THE NEXUS BETWEEN CREDIT RISK AND LIQUIDITY RISK AND THEIR IMPACT ON BANKS FINANCIAL PERFORMANCE: EVIDENCE FROM PAKISTAN

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Abstract. *Risk management became an important dilemma in the banking literature and has gained consideration since the financial crisis of 2007-08 which brought numerous challenges for most organizations. More than 325 banks' failure was reported in the United States during the worldwide financial crisis. The high number of banks failures needs to evaluate the risk management efficiency of banking institutions of Pakistan. In this study, we used the PVAR model and Simultaneous equation approach to examine the link between Liquidity Risk and Credit Risk and its influence on banks' performance working in Pakistan. The panel data was collected from 33 banking institutions between the period 2008 - 2018. The results revealed that Credit Risk and Liquidity Risk are not interrelated with each other. However, the two risks independently influence the banks' performance and their relative interaction plays a major role in the instability of the banking sector. The findings form the foundation for recent regulatory exertions to better understand the two types of risks and to strengthen the joint management of both liquidity risk and credit risk.*

Keywords: Liquidity Risk, Credit Risk, Bank Performance, Pakistan

Introduction

The 2007-08 worldwide financial downturn after the world-wide economic Depression of the 1930s was engulfed severe financial crisis (Zandi, 2008). It affected the economic climate of nearly every country which resulted in low growth, rising inequality, political instability and in some cases created social tensions. More than 325 banks' failure were reported in the US during the worldwide financial crisis (Bradrania, Li, & Xu, 2017). Most banking

institutions become apprehensive regarding lending to other organizations due to the spreading of the economic downturn and the acute shortage of liquidity. In this condition, the largest number of financial institutions lack the forecasting models for the effective management of risks which resulted a deterioration in the "balance sheet" and challenges of acquiring new sources of funds (Cucinelli, 2013). Therefore, a meticulous concern has been given towards the factors behind banking institutions' deficiency in the economy (Agnello & Sousa, 2012). According to Ghosh (2016) credit flow, inflation rate, nominal exchange rate depreciation and greater bank asset concentration significantly increased the possibility of banking crises while real GDP growth, higher bank profit, economic freedom and economic development decrease such chances.

Banking institutions have to experience financial losses due to several kinds of financial risks. These risks include liquidity risk (the probability that depositors may unexpectedly take out their deposits) (Cecchetti, Schoenholtz, & Fackler, 2006), Credit Risk (borrowers incapability to repay loans at maturity, (interest rate risk) volatility in interest rates can change the worth of investment), and operational risk (the bank system and process may collapse due to inadequate or failed system, procedure, policies, employee errors and fraud or any other activities which disrupt the business processes). Amongst these, CR and LR are the main causes of banks' failures and bankruptcy.

According to the studies conducted by Gorton and Metrick (2012) and Acharya and Viswanathan (2011) CR and LR faced by banking institutions are positively co-related. Banks use customers' deposit or opening credit line to create liquidity and finance risky projects (Kashyap, Rajan, & Stein, 2002). Both types of risks independently influence the banks' profitability of default (PD), and their interaction can reduce the default risk (Imbierowicz & Rauch, 2014). The considerable body of previous literature studies outlined the mutual relationship of CR and LR and their link with banks' efficiency. Numerous research scholars including Gorton and Metrick (2012), Viral V. Acharya, Shin, and Yorulmazer (2010), Gatev, Schuermann, and Strahan (2009), Cai and Thakor (2008), and Goldstein and Pauzner (2005) analyzed the matter from various dimensions, mainly from a theoretical perspective. During the financial collapse of 2007-2008, most banks failed due to CR and LR, and the overall business environment was affected. LR increased as with the increased in loan defaults which affected the banks' reserves and capital. Banking institutions get loans from the money lenders even at a higher interest rate when facing liquidity problems (Jenkinson, 2008). Banks confronted with CR because of the information asymmetries in the lending market. Thus, the co-occurrence of both types of risks leading to banks' failures has been pragmatic. In view of

these facts, the relative interaction and relationship between CR and LR and their impact on the stability of the bank must be empirically analyzed.

This study is designed to find the relationship between liquidity risk (LR) and credit risk (CR) and their impact on banks performance.

The banking sector of Pakistan has entered a new phase of development over the past number of years, yet facing several challenges where economic uncertainty, political instability, higher credit growth rate, opening of market to rivals and increasing level of loans from bank remain the main issues. Therefore, it is essential to study the importance and effect of CR and LR on banking institutions performance working in Pakistan. In the light of worldwide financial crises, with the joint occurrence of CR and LR, many scholars reported that banking sector were largely unaddressed (Levieuge, Lucotte, & Pradines-Jobet, 2019). Among the various elements that fed the financial crises were an eroding sense of responsibility in the lending process between borrowers and lenders, lax oversight by policymakers skeptical of market regulation, incorrect rating and the "animal spirits" of entrepreneurs and investors.

Regarding the association between banking institutions efficiency and risk, previously no research studies determined to look at the reciprocal relationship and their effect on banking institutions performance in Pakistan. The latest example of studies concerning LR and CR includeRamzan and Zafar (2014), Arif and Nauman Anees (2012), Haneef *et al*. (2012), Iqbal (2012) through which LR and CR have been examined extensively, but independently. The present study will contribute to the relevant literature and will give knowledge to policy makers and individuals relating to the association of CR and LR and their influence on banking institutions performance in Pakistan.

1. Literature Review

2.1. Relationship between Credit Risk (CR) and Liquidity Risk (LR).

Hassan, Khan, and Paltrinieri (2019) investigated the relationship between CR and LR by using the simultaneous structural equation on a dataset of 52 Islamic Banks (IBs) and Conventional Banks CBs) for the period 2007-15 found negative relationship. According to the study of Ghenimi, Chaibi, and Omri (2017) and Imbierowicz and Rauch (2014), both types of risks do not have meaningful or time-lagged relationship. However, they affect banking institutions probability of default (PD) separately and contribute to banking institutions instability. As stated by Bordeleau and Graham (2010) insufficient liquidity is same as a person's suffering from a sickness. LR is an indication of a critical condition and consider as revenue minimizing costs which results in

failure and financial distress (Dermine, 1986). In accordance with the industrial organization approach as well as the theory of financial intermediation CR and LR are connected with each other (Bryant, 1980; Diamond & Dybvig, 1983). As pointed out bySamartín (2003) simultaneously "CR and Liquidity risk" reciprocally take part in bank's volatility.Nikomaram, Taghavi, and Diman (2013) and Diamond and Rajan (2005) reported significant and positive relationship between LR and CR.Imbierowicz and Rauch (2014) revealed a significant as well as positive association but could not find a reciprocal association whereas,Louati, Abida, and Boujelbene (2015) reported the significant, but negative relationship between CR and LR.

2.2. Credit Risk (CR), Liquidity Risk (LR) and Banks Performance

Liquidity described the capability of the financial service companies to meet the customers' cash requirements and provide advances in the form of overdraft and financial loans. Liquidity is also bank cash and cash equivalent such as treasury bills and commercial papers etc. According to Viral V Acharya and Mora (2015) banks have an important role as liquidity providers at the time of financial crisis. With the strong support and help of government and government sponsor agencies, banks became able to provide liquidity. At the start of the financial meltdown of 2007-2008, the inflow of deposits became weakened and loan to deposit deficit was widened, which exposed banking institutions to higher undrawn commitments.

LR arises when the business entity becomes unable to satisfy its obligations (Choudhry, 2013; Nikolaou, 2009). It also arises when an organization borrows money at a higher rate of interest or facing penalty overheads under pledged tenures, or trading assets at a lower rate in the market. The concept of liquidity in financial and economic literature explains that liquidity is the business ability to exchange its prevailing wealth without any price reduction. Liquidity is a term which describes in term flow, put simply, it is a flow concept (Nikolaou, 2009).

CR management plays the most important role for bank's financial performance and liquidity (Kiselakova & Kiselak, 2013). The crucial role of CR management is becoming more common with the passage of time due to various reasons, namely; organization liquidity problems, economic stagnation and crisis, violation of the accounting procedure and standards, declining and volatile value of security on loans, a rise in off-balance sheet derivatives, financial globalization and new capital requirements regulations. According to DeYoung and Torna (2013), low equity, low earning over-exposure, excessive investment, and bad macroeconomic conditions increase credit risk. They found out that CR has a vital role in banks stability. Lending would be the most popular source of credit risk; however, a number of other factors identified in

the literature behind CR include, interbank operation, inappropriate credit policies, acceptances, trade financing, volatile interest rate, financial futures, forex trades, bonds, swaps, options, settlement of transactions, poor management, low liquidity level, poor loan underwriting and information asymmetry (Chen, J Fabozzi, Pan, & Sverdlove, 2006). It is considered to be the key threat to the performance and solvency of most banks and imposed a burden on taxpayers around the world (Herring, 2002).

According to Ratnovski (2013), bank refinancing risk arises due to failure to refinance liabilities, maturing deposits, and solvency problems. To manage credit risk, banks should increase liquid assets or enhance transparency to communicate solvency. This counterbalancing capacity provides complete protection against small shocks. This also encourage that the coexisting of transparency and liquidity requirements on solvency could resolve the difficulties of the re-financing of banking institutions. The theory on the banking liquidity requirement developed by Calomiris, Heider, and Hoerova (2015) highlights the fact that banking institution needs to manage the assets side rather than capital. They need to preserve significantly more liquid assets to cope with LR and control and monitor the hazards they may be faced. According to Vazquez and Federico (2015) banks with higher leverages and fragile liquidity were exposed to the risk of bankruptcy.Banks' reliance on the interbank market also raises the potential of insolvency (Demirgüç-Kunt & Huizinga, 1999).

As stated by Berger and Bouwman (2006) capital increases the prospect of endurance and so decrease the chances of a bank failure at all time. It also enhances the performance of small, average and sizable banks during financial crises. In the situation of debts revival,insubstantial market liquidity accelerates the correlation between CR and LR. It can be linked to an expansion of the risk settlement of liquidity and credit, which often increase business failure risk. According to Acharya and Mora (2015) banking institution failure during the financial meltdown have largely been endured due to insufficient liquidity earlier than actual default. Their analysis stated that banking institutions which failed catch the attention of depositors by offering substantial rates of interest. The joint existence of credit and LR certainly push banks into default.

3. Methodology

3.1. Data Sources

The sample data obtained from the annual issued financial statements of 33 banking institutions working in Pakistan covering the period between 2008-2018. Whereas the data on macro-economic variables (GDP growth rates and

inflation rates), were retrieved from World Bank Development Indicators. The internal and external bank variables are treated explanatory variables.

3.2. Hypothesis

$H_{1.}$ There is inter-dependency between Credit Risk (CR) and Liquidity Risk (LR)

$H_{2.}$ There is significant positive relationship between Credit Risk (CR) and Liquidity Risk (LR).

H_3 Credit Risk (CR) and Liquidity Risk (LR) reciprocally contribute to banks instability.

3.3. Variables of the Study

The Z - score measured is a dependent variable which is banks stability, distance to insolvency. The approach was used by (Atoi, 2018; Beck, Demirgüç-Kunt, & Merrouche, 2013; Ghenimi et al., 2017; Rizvi, Narayan, Sakti, & Syarifuddin, 2019). They found the inverse correlation between bank performance and probability of default (PD). The Z-score can be calculated as follows:

$$\boldsymbol{Z} = (k+\mu)/\sigma$$

Where:

μ: Banks performance (ROA). The σ of the ROA determined moving averages 10 periods. **K:**Equity capital as a % of total assets,σ: (Std.dev) of ROA as proxy for return volatility. Rise in Z-score connotes a lower possibility of bankruptcy of the banks. For reason of skewness, this study uses the log of Z-score as used by (Houston, Lin, Lin, & Ma, 2010; Laeven & Levine, 2009). Table 01 shows the independent variables and their corresponding specific measures

Table 1 *Description of the used Variables.*

Independent Variables	**Measure**
Internal Factors	
CAR	$\frac{Total\ Eligible\ capital}{Credit\ RWA + Market\ RWA + Operational\ RWA}$
Credit Risk	$\frac{Total\ Non\ Performing\ Loan}{Total\ Loan}$
ROE	$\frac{Net\ Income}{Equity}$

NIM	$\frac{Investment\ Income - Interest\ Expenses}{Average\ Earning\ Assets}$
Liquidity Gaps	$Logarithm\ of(Assets - Liabilities)$
ROA	$\frac{Net\ Income}{Total\ Assets}$
Bank Size	Logarithm of Total Assets
Liquidity	$\frac{Liquid\ Assets}{Total\ Assets\ Ratio}$
Efficiency	$Cost\ to\ Income\ Ratio = \frac{\text{Operating Costs}}{Operating\ Income}$
Loan assets	$\frac{Net\ Loan}{Total\ Assets}$
External Factors	
Inflation Rate	Consumer Price Index
GDP	Relative Real Growth GDP

3.4. Model

This study used a PVAR model and simultaneous-equation approach for possible lagged or reciprocal linked between CR and LR. Next, the Panel data regression model is employed to evaluate the impact of CR and LR on banks permanence.

3.4.1. Simultaneous Equation Approach

Econometricians developed various techniques for the estimation of the linear simultaneous equation. The most common and simplest estimation method of simultaneous equations model is the **TSLS**(Two-Stage-Least-Squares) method. The technique is commonly used for the analysis of structural equations. The **TSLS** is the extension of **OLS** method. The model was developed in early research by Theil (1953) and Basmann (1957) among others. In this study, the **TSLS** model is used to evaluate the causal relationship between LR and CR as used by Shen, Chen, Kao, and Yeh (2009); Das, Quintyn, and Chenard (2004).

$$CR_{it} = C + \beta_1\ CR_{i,t-1} + \beta_2 LR_{i,t} + Control\ Variables_{i,t} + Macro^{j}_{t}$$

$$LR_{it} = C + \beta_1\ LR_{i,t-1} + \beta_2 CR_{i,t} + Control\ Variables_{i,t} + Macro^{j}_{t}$$

Where:

$i = 1$
$N = Banks$

$t = Time\ Period$
$CR\ it = Credit\ Risk\ of\ Bank\ i, time\ t.$
$LR\ it = Liquidity\ Risk\ of\ Bank\ i, time\ t.$
$Control Variables$
$= Bank\ specific\ control\ variables\ such\ as\ Bank\ Size,$
$ROA, CAR, NIM,\ \ Liquidity\ Gap, Assets\ Growth\ and\ Efficiency.$

$Macro\ jt = Real\ GDP\ Grwoth\ and\ Inflation\ Rate$

The above equations allow for both reciprocal and possible time-lagged effect as well as controlling for possible endogeneity of the independent variable in two stage least square approach. The control variables indicating the health of banks used in the study include ROA, Bank size, ROE, NIM, CAR, Liquidity gaps, efficiency and assets growth. Macro variables used in the study includes inflation rate and real GDP growth. The above listed variables have been used by various scholars including Zhang, Cai, Dickinson, and Kutan (2016), Kabir, Worthington, and Gupta (2015), Berger and Bouwman (2013), Cole and White (2012), Akhtar, Ali, and Sadaqat (2011), and Eklund, Larsen, and Berhardsen (2001).

3.4.2. Panel Vector Auto Regression Model (PVAR)

Vector Auto-Regression is now a standard part of Applied Econometrics and has been increasingly used for applied research (Holtz-Eakin, Newey, & Rosen, 1988). The PVAR (Panel Vector Auto-Regression) model is used in this study to observe the possible relationship between liquidity and CR when the impact regarding the possible lagged relationship is not clear. The model used by various researchers, including Ghenimi *et al*. (2017), Imbierowicz and Rauch (2014), Hertrich (2014) and Nkusu (2011).

The model is written as follows:

$$\boldsymbol{Y_{it}} = \boldsymbol{\mu_{it}} + \boldsymbol{\Theta(L) y_{it}} + \boldsymbol{\mathcal{E}_{it}}$$

Where $\boldsymbol{\Theta}$(L) is a matrix in the log operator, *i*= 1, ---, N is the cross-sectional indicators, *t* = 1, ---, T is the time dimension, $\boldsymbol{Y_{it}}$is a vector of variables of interest and $\boldsymbol{\mathcal{E}_{it}}$ is a vector of disturbance.

3.4.3. Panel Data Regression Model

To evaluate the relationship between outcome and predictor variables the panel data regression model suggested by Gujarati (2009), Tabachnick and Fidell (2007) was used. The paper follows the following regression equation to analyze the impact of LR and CR on bank stability.

$$Z-Score_{it}= \beta_0+\beta_1 Z-Score_{it-1}+\beta_2 LR_{it}+\beta_3 CR_{it}+\beta_4 LR^{*}CR_{it}+\beta_5 BS_{it}+\beta_6 ROA_{it}+\beta_7 CAR_{it}+\beta_8 LG_{it}+\beta_9 Efficiency_{it}+\beta_{10} inf_{it}+\beta_{11} GDP_{it}+\varepsilon_{it}\_03$$

Where:

$i = Banks\ (We\ have\ 33\ banks)$

$t = time\ period\ (2008-2018)$

$Z-Score_{it} = Banks\ performance\ for\ time\ t$

$Z-Score_{it-1} = The\ first\ dependent\ variable\ which\ capture\ the\ banks\ persistence\ in\ bank\ performance\ over\ time.$

$LR = Liquidity\ Risk$

$CR = Credit\ Risk$

$BS = Banks\ Size$

$ROA = Return\ on\ Assets$

$CAR = Capital\ Adequacy\ Ratio$

$LG = Loan\ Growth$

$Inf = Inflation$

$GDP = Gross\ Domestic\ Product$

These variables have been used by various researchers, such as Ghenimi *et al.* (2017), Cole and White (2012), Zhiguo He and Wei Xiong (2012), and Aubuchon and Wheelock (2010).

3.5. Results and Analysis

3.5.1. Descriptive Statistics

Table 2 shows the descriptive statistics (μ and π) of the dependent and independent variables.

The mean score of liquidity is 0.080; the means of CR is 4.284, the mean of CR* LR is 0.517, the mean value of ROA is 1.549, the average value of z-score is 3.26, the mean value of size is 3.028, the average of CAR is 10.618, the average of loan growth is 3.351, the average of efficiency is 1.54 and average of crisis is 0.24, the average of loan assets is 0.451, the average of ROE is 6.981, the average of NIM is 0.044, the average of liquidity gap is 2.144, the average of inflation is 2.098 and the average of GDP is 5.355.

Table 2 *Descriptive Statistics of Variables (N=330)*

Variables	Mean	Std. Deviation
Liquidity.	0.080	0.081
Credit Risk.	4.284	8.714
CR* Liquidity risk.	0.517	2.195
ROA	1.549	2.432
Z – score	2.36	1.085
Size	3.028	0.734
CAR	10.618	12.318
Loan Growth	3.351	1.262
Efficiency	1.54	0.133
Loan Assets	0.451	0.143
ROE	6.981	26.94
NIM	0.044	0.219
Liquidity Gap	2.144	0.831
Inflation	2.098	0.073
GDP	5.355	4.098

Notes: SPSS Output from Data of Sampled Banks, 2008-2018& Author calculation. ROA (Return on assets), CAR (Capital adequacy ratio), ROE (Return on equity), NIM (Net interest margin), GDP (Gross Domestic Products).

3.5.2. The relationship between LR and Credit Risk, TSLS Regression Model

In this subsection, the simultaneous equation is used to assess thoroughly the relationship between LR and credit risk. Table 03 illustrates the estimated results by adopting the TSLS regression model. Nonperforming loans Ratio (NPLR) was used as a proxy for credit risk. The Liquid Asset to Total Asset Ratio is proxied for liquidity risk. Durbin-Wu-Hausman, also called Hausman Specification Test, was used for endogeneity detection. For the detection of over identifying restriction, the Sargan-Hansen test was used. To find the correlation between transformed error term the AR (2) test was used. These tests show that the instruments are valid.

Table 3 *The relationship between LR and CR*

		LR Model-1	
	Model-1	Coefficient.	P-Value
1	(Constant)	-.537	0.000***
	CR	-0.002	0.000***
	Bank Size	-0.033	0.270
	ROE	0.0001	0.767
	ROA	0.002	0.687
	NIM	0.013	0.337

Liquidity Gap	0.031	0.453
CAR	-0.001	0.108
Inflation Rate	0.372	0.000***
GDP	-0.001	0.0206
AR2 Test	-0.20	0.841
Hansen J-test	23.96	0.181
DWH test	165.61	0.000

Dependent Variable: Liquidity Risk

Notes: Hansen J-test: over-identification restriction in GMM estimation. Durbin – Wu-Hausman: test of the endogeneity AR2: second order autocorrelation in first difference. *** 1% significance levels.

		CRModel-2	
	Model-2	Coefficient.	P-Value
1	(Constant)	2.181435	0.858
	LR	-12.9885	0.70
	Bank Size	-1.32187	0.005***
	ROA	-1.076132	0.000***
	Loan Assets	-1.730645	0.556
	Efficiency	-9.676002	0.002***
	Inflation Rate	22.63581	0.000***
	GDP	-0.3604303	0.000***
	AR2 Test	1.33	0.187
	Hansen J-test	26.97	0.104
	DWH test	185.647	0.000

Dependent Variable: Credit Risk (CR)

Notes: Hansen J-test: over-identification restriction in G.M.M estimation. Durbin-Wu-Hausman: test of the endogeneity AR2: second order autocorrelation in first difference. *** 1% significance levels.

The effect of CR on bank liquidity (inverse of liquidity risk) is unfavourable but significant at 1 percent level, where the reverse causation significant and unfavourable. There is no meaningful reciprocal association between LR and CR from a statistical perspective. The outcomes displayed above in Table 03 are similar to the results proven byImbierowicz and Rauch (2014) who stated that there is no reciprocal association between LR and CR. Accordingly, it is determined that there exists a unidirectional causal relationship between LR and CR. Therefore, the hypothesis H1 and H2 in this research cannot be verified.

3.5.3. Credit Risk (CR) and Liquidity Risk (LR): PVAR Model

This section examines the direct association between "Credit Risk (CR) an d Liquidity Risk (CR)". Furthermore, we investigated the results of no meaningful association between CR and LR in further robustness tests. The simultaneous equation was replaced by PVAR model robustness test for results. We did not detect any clear pattern of causal relationship between the variables which are economically or statistically meaningful.

The results estimated by using PVAR regression is presented in Table 4. It is revealed that there is no reciprocal association between both categories of risk. Therefore, this study results show that there is no meaningful causal relationship or considerable co-movement between CR and LR.

Table 4 *PVAR Model-Robustness Tests*

	CR	**LR**
CR-1	1.741206 (22.1364) *	-0.002113 (-1.18335) ***
Liquidity -1	-2.819383 (-0.32748)	1.718277 (7.98416)

3.5.4. Impact of CR and LR on Banks stability: Fixed Effect Model

The nonexistence of the meaningful relationship concerning the two category risks “CR and Liquidity Risk” found in previous analyses indicate that banking institutions operating in Pakistan do not jointly manage these two-important types of risk. Therefore, it is reasonable to investigate the joint occurrence of LR and CR and their contribution to bank instability (H_3). There are so many logical reasons which support this statement. The substantial body of research has proven that CR as well as LR are separately associated with banks stability. According toImbierowicz and Rauch (2014) most banks failed due to the joint occurrence of both CR and LR at the time of financial disaster. From a theoretical aspect, this study has a logical reason to find out whether CR and LR solely and mutually affects bank stability. The GMM approach suggested byBlundell and Bond (1998) adopted in this study to figure out the effect of CR as well as LR on banks stability. Table 05 represent the outcomes of the Hansen Test for over-identifying restriction and the AR – 02 second order correlation test.

Table 5 *Impact of CR & LR on Banks Stability. Fixed Effect Model (N=300)*

Independent Variables	**Coefficient**	**P- value**
Constants	0.1026016	0.899
Z-score-1	0.3188107	0.000***
Liquidity	-0.2319071	0.0321**
Credit risk	-0.0063144	0.021**
CR* liquidity risk	-0.0121551	0.092*
ROA	0.0784133	0.000***
Size	0.224011	0.000***
CAR	0.0013011	0.0673*
Loan growth	-0.8574636	0.000***
Efficiency	-0.3200832	0.178
GDP	0.0023733	0.628
Inflation rate	1.370563	0.002***
Hausman FE		
AR-1	5.86	0.000
AR-2	0.34	0.724
Hansen J-Test	21.23	0.330

Notes: Hansen J-test is used for over-identification restriction in GMM estimation. AR- 2 refers to test of second order autocorrelation in first difference. *,10 % ** 5% and, *** 1% significance level.

The above results in Table 05 showed that the AR (2) is valid for serial correlation testing. The AR (2) p - value is higher than 0.10. Therefore, the null hypothesis for banks cannot be rejected. In transformed residuals, the serial correlation was not detected. The p – value of the Hansen J test is greater than 0.1, which demonstrates that model specification is correct and the restrictions of over- identifying are valid. The dependent variable Z-score -1 was significant and positive at 1% level, verifying the model specification's dynamic character(Tan, 2015).

The impact of the two important categories of risk, such as LR and CR on banks performance revealed negative, it also increases bankruptcy. Certainly, a higher amount of CR is related to bankruptcy and the possibility of collapse. This study results suggest that CR and bank performance are inversely related, as CR increases, it diminishes banks stability. The influence of LR on bank performance was reported negative, but significant which indicates that banks with adequate liquidity are more stable. Strong liquidity position makes it possible for financial institutions to overcome problems caused by unexpected withdrawals of funds. If banks do not have sufficient liquid assets, bank performance may be affected. The recent financial collapse is also known as

liquidity crisis. Since 2010, regulatory authorities have taken steps to prevent liquidity risk. Higher CR and LR affect the stability of banks, which confirms the conclusion demonstrated byImbierowicz and Rauch (2014).

The impact of the interrelationship between "credit risk*liquidity risk" on bank performance found negative and significant at the 10 % level. This is not surprising, as LR and CR increase or decrease together. The result of the model therefore revealed the unfavorable influence on banks stability of the relative interaction between LR and CR. The negative impact of LR increased as CR increased. If CR is high, LR adversely affects the bank performance. Banks with lowest level of LR are safe than banks with high level of liquidity risk. Satisfactory level of liquidity lets banks to sustain their stability. The joint impact of both CR and LR is theoretically indicated byImbierowicz and Rauch (2014), Nikomaram *et al*. (2013), and Zhiguo He and Wei Xiong (2012). The results of the present study indicate that the bank stability is affected by a joint increase in CR and LR Imbierowicz and Rauch (2014) and Nikomaram et al. (2013). As shown in Table 5, the return on assets (ROA) has a positive and significant impact at 1 percent level on bank performance which is contradict with the results reported bySrairi (2013). However, at the 1 percent level, the impact of bank size on bank performance was found significant and negative which reduce the stability of the banks and the possibility of bank failure. Large banks increase the risk of their assets De Jonghe (2010), Uhde and Heimeshoff (2009) and Stern and Feldman (2004). This also confirms the results showed revealed by Nguyen, Skully, and Perera (2012) and opposed found by Imbierowicz and Rauch (2014).

The impact of CAR on banks performance was reported significantly positive. In fact, at a time of crisis, capital plays a safety role for banks which reduce the risk of bank insolvency and serve as a cushion to reduce losses. This confirms that capital adequacy is negatively linked to banks failure revealed by Imbierowicz and Rauch (2014). As an important indicator of banks performance, regulatory authorities and bank management used the CAR. It is therefore concluded that the CAR is an important measure for the assessment of bank performance and efficiency that affects the likelihood of insolvency.

Loan growth has a negative impact on banking stability. It shows that banks with excessively high loan growth rate are witnessing a significant drop in performance. Banks with higher loan growth rates have taken higher risks than banks with lower loan growth rates, a decrease in performance as an indicator of bank riskImbierowicz and Rauch (2014), Cornett, McNutt, Strahan, and Tehranian (2011).

The impact of efficiency on banks stability was found negative, which indicates that banks with lower management competency face a higher risk

(Shehzad, De Haan, & Scholtens, 2010). While the management efficiency is recognized to be a key contributor to banks collapse. In most research studies about the bank's failures, the efficiency and quality of bank management are cited as the main reasons. According to Pantalone and Platt (1987) the main consequences of banks failure or near-collapse usually results from illegal activities such as embezzlement and fraud or mismanagement. The causes of bank failure depend on the capability of its management. This study result also confirms the work of (Bourkhis & Nabi, 2013; Imbierowicz & Rauch, 2014; Srairi, 2013).

The growth rate of GDP has a positive impact on the banks' stabilization. This significantly reduces the risks of bank failure (Imbierowicz & Rauch, 2014). The relationship between the banking sector and economic growth shows that growth in the financial sector is a major contributor to economic development Levine, Loayza, and Beck (2002). According to Jokipii and Monnin (2013) bank stability is an important factor for GDP growth, followed by improvement in real output growth. On the other hand, instability in the banking sector leads to increased uncertainty in real output growth. Finally, the influence of inflation on bank stability was positive and confirmed the outcome (Srairi, 2013).

The above explained outcomes demonstrate the importance of LR and CR in banking sector and their collective role in banking instability. The results validate the research hypothesis H3. As a result, the effect of the LR and CRon banking performance in Pakistan is very important.

4. Conclusion

The most crucial predicator of the stability and long-term survival of the financial firms are LR and CR. We examined the impact of LR and CR on bank stability in this research study. Data were collected from the annual reports of 33 banks in Pakistan from 2008 to 2018.The results of the study showed that the reciprocal relationship between LR and CRis not economically significant but both types of risks have a significant impact on the performance of banking institutions. The study has many policy implications, such as providing a number of recommendations and good insight regarding bank efficiency and stability, understanding of LR and CR to policy makers, bank management and supervisors. Finally, the findings recommend the joint management of CR and liquidity risk, which can enhance the stability of financial institutions.

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