of -0.05. The macroeconomic variables, such as the interest rate is negatively correlated

with the DTD having a value of -0.28, whereas, the exchange rate is positively correlated with the DTD with a value of 0.23. Thus, the overall results of the correlation analysis suggest that there is no issue of serious multicollinearity in the dataset.

Table 4.2 Correlation Matrix

	DD	SIZE	MGT	MRP	NPL	REGCAP	Tier1	Tier2	LEQI	PROFI	LEVI	TURN	I	EX	IPI
DD	1														
SIZE	0.36	1													
MGT	-0.21	-0.37	1												
MRP	0.31	-0.20	-0.02	1											
NPL	0.01	0.65	-0.19	-0.05	1										
REGCAP	0.13	-0.33	0.22	0.13	-0.09	1									
TIER_1	0.37	0.81	-0.23	-0.14	0.68	0.09	1								
TIER_2	0.22	0.76	-0.14	-0.12	0.75	-0.04	0.85	1							
LEQI	0.05	0.20	-0.20	0.15	0.19	-0.47	-0.01	0.06	1						
PROFI	0.39	0.48	-0.26	-0.18	0.16	0.09	0.41	0.33	0.02	1					
LEVI	0.28	0.14	-0.01	-0.03	0.06	-0.08	0.10	0.23	0.11	0.34	1				
TURNI	-0.05	0.19	-0.06	0.00	0.18	0.01	0.25	0.31	0.09	0.03	-0.07	1			
I	-0.33	-0.38	-0.08	0.24	-0.09	0.23	-0.25	-0.27	0.14	-0.37	-0.29	0.05	1		
EX	-0.15	0.13	0.04	-0.33	0.01	-0.14	0.10	0.08	-0.07	-0.07	-0.39	0.18	-0.17	1	
IPI	0.31	-0.11	-0.03	0.74	-0.02	0.10	-0.09	-0.06	0.08	0.00	0.22	-0.10	0.01	-0.64	1

In order to confirm the absence of multicollinearity in the data, the current research study has also applied the Variance Inflation Factor (VIF). Asteriou and Hall (2011) have described that the VIF is another method of detecting severe multicollinearity in the dataset. If the VIF value is below 10, meaning that there is no issue of multicollinearity in data. However, if the VIF value is above 10, we have the issue of multicollinearity in that case (see, Wooldridge, 2012;

Studenmund and Johnson, 2016)**.** Table 4 reports that all the VIF values of the explanatory variables are below10, confirming the absence of multicollinearity in the dataset.

Table 4.3 Variance Inflation Factor

Variables	**Centered VIF**
Size	8.17
Tier_1	7.39
Tier_2	5.51
MRP	1.21
MGT	1.96
REGCAP	2.98
NPL	2.74
PROFI	2.03
LEVI	1.61
LEQI	1.67
TURNI	1.1
I	4.43
EX	4.01

4.3 Likelihood Test

The likelihood test is applied to choose which panel estimation approach is more appropriate for the sample data between the common constant and fixed-effects model. The findings reported in Table 4 suggest that the FEM is more appropriate because the calculated p-value is 0.00 < 0.05; therefore, we accept H_0 and reject H_1.

H_0: The fixed-effects model is appropriate.

H_1: The common constant model is appropriate.

Table 4.4 : Likelihood test

Effects Test	Stat.	*d.f*	Prob.
Cross-section F	3.442282	(19, 167)	0.0000
Cross-section Chi-square	66.096131	19	0.0000

4.4 The Hausman Test

Researchers apply Hausman's test to choose the more suitable approach between the FEM and REM for the sample of data considered. Hausman's test results in Table 5 show that the chi-square calculated value is lower than its critical value; hence, we accept H_0 and reject H_1. The results of Hausman's test suggest that the REM is more appropriate for estimating the parameters of the proposed model.

H_0: The REM is suitable for the data.

H_1: The FEM is suitable for the data.

Table 4.5: The Hausman test

Test cross-section random effects

Summary	*Chi-sq. statistic*	*Chi-sq. d.f.*	*P-value*
Cross-section random	0.00000	13	1.0000

4.5 Results

In this section, the results of the random effect model are introduced and given in Table 6. The negative and positive co-efficient value of the independent variable Beta demonstrates the level of effect on the dependent variable. The probability P-value shows the level of significance of the independent variables.

Table 4.6 Results

Variable	Coefficient	Std. Error	t-Statistic	P-Value	Sig
C	-28.57509	9.520066	-3.001564	0.0031	***
SIZE	1.635284	0.466376	3.506367	0.0006	***
MRP	6.263208	0.936830	6.685530	0.0000	***
NPL	-3.88E-08	1.31E-08	-2.964524	0.0034	***
REGCAP	21.86250	6.422925	3.403823	0.0008	***
LEQI	0.397055	0.172032	2.308028	0.0221	**
LEVI	0.353979	0.182964	1.934690	0.0546	**
TURNI	-0.233031	0.132667	-1.756515	0.0807	*
I	-30.30977	7.006723	-4.325812	0.0000	***
R-squared	0.557205		Prob (F-statistic)	0.000000	
Adjusted R-squared	0.521107		F-statistic	15.43612	

''P < 0.1 Weak Significance, **P < 0.05 Semi strong Significance, ***P <0.01 Strong Significance*

The analysis reports the positive relationship between DD and Size. 1% increase in the Bank's Size leads to an increase of 1.63%. The Effect of Size on the DTD is highly significant, with the 1 per cent level of significance. This result is consistent with the findings of the study conducted by Schenck (2014) similarly, the study of Waqas and Md-Rus (2019) described that Size is the significant determinant of the financial distress, and the same findings have been found in the study of Ahmad and Arif (2007). In addition, the study of Al-Wesabi and Ahmad (2013) reported that Size is an insignificant relationship with credit risk. Based on the analysis, the

study reported that Size is the positive and significant determinant of the DD, meaning that whenever the bank size increase it provides more opportunities for the borrowers and lenders but ultimately probability of non-repaying loan also increases the probability of Default.

The effect of MGT efficiency on DD is a negative 1% increase in MGT will lead to a decrease of 1.57% in DD. The results support past findings that management efficiency is a negative and insignificant[9] relationship with DD. Furthermore, these results are consistent with the study of Ahmad and Ahmad (2004), who reported a negative and insignificant relationship between Size and credit risk. Similarly, the study carried out by Ahmad and Ariff (2007), and Schenck (2014) indicated that MGT is a significant determinant of DD. Similarly, MRP is also a significant determinant of DD on the .01% level of significance. The study further indicated that a 1% increase in the MRP would increase the DD by 6.2%. The results support the findings of Schenck (2014). From the analysis, we conclude that the market risk premium is a premium that is associated with a high risk. In other words, it is a quantitive measure that investors want by market participants for high risk. From the analysis, we conclude that we accept our null hypothesis that MRP has a positive and significant impact on DD. The non-performing loan is also significant at the 1% level of significance. The 1% increase in NPL will lead to a decrease of 3.8% in DD. The result supports the analyses of Ahmad and Ahmad (2004) and Schenck, (2014). The results indicate that the non-performing loan is used as a controlling factor over expected losses, and these provisions are triggered by default incident on loans.

REGCAP is also significant at the 1% level of significance. If REGCAP increases by 1%, it will increase the DTD by about 21%. The finding supports the study of Al-Wesabi and Ahmad(2013), which indicated there is a positive relationship between credit risk and REGCAP.

[9] See table 14 in Appendix se

However, the study contradicts with the analysis of Ahmad and Ahmad, (2004) who concluded that REGCAP is negatively but significantly related to risk. The results also indicate that the Pakistani banks need to have a good capital base to stood against any losses. In addition, the State bank of Pakistan imposed on all DFI'S/Banks to maintain the minimum capital adequacy ratio of 10 per cent on both consolidated and standalone to stand against any losses[10].

Tier 1 and Tier 2 capital is the insignificant predictor of DD for the Pakistani banks[11]. The study supports the finding of Schenck, (2014) who concluded that Tier 1 capital is the insignificant predictor of the DTD. Tier 2 capital is also insignificant because, according to the Basel 111 accord, tier 11 capital is composed of 100 per cent of tier 1 and an undisclosed reserve. The Liquidity index is composed of many liquidity indicators. LEQI is significant at the 5 % level of significance. The 1 per cent increase will lead to a .39% increase in the DD. The study supports the analysis of Waqas and Md-Rus, (2019), Altman (1968), Rashid and Abbas, (2011) and Waqas and Md-Rus, (2019), who concluded a positive and significant relationship between liquidity and financial distress. The overall results indicate that whenever Bank have idle liquid cash and not is investing it for the sake of earning a profit, and it will increase risk. The PROFI index is composed of different indicators, namely, the net interest margin, spread ratio, return on assets, and return on equity and net income to the ratio of the total assets. The results indicated that the PROFI is having a negative and insignificant effect on the DD[12]. If there is a 1% increase in profitability, it will lead to a 0.028% .028% decrease in the DTD. The study supports the findings of Altman (1968); Beaver (1966); Ohlson (1980); Shumway (2001); Rashid and Abbas (2011); and Waqas and Md-Rus (2019). However, in our current analysis, the PROFI index is

[10] https://dnb.sbp.org.pk/bprd/2013/Basel_III_instructions.pdf
[11] See table 14 in appendix section
[12] See table 14 in appendix section

insignificant. The LEVI index is composed of four indicators, namely, capital ratio, deposit to equity ratio, total debt to total assets ratio and the current liability to total assets ratio. A 1% rise in leverage of the company leads to an increase of .35% in the DTD. The LEVI has a significant effect on the DD at the 5% level of significance. Theoretically, we can define the leverage as the amount of debt used to finance assets, whenever debt increase, it will also increase the default risk. The result is consistent with the study of Rashid and Abbas (2011); and Waqas and Md-Rus (2019). The turnover index is composed of two indicators, namely, sales to total assets ratio, and working capital to assets ratio. The results of the study indicate that an increase in the turnover of banks will lead to a decrease in the DTD. The negative coefficient depicts that the firm with a high turnover ratio faces fewer chances of default risk. Turni is statistically significant at the 10% level of significance.

The macroeconomic indicators, such as the interest rate, is highly significant with a negative sign. A 1% increase in the interest rate will cause a 30% decrease in the Distance to default. The negative coefficient of the interest rata indicates that if the central Bank of Pakistan increases the interest rate, this policy will attract more depositors to invest in the commercial banks. On the contrary, the banks also charge the high-interest rate on their loan, which increases the overall strength of the Bank and ultimately, it decreases the default risk. The exchange rate and the industrial production index have a negative coefficient value which indicates a rise in EX and IPI, which causes a decline in the DD. In our analysis, EX and IPI variables are statistically insignificant[13]. The adjusted R^2 of the model is 52% which means that 52 per cent of the variation is captured by the model.

[13] See table 14 in appendix section

4.7 Individuals Banks Distance to Default

DD is a parameter that gauges how a firm is away from Default. According to Merton's KMV, if the value of firm market shares is a decline in such a way that it becomes less than the value of the debt, then the Bank is in the position of Default or close to Default. Table 6 reports the ten years mean value of individual's banks from the sample period

Table 4.7 Mean Distance to Default

Banks	**ABL**	**BAFL**	**AKBL**	**BAHL**	**BOK**	**BOP**	**BIPL**	**FABL**	**HBL**	**HMB**
Mean(DD)	4.48	0.83	0.12	2.05	1.15	-1.42	0.68	-0.45	2.58	5.10
Banks	**JSBL**	**MCB**	**MEBL**	**NBP**	**SBL**	**SILK**	**SNBL**	**SCBPL**	**SMBL**	**UBL**
Mean(DD)	0.26	3.72	2.59	1.24	0.82	0.21	0.53	2.52	-1.63	2.92

The positive mean value of ABL, BAHL, BOK, HBL, HMB, MCB, MEBL, NBP, SCBPL and UBL and their respective value 4.48, 2.05, 1.15, 2.58, 5.10, 3.72, 2.59, 1.24, 2.52 and 2.92. These values indicate the high DTD (or low default risk). These are large banks with high market capitalization and profitability, efficiency and top performer in the banking industry. However, BAFL, AKBL, BIPL, JSBL, SBL, SILK, SNBL, and their respective mean value is 0.83, 0.12, 0.68, 0.26, 0.82, 0.21 and 0.53 indicate that these are small banks and their DTD is positive, indicating that the probability of default is low. These banks perform moderately in the industry. In addition, BOP, FABL, SMBL and their mean values indicate that these banks are very close to Default. The negative value of the DD indicates a closeness to Default. Similarly, the Pakistan Stock Exchange has recently declared the Summit bank as defaulter because of a decrease in the share price less than the face value. Comparing the calculated mean value with the market

equity value, the study indicates that the DD is a reliable measure to predict the default risk. The analysis also indicates that the banking sector of Pakistan is strong with a low probability of Default.

Chapter 5

Conclusion and Recommendation

5.1 Conclusion

The current study aims to investigate accounting, financial and macroeconomic determinants that influence Pakistani banks' default risk and also to investigate the degree of how much these responsible determinants affect bank default risk. The study also aims to investigate whether or not the DTD is a reliable measure for predicting default risk.

For such purposes, the underlying study investigated the effect of bank-specific and macroeconomic variables on the DTD for the Pakistani listed banks by considering panel data covering the period 2009-2018. The Bank specific variables are further reduced by making an index of profitability, liquidity, leverage, and turnover through the principal component analysis. In other words, the bank-specific factors include the size of banks, management efficiency, regulatory capital, market risk premium, non-performing loan ratio, tier1 capital, tier 11 capital, profitability index, liquidity index, leverage index, and turnover index. Similarly, the macroeconomic indicators consist of the interest rate, exchange rate, and the industrial production index. They examined data is extracted from the official websites of the State Bank of Pakistan, Pakistan Stock Exchange, Business Recorder, Open doors for all and the Global economy.

The empirical findings from the balanced random effect model reported that the relationship between the bank size and the DTD is positive and significant. Specifically, whenever the bank size increases its portfolio also increases, which provide better opportunities for borrowers and lenders, but ultimately the probability of non-repaying loan and the non-performing loan is also

increased that further increase default risk. Similarly, the findings also reported that the relationship between management efficiency and DTD is negative. When the Management of banks performs efficiently, then ultimately, the risk of Default will be decreased, and this outcome is consistent with the findings of (Ahmad, 2003; Angbazo et al., 1998). The negative relationship of MGT with DTD indicates that lower efficiency will lead to high default risk. The results further indicated that the nature of earning assets that are fully based on interest on banks and after three months of arrears on interest immediately create non-performing loans which ultimately recognized default risk. In addition, the analysis also supported the fact that MRP is a good predictor of the default risk. Whenever investors demand high market risk premiums, then ultimately, there is a high risk in the market. The analysis shows a significant positive relationship between DD and MRP, and this outcome supports the finding of (Schenck, 2014). Specifically, when MRP decreases by 1 per cent, it would lead to a decline of 6.3 per cent in DD.

The non-performing loan is also a significant negative effect on DD, meaning that non-performing loans increase, it will lead to a decrease in DD, and our analysis supports the findings of (Ahmad, 2004; Schenck, 2014). The provision for the non-performing loan is used as a controlling factor over expected losses, and also these provisions are triggered default incident over the expected loss. The findings further reported that the effect of REGCAP on DD is positive and significant, indicating that the Pakistani banks have a good capital base to face any future financial loss or default risk. In other words, whenever the default probability rises, the central Bank of Pakistan increases REGCAP requirements. Similarly, the results revealed that Tier1 and Tier 11 capital ratios were insignificant, which supports the findings of (Schenck, 2014).

The liquidity index is a positive and significant effect on the DTD, meaning that whenever the liquidity of a bank rises, it increases the financial cost for banks that further increase the risk for banks. The analysis supports the previous findings of (Waqas and Md-Rus, 2019; Altman, 1968; Rashid and Abbas, 2011; and Waqas and Md-Rus, 2019). The analysis suggested that the PROFI is an insignificant predictor of DTD. In addition, LEVI is a positive and significant predictor of DD. The study supports the previous findings of (Rashid and Abbas, 2011; and Waqas and Md-Rus, 2019). Leverage is the amount of debt using to finance assets. Whenever the debt portion increases in the capital structure of the banks, then it ultimately increases the default risk. Furthermore, the turnover ratio is the significant negative predictor of default risk. Whenever banks smoothly run their operation and increase their revenue, consequently, their default risk will be decreased.

More importantly, the empirical results of the study also reported that the interest rate is a significant negative determinant of the DTD; meaning that when the central Bank of Pakistan rises the bank's rate, it would highly attract the investors to invest in banks, which create investment opportunities for investors to earn high returns. It ultimately decreases default risk. However, other macroeconomic indicators, such as EX and IPI, are insignificant in the relationship with the DTD in the context of Pakistan's economy.

5.2 Recommendation

The analysis of default risk and their major determinants have several Bank specific and macroeconomic policy implications. The results of the study assumed default risk is a measure of financial stability. The overall result of the DTD revealed that the Pakistani banking industry is perfectly stable. Based on the reported results, the study recommended that the banking sector of Pakistan is using the DTD as the best predictor for measuring the default risk. Further, some

significant determinants outcomes acquired from the analysis is Bank size, Market risk premium, Non-performing loans, regulatory capital, liquidity, leverage, Turnover and Interest rate. This study recommends some policy implication to risk assessment manager in the banking sector to consider these banks specific factors and overcome the default risk of banks. Macroeconomic results also recommend that monetary authority of the Central Bank should increase bank rate to attract more investors for investment, and ultimately it reduces default risk.

5.3 Future Research Direction

This empirical study explores Bank specific and macroeconomic determinants of default risk of Pakistani listed banks. The study reveals that DTD is a significant determinant of default risk. Along these determinates further exploration should be possible by adding some different factors. In addition, this study recommends some exploration factors for future research. Future investigation will be better one someone extends the study to Non-financial sector. This study used only ten-year data of Pakistani listed banks with the stock exchange. Further, It will be helpful in foundation study for future investigation by using investment banks, microfinance banks, mutual funds companies, insurance companies and leasing organization. There are few internal factors, like interest earned, net income, total liability, receivable and payable turnover ratios, financing cost on credit, operating cost and macroeconomic indicators like the Gross domestic product, consumer price index, producer price index, trade balance and imports etc. are excluded from the study. In this way, it is highly recommended to consider these factor in future research that further explore some other significant predictor of default risk.

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Appendix

Table 7.1 : Descriptive Statistics of all Variables

Variables	Obs	Mean	Std.Dev	Min	Max	Skewness	Kurtosis	Prob.
DTD	200	1.415406	2.800391	-8.79821	12.51163	0.389526	2.624162	0.000
Size	200	19.64789	1.073424	16.98242	21.83046	0.33308	0.41302	0.06
MGT	200	0.3177	0.10148	0.1447	0.8072	1.4777	3.200	0.01
Tier 1	200	34262.13	34571.85	-4248.68	135871.5	1.379879	0.848667	0.00
Tier 2	200	8022.813	10522.08	-832.833	47110.56	1.925739	3.228147	0.00
REGCAP	200	0.087174	0.044021	0.016006	0.298122	1.9360	5.3335	0.00
NPL	200	25138052	27017970	741680	128277000	1.8718	3.4956	0.00
MRP	200	0.087685	0.214028	-0.22657	0.345123	-0.26598	1.438866	0.00
PNIM	200	0.032862	0.019799	-0.0156	0.19086	3.71255	27.63981	0.00
PSR	200	0.423618	0.136117	-0.0321	0.927	-0.19577	1.885359	0.01
PROA	200	0.496591	0.975602	-5.41	2.64	-1.64688	8.841754	0.00
PROE	200	0.071091	1.100963	-14.7427	2.3471	-12.35	166.8863	0.00
PNITA	200	0.085082	0.104999	-0.0024	0.6078	2.242332	10.13534	0.00
LCACL	200	12.10482	48.78683	1	68.4852	13.63597	19.0902	0.00
LCCTA	200	0.081849	0.026507	0.003078	0.1836	1.022838	4.540894	0.00
LDTA	200	0.757431	0.089524	0.468638	1.233422	-0.01703	4.25716	0.00
LITA	200	0.120698	0.120698	0.1222	0.6861	-0.10096	-0.81865	0.00
LCR	200	0.306447	0.277183	-0.031	0.916	0.634579	-1.14393	0.00
LDER	200	14.36175	33.08613	-42.45	101..8	8.594774	84.94703	0.00
LTDTA	200	0.895792	0.135504	0.004804	1.110119	-5.72251	35.31148	0.00
LCLTA	200	0.012517	0.008758	0.000109	0.1	5.462826	50.0487	0.00
TSTTA	200	0.093256	0.083667	0.01007	0.494806	3.296626	10.56619	0.00
TWCTA	200	0.073176	0.068774	0.020186	0.968811	11.24514	145.9986	0.00
I	200	0.093	0.027496	0.0575	0.14	0.241258	-1.26801	0.00
EX	200	98.419	11.42701	81.71	121.82	0.318792	-0.40335	0.00

IPI	200	.0293	.0311	-0.0332	.0798	-0.203	2.761	0.00

Table 7.2

Variable	Coefficient	Std. Error	t-Statistic	P-Value	Sig
C	-28.57509	9.520066	-3.001564	0.0031	***
SIZE	1.635284	0.466376	3.506367	0.0006	***
MGT	-1.577189	1.844313	-0.855163	0.3936	
MRP	6.263208	0.936830	6.685530	0.0000	***
NPL	-3.88E-08	1.31E-08	-2.964524	0.0034	***
REGCAP	21.86250	6.422925	3.403823	0.0008	***
TIER_1	2.16E-05	1.36E-05	1.584449	0.1148	
TIER_2	-5.54E-05	3.55E-05	-1.561632	0.1201	
LEQI	0.397055	0.172032	2.308028	0.0221	**
PROFI	-0.028106	0.187284	-0.150069	0.8809	
LEVI	0.353979	0.182964	1.934690	0.0546	**
TURNI	-0.233031	0.132667	-1.756515	0.0807	*
I	-30.30977	7.006723	-4.325812	0.0000	***
EX	-2.497064	2.368108	-1.054455	0.2931	
IPI	-8.328439	7.566458	-1.100705	0.2725	
R-squared	0.557205		Prob (F-statistic)	0.000000	
Adjusted R-squared	0.521107		F-statistic	15.43612	

''P < 0.1 Weak Significance, **P < 0.05 Semi strong Significance, ***P <0.01 Strong Significance*