

## **The Interdependence of Liquidity Risk and Credit Risk in Banks: A Case Study of Pakistan**

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development, and plays an essential role for economic growth of an economy. This study examined the relationship between liquidity risk (LR) and credit risk (CR) in the banking sector, using the data of 15 commercial banks of Pakistan over 2002-2016. The study also analyzes the sources of risks on the bank institutional-level and how the relationship between liquidity and credit risk influence to banks. The findings of the study suggest that both risk categories have a reciprocal relationship and also influence banks' stability. The LR and CR have separately improved the stability of the bank, and the impact of their interaction depends on the overall level of bank risk and can either aggravate or mitigate the default risk.

**Keywords:** Liquidity Risk, Credit Risk, Commercial Banks, Regulations

**JEL Classification:** D81, G21, G81

### **1. Introduction**

The role of the banking sector is very essential in the economic and financial development of a country. This sector is one of the most fundamental parts of any country's economy. Financial performance of a bank shows its ability to make new resources, from day-to-day operations over a given period and it assessed by net income and cash flow from operations. Banking activities are different from other economic activities due to their assortment of products and services. Therefore, assessing the performance of banking institutions is a vital process and necessary for the persistence of banks' activities, to meet the challenges.

Bankruptcy of financial institutions is a serious threat to the entire economic system, which is associated with all types of financial risks. Risk can be explained as a possibility of undetermined future events which are unavoidable, and it affects the profit (Owojori, Akintoye & Adidu, 2011). No doubt banking sector is also facing the different types of

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risks like financial and non-financial in the current changeable and risky environment. These risks may possibly make threats for the continued existence and achievement of the banks. In this regards, management of risk prevalent in investment options is becoming an emerging issue. In the modern era, the financial institution can take the competitive edge only with the efficient management of risk. It will not only increase the return, but also provide strong strength to survive in a competitive market.

The management (i.e. board of directors of banks) should create an efficient organizational makeup to constantly observed banks 'liquidity. Credit risk is the probability of incurring losses resulting from non-payment of loans or other forms of credit by debtors. A bank, which has liquidity problems, may have trouble in meeting the demands of depositors (Arif & Anees, 2012). Some studies (e.g: Sawada, 2010; Akhtar et al., 2009; Arif & Anees, 2012) also explained the diverse effect of liquidity risk according to its measures. It is determined through two different methods. As per first method, liquidity risk is measured by adjusted asset size, which comprises on the liquidity ratios such as, cash to total asset (Barth et al., 2003; Arif & Anees, 2012), cash to total deposit (Shen et al., 2009; Mugomba, 2013)

This study carries out to accomplish the following objectives

- To investigate the relationship between the liquidity risk and credit risk for banks operating in Pakistan
- To analyze the relationship between the liquidity risk and credit risk with respect to bank size

To the extent of our understanding, at international level, Imbierowicz et al. (2014) investigate the relationship between credit risk and liquidity risk for U.S. commercial banks. However, no study has investigated the relationship between liquidity risk and credit risk empirically for banks of Pakistan. There are few studies that try to explore the relationship between multiple risks <sup>1</sup> faced by banks of Pakistan. However, they have not captured the relationship between liquidity and credit risk explicitly for banks operating in Pakistan. A few empirical studies, for example,

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<sup>1</sup> Like credit risk, liquidity risk, foreign exchange risk, operational risk and interest rate risk.

Abdullah et al. (2012) find the negative relationship of debt to equity ratio with liquidity risk both in domestic and foreign banks of Pakistan. Another study by Ahmad et al. (2011) studied the Islamic banks of Pakistan. We find no study that examines the effects of these risks jointly on financial performance of banks, specifically in case of Pakistan. The study evaluated the financial performance of banking sector, which has developed rapidly in last two decades.

It is also very likely that different types of risk faced by banks are interlinked with each other. Therefore, it would be worthwhile to examine the relationship between these two types of risk. In this regard, this study enhances our understanding about the association of two major types of risk, namely as credit and liquidity risk that banks face in their operations.

### **1.1 Theoretical Foundation and Hypothesis Development**

Over the past years, a tremendous amount of literature has dealt with banks' liquidity and credit risks. Explanations for the way banks work and their major risk and return sources are given by two major research strands regarding the microeconomics of banking: (I) the classic financial intermediation theory, most prominently represented by Bryant (1980), and (II) Diamond & Dybvig (1983) presented the industrial organization approach. The financial intermediation models view banks as pools of liquidity that provide both depositors and borrowers with the ready availability of cash, thereby enhancing economic welfare and internalizing economic liquidity risk. The industrial organization approach models suggest the banks are profit-maximizing price takers in oligopolistic loan and deposit markets, facing an upward sloping demand for deposits and a downward sloping demand for loans with respect to increasing interest rates.

On the asset side, banks generate returns through loan interest rates; on the liabilities side, banks face costs through deposit interest rates. The models of both strands of the literature suggest that at least theoretically, there is a relationship between liquidity and credit risk. So far, empirical evidence is ambiguous about the question of whether the relationship is positive or negative. The Monti-Klein framework and its extensions (Prisman, Slovin, and Sushka, 1986) take borrower default and sudden

fund withdrawals into account, both assumed to be lowering a bank's profit. Equity, other than debt funding and marketable securities are seen as given.

Banks maximize their profits by maximizing the spread between deposit and loan rates. It gives an exogenous main rate of refinancing as well as stochastic borrower defaults and fund withdrawals. From a theoretical perspective, the relationship between liquidity risk and credit risk, therefore seems to be clearly established. The theoretical suggestions underlying by Krasa and Villamil (1992) look at the factors affecting bank size. They focus on the gains from size as compared to the costs of monitoring the quality of a bank's book. They show these two factors liquidity and credit risk ensure that optimal bank size (from the perspective of the equity owner) is determinate.

De Nicolo (2001) measured the relationship between size, charter value and insolvency risk for banks in a range of countries. He finds that charter values (measured by Tobin's  $q$ ) decrease in size while insolvency risk (measured by Z-score method) rises in size, which is consistent with the Merton (1977) analysis set above. It shows that taking more risk offsets any size related scale economies of diversification benefits. Indeed, large banks' returns on assets and return volatilities increase in size, suggesting large banks choose higher risk than its optimal. Based on assumptions and outcomes of the microeconomic models discussed above, our hypothesis for the relationship between liquidity and credit risk are

**H1:** There is no relationship between liquidity risk and credit risk in banks.

**H2:** Bank size has a significant impact on the relationship between liquidity and credit risk.

The remaining paper carries literature review, data, methodology, results & discussions, and conclusion in separate sections in a sequence.

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## 2. Literature Review

Banking sector considers as a key source of financing to business and national income as well. The significant risk has been faced by banks on daily basis while performing their regular operation (Pukeliene & Deksnyste, 2010). The issue of risk-taking has been a central focus of the banking sector. Financial risk can be narrowed down into credit risk, and liquidity risk. Once the amount of risk within each of these financial risk parameters has been assessed, the overall financial performance of a bank can be determined.

The banking business contains high risk specially when proportion of borrowed funds is far higher than the owners' equity (Owojori, Akintoye & Adidu, 2011). However, various well-known risk management approaches are used to manage liquidity and credit risk. The purpose of research studies on banking sector is mostly two folds. On the one hand, they are focusing on the operational performance and risk (Jemison, 1987; Iannotta, Nocera, & Sironi, 2007; Beccalli, 2007), while on the other hand, they are linking the risk with financial performance.

### 2.1 Liquidity Risk

In context of banking sectors, liquidity risk is an important dimension of financial risk, which is the risk of not having borrowing capability or enough cash to meet the day-to-day needs of loan demands or deposit withdrawals by customers. In this case, commercial banks have to borrow emergency funds from outside at excessive cost to meet its obligation (Angbazo, 1997). This risk badly affects a bank's financial position. Therefore, guarantee of the availability of adequate funds is an essential for a commercial bank's management to meet future demands of customers at reasonable cost. Furthermore, the risk of being unable to settle an obligation appropriately is known as liquidity risk (Muranaga & Ohsawa, 2002). In banks, the majority of the assets are funded with deposits, and most of the times the current deposits are used. A bank, which has liquidity problems, may have trouble in meeting the demands of depositors (Arif & Anees, 2012).

The problem of liquidity risk may arise because of the maturity mismatch between assets and liabilities, which creates the liquidity gap. Liquidity

gap is the main reason of liquidity risk in banks, which can negatively affect the bank profits. However, this liquidity risk may be mitigated by decreasing the liquidity gap (Plochan, 2007). Higher liquidity gap will create liquidity risk which has adversely effect on financial performance (Arif & Anees, 2012; Mugomba et al., 2013). The commercial banks are not able to increase its liabilities and they try to fund its assets by giving more advances. Therefore, the banks become illiquid which means they are not able to change their assets into money to meet the demand of depositors (Tabari et al, 2013).

The previously studies state that liquidity risk has a positive effect on financial performance (Molyneux & Thornton, 1992; Barth et al, 2003), whereas a few studies found that it has a negative impact on financial performance (Bourke, 1989; Pasiouras & Kosmidou, 2007). Some studies (e.g: Sawada, 2010; Akhtar et al., 2009; Arif & Anees, 2012) also explained the diverse effect of liquidity risk according to its measures. It is determined through two different methods in the literature. As per first method, liquidity risk is measured by adjusted asset size which comprises on the liquidity ratios such as, cash to total asset (Barth et al., 2003; Arif & Anees, 2012), cash to total deposit (Shen et al., 2009; Mugomba, 2013). In case of second method, it is measured by the adjusted loan size, which involves the net loans to total asset and non-performing loans to total asset (Maaka, 2013). According to Ennis and Keister (2006), it is stated that commercial banks are holding more liquid assets when they are operating more, which recommends cash in hand as liquid assets decrease liquidity risk.

In most of the developing countries, the banking sector is ill equipped to face the temporary liquidity shocks and manage the risk effectively. Mugomba et al. (2013) discussed bank solvency measured as loan to deposit ratio and the determinants of bank solvency, profitability of banks, credit risk, liquidity gap, inflation and GDP. It is a requirement of central bank to keep specific amount as cash reserve to maintain liquidity. Central bank regulation sets the minimum fraction of customer deposits as reserve that each commercial bank must hold rather than lend out (Sohaimi, 2013). Every bank tries to keep up sufficient funds to fulfill the requirement and meet the unexpected demands from depositors.

## 2.2 Credit Risk

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The credit risk in the commercial banks arises when the borrower is reluctant to perform his obligation which causes the economic loss for commercial banks (Khan & Khan, 2010). The credit failure in commercial banks is not new or a rare occurrence, the major reason behind the credit failure is the poor risk management. It can affect the liquidity position as well as cash flows and profitability of commercial banks. Therefore, the credit risk is considered as one of the biggest threats to financial performance and a major reason of bank failures (Greuning & Bratanovic, 2009). The credit operations are an important source of earning for the commercial banks. A large amount of credit money is supported by the strong economic activity in the country. According to Akhtar (2007), the development of the credit operations is based on the growing business activities in the country along with regular improvement in internal credit reviews. It is observed that the default rate in commercial banks has decreased over the last few years, which indicates the effective management of credit risk. Credit risk arises in the banks as the advances are considered uncertain and the bank does not predict exactly the percentage of its loans (Wong, 1997). Once a bank fails to receive principal amount and interest on loans and non-treasury securities, it leads to credit risk.

Adeusi et al. (2014) has focused on the relationship of credit risk management practices and financial performance of commercial banks in Nigeria. Profitability as a measure of financial performance is calculated as return on equity (ROE) and return on asset (ROA). The study concludes that a significant relationship exists between risk management and banks financial performance. Thus, better risk management techniques in terms of managed fund, reduction in cost of bad and doubtful loans and the debt equity ratio leads towards better bank performance.

The loans are also a biggest threat to the bank solvency because of the poor risk management and recovery of loans and advances within the specified time (Fredrick, 2012). The bank needs money from other sources to manage its loans and advances which leads banks towards the central bank to get money on higher interest rate. It is important for bank to manage an effective ratio of loans and advances to avoid such mishap (Ogboi & Unuafe, 2013)

### 2.3 Interdependence among Liquidity Risk and Credit Risk

There is an enormous account of literature that deliberates on the liquidity and credit risks of commercial banks. De Nicolo (2001) studied the association among charter value, size and banks' insolvency risk in an assortment of countries. He proposed that risk-taking counterbalances any size economies of scale generated by size that provide diversification gains. Thus, large banks' returns on assets in addition to volatilities in these returns grow in size, signifying that large banks take on more risk than is optimum.

As indicated earlier, the hypothesis of the presence of reciprocal relationship amid liquidity risk and credit risks is reinforced by the theoretic financial intermediation research Bryant (1980). The models proposed by Bryant (1980) and Diamond & Dybvig (1983) verify the inverse relationship between the two risks.

The liquidity and credit risk should assume a positive relationship and should jointly affect bank stability. This notion is reinforced by recent literature that emphasizes on the financial downfall of 2008. It is also explained by Acharya and Viswanathan (2011), Diamond and Rajan (2005), Gorton and Metrick (2012) and He and Xiong (2012).

The model proposed by Diamond and Rajan (2005) was grounded on the belief that banks get money from inexpert depositors, that is then utilized in lending operations. Issues arise when too many economic ventures sponsored with advances yield inadequate funds and consequently bank fails to satisfy demands of its depositors. Owing to such deterioration in assets, gradually all the depositors demand their money back. As a result, banks call in all of their loans and in so doing diminish total liquidity in the financial markets. Hence, higher credit risk is accompanied by higher liquidity risk due to depositors' claim. Acharya and Viswanathan (2011) demonstrated that increased debt/loan in the banking system produces higher risk of a "bank run". Thus, in a crisis, as soon as asset prices start to decline, banks face difficulty to "roll over debt", thus realizing the liquidity risk.

Wagner (2007) also illustrated that increase in liquidity of banks can heighten the risk of instability in the banking system. He argued that even



though banks are benefited from more liquidity in assets with reference to stability, distresses turn out to be less expensive for banks, therefore they more likely not to avert them from happening.

Acharya, et al. (2010) empirically concluded that the cash holdings of a bank rises during the times of financial distress. They developed a model wherein liquid assets become an ex-ante strategic decision of dynamic bank management with the purpose of purchasing other banks' assets at shockingly low prices during a financial crisis. Cai and Thakor (2008) suggested that interbank competition with higher credit risk can diminish liquidity risk.

Lastly, according to Acharya and Naqvi (2012) during a severe financial crisis, household besides corporate depositors assume a "flight for quality" and start depositing their funds with banks at low rates, as a result increased funds in bank. Cole and White (2012), and Berger & Bouwman (2013) focused on bank defaults in the course of financial distress, and observed unwarranted investment banking activities, low levels of equity, and significant investment in real estate loans considerably increases a banks' probability of default.

The above studies show a clear inference that credit risk has a significant role in determining the overall stability for any bank. Hence, based on the evidence enlisted above it may be assumed that joint occurrence of liquidity and credit risks may have been a causal factor for bank defaults specifically in the times of a financial crisis. The several studies (Jemison, 1987; Iannotta, Nocera, & Sironi, 2007; Beccalli, 2007) have examined the financial risks, including credit and liquidity risk related to the earnings response of commercial banks and its effects on the stock returns. There are also a few number of studies about analyzing liquidity risk (Akhter et al., 2011; Arif & Anees, 2012; Tabari et al., 2013) and credit risk (Miller & Noulas, 1997; Poudle, 2012; Ogboi & Unuafe, 2013), with respect to financial performance of banks. The financial risk considered as one of the determinants of banks' profitability. It has been identified that financial different risk have negative influence on performance of commercial banks which may lead towards the banking crises (Maaka, 2012). Bank size also plays a significant role in determining the exposure of these risks for banks (Aggarwal & Jacques, 2001; Jacques & Nigro, 1997; Shrieves & Dahl, 1992; Stolz, Heid, &

Porath, 2003; Van Roy, 2003). There is lacuna in research on the joint effects of liquidity and credit on the bank stability and performance while taking into account the size of bank, this study aims to fulfill this gap by testing the association of these risks with the financial performance of commercial banks in context of Pakistan.

### **3. Data and Methodology**

#### **3.1 Data and sample selection**

To analyze the relationship between liquidity and credit risk, the sample of 11 commercial banks and 4 public banks of Pakistan is taken for the period of 2002-2016. The selected sample of 15 banks is based on large capitalization. These are renowned commercial banks of Pakistan.

In this regard information has also been reserved by the reports and statistics presented by the State Bank of Pakistan and Pakistan Bureau of statistics. Data obtained from various editions of the publication Money and Banking Statistics issued by State Bank of Pakistan<sup>2</sup>, which contains annual information of the balance sheets, income statements and off-balance sheet items for all banks operating in Pakistan. The sources for macroeconomic data<sup>3</sup> such as GDP, saving ratio, and interest rate collected from IFS, WDI and Pakistan Bureau of statistics.

In this study, a dedication for the work has been made on annual reports of the profit and loss account, balance sheets and off-balance sheets to consider the assumed hypothesis on the relationship of the liquidity risk and credit risk operation of commercial and public banks in Pakistan. Beside this, the subdivision of the sample data has been made to examine the credibility of proxy variables of the liquidity risk and credit risk for the selected banks of Pakistan. The extracted data has been bifurcated into small and large banks. Sample has been constructed under organized measures by deeply reviewing the information of the report of State Bank of Pakistan and relationship of variables has been generalized to evaluate the impact and relation of liquidity risk and credit risk.

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<sup>2</sup><http://www.sbp.org.pk/stats/stat-bal-sheet.htm>.

<sup>3</sup><http://data.worldbank.org/country/pakistan>.

### 3.2 Methodology

There are two main variables to measure the risk: First measure is the liquidity risk, and second one is the credit risk shown in Table 1. The liquidity risk (LR) calculated by subtracting the volume of all assets, which the bank can quickly, and at low cost turn into cash at fair market value. To cover possible short-term withdrawals from the volume of liabilities this can be withdrawn from the bank on short notice. While credit risk (CR) variable will be calculated by dividing the average net loan losses (loan charge-offs minus loan recoveries) in the current year by the average loan loss allowance recorded in the previous year.

**Table 1: Bank liquidity risk and credit risk proxy variables**

<i>Proxy</i>	<i>Calculation</i>
Liquidity Risk (LR)	$\frac{[(Demand\ Deposits + Transaction\ Deposit + Brokered\ Deposits + Unused\ Loan\ Commitments) - (Cash + Currency\ \&\ Coin + Trading\ Commercial\ Paper\ Securities\ available\ for\ Sale) \pm Net\ Inter-Bank\ Lending\ Position \pm Net\ Inter-Bank\ Acceptances]}{Total\ Assets}$
Credit Risk (CR)	$\frac{Loan\ Charge - Offs_t - Loan\ Recoveries_t}{Loan\ Loss\ Allowance_{t-1}}$ <i>Offs<sub>t</sub> = written off as uncollected by bank</i>

To account for possible reciprocal or lagged relationship between the variables this study employed a structural equations approach where systems of equations estimated via generalized least squares. The equations estimated simultaneously directing for the possible endogeneity of the respective independent risk variable in a three stages least square approach.

$$\begin{aligned}
 CR_{i,t} &= \sum_{\tau=0}^{MAXm} LR_{i,t-\tau} \\
 &+ \sum_{\tau=1}^{MAXn} CR_{i,t-\tau} + \text{Control Variables}_{i,t} + \epsilon_{i,t} \quad (1)
 \end{aligned}$$

$$\begin{aligned}
 LR_{i,t} &= \sum_{\tau=0}^{MAXm} CR_{i,t-\tau} \\
 &+ \sum_{\tau=1}^{MAXn} LR_{i,t-\tau} + \text{Control Variables}_{i,t} + \epsilon_{i,t} \quad (2)
 \end{aligned}$$

**Endogenous Variables** =  $CR_{i,t}, LR_{i,t}$

**Exogenous Variables** =  $CR_{i,t-\tau}, LR_{i,t-\tau}$

**Control Variables** =  $ROA, SR, GDP, TA$

The dependent variables are stochastic whereas independent variables are non-stochastic. Moreover, the exogenous or independent variables are classified into two categories: predetermined (lagged as well as current) and lagged endogenous. The system of simultaneous equations is said to be complete if the number of simultaneous equations (let say three) is equal to the number of dependent variables (let say three). Structural models consist of complete system of equations. In the study three stage least square (3SLS) technique has been utilized, which is introduced by Zellner & Theil (1962). It can be seen as a special case of multi-equation where the set of instrumental variables is common to all equations. Therefore it is more efficient than two stage least square (2SLS) technique.

In the above set of simultaneous equations, when  $\tau = 0$  then  $t-\tau$  represents the contemporaneous effect. When  $\tau = 1$ ,  $t-\tau$  depicts a possible time-lagged effect of the independent variable to observe comprehensively its influence on the dependent variable. In addition, control variables accounting for the bank's general health structure, and interest rate environment are included. These are the log of total assets,

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the ratio of short-term to long-term deposits, the ratio of trading assets to total assets, commercial loan to total loans, log of GDP, the saving ratio. Furthermore, we are able to address a possible autocorrelation of the dependent variables with regard to possible lagged relationship. The appropriateness of a maximum lag length would be confirmed by employing the Schwert (1989) and Ng-Perron (2000) criteria.

#### **4. Empirical Results and Discussion**

This section contains descriptive statistics and the interdependencies of liquidity risk and credit risk of banks with other control variables i.e. total assets, capital ratio, return on assets (ROA), standard deviation (ROA), trading-ratio, saving ratio (SR) and gross domestic product (GDP). The below mentioned simultaneous equation estimated by three stage least square method under three different models and models are providing the different effects of the variables on the theory.

Table 2 shows the descriptive statistics of all variables.

70 The Interdependence of Liquidity Risk and Credit Risk in Banks:  
A Case Study of Pakistan

Variables	Mean			Std. Dev.			Maximum			Minimum		
	Small Banks	Large Banks	All Banks	Small Banks	Large Banks	All Banks	Small Banks	Large Banks	All Banks	Small Banks	Large Banks	All Banks
Liquidity Risk (LR)	0.59	0.61	1.2	0.19	0.18	0.37	0.93	0.98	1.91	0.06	0.06	0.12
Credit Risk (CR)	0.51	0.51	1.02	0.17	0.18	0.35	0.90	1.10	2.2	0.20	0.10	0.3
Z-score	1.69	2.85	4.54	1.47	1.85	3.32	6.10	8.25	14.35	0.04	0.03	0.07
Total Assets	18.54	19.86	38.4	0.96	0.72	1.68	15.99	21.35	37.34	19.86	17.94	37.8
Capital Ratio	0.14	0.14	0.28	0.07	0.03	0.1	0.39	0.22	0.61	0.01	0.07	0.08
Return on Assets (ROA)	0.01	0.02	0.03	0.02	0.03	0.05	0.10	0.19	0.29	-0.12	0.00	-0.12
Standard deviation (ROA)	0.03	0.03	0.06	0.01	0.01	0.02	0.05	0.05	0.1	0.01	0.01	0.02
Trading-Ratio	0.05	0.02	0.07	0.07	0.05	0.12	0.21	0.25	0.46	-0.17	-0.00	-0.17
GDP	9.45	9.45	18.9	0.51	0.51	1.02	10.25	10.25	20.5	8.64	8.64	17.28
Saving Ratio (SR)	10.67	10.61	21.28	3.20	3.19	6.39	17.61	17.62	35.23	6.99	6.99	13.98

**Table: 3 Correlation Matrix**

<b>Variables</b>	<b>Lr</b>	<b>C r</b>	<b>TA</b>	<b>C A R</b>	<b>RO A</b>	<b>Sd. R O A</b>	<b>TR</b>	<b>S R</b>	<b>G DP</b>
Liquidity Risk (LR)	1.00								
Credit Risk (CR)	0.86	1.00							
Total Assets	0.334	0.233	1.000						
Capital Ratio	0.165	0.381	0.062	1.000					
Return on Assets (ROA)	0.189	0.067	0.043	0.055	1.000				
Standard deviation (ROA)	0.006	0.212	0.288	0.011	0.074	1.000			
Trading-Ratio	0.118	0.116	0.176	0.092	0.257	0.110	1.000		
Saving Ratio (SR)	0.013	0.090	0.378	0.080	0.018	0.520	0.026	1.000	
GDP	0.023	0.368	0.454	0.076	0.087	0.661	0.157	0.800	1.000

The correlation matrix used to measure the direction of relationship and strength between the variables. Table 3 shows the strength and direction between given variable. Its shows a positive relationship between credit risk and liquidity risk, Imbierowicz & Rauch (2014) also found a positive relation. The liquidity risk has a positive association with capital ratio, return on asset and trading ratio. However, the liquidity ratio has a positive relationship with Saving Ratio and GDP. It has shown that credit risk has a positive association with total asset, capital ratio, GDP, Return on Assets (ROA), Trading-Ratio and Saving Ratio.

Three stage least square (3SLS) method is used to check the interdependencies of liquidity risk and credit risk of banks. Table 4 is

providing the different scenarios considering the different lag length of the variables and coefficient of the variables in which two general scenarios has analyzed. It is indicating that the highest statistic of 0.3171 is observed under the head of Model 2 as a total effect of the liquidity risk on overall banks and coefficient with credit risk which is maximum to proven the strength and significance of the assumption. The value of total effect in Model 2 increased due to the negative value of coefficient at lag one.

**Table 4: Relationship of Liquidity Risk and Credit Risk for all Banks**

LR-All Banks	(Dependent variable: Liquidity Risk)		
	Model 1	Model 2	Model 3
CR(t)	0.029** (0.013)	0.768** (0.344)	0.197* (0.114)
CR(t-1)	—	-0.451* (0.250)	-0.199** (0.099)
CR(t-2)	—	—	0.204** (0.102)
Total Effect	0.029	0.3171	0.208
Return on Assets	1.052** (0.429)	1.314** (0.489)	1.006** (0.459)
Total Assets	-9.850** (4.061)	-4.900* (2.593)	-9.570*** (0.00)
Ln GDP	-0.2185* (0.116)	0.013* (0.007)	-0.092* (0.046)
Trading Ratio	-0.132* (0.069)	-0.121* (0.063)	0.044** (0.020)
Saving Ratio	-0.025** (0.011)	-0.016* (0.008)	-0.028* (0.013)
Observations	195	195	180
R <sup>2</sup>	0.5690	0.7008	0.7095

Note: Standard errors in parentheses, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



The second highest total effect observed under the head of Model 3 and the absolute value is 0.208 that is also a promising statistic to judge the assumption made in the study. The least value of total effect observed under the head of Model 1 and the absolute value is 0.029, considered as a least promising situation to judge the assumption. However, assessing the strength of credit risk association with liquidity risk, the results indicating high significant with each other as per the total effects of coefficient. Based on this result our first hypothesis “*there is no relationship between liquidity risk and credit risk for banks operating in Pakistan*” has rejected. Our study is consistent with Nikomaram et al. (2013) and Imane (2015) which shows that there is a positive and significant relationship between credit and liquidity risks. Similarly, Imbierowicz & Rauch (2014) also found a significant relationship between liquidity risk and credit risk with GDP.

Berrios (2013), conducted a study to see the interdependencies of liquidity risk and credit risk and their effect on the operation of banks. They found that there exist a weak coordination between the liquidity risk and credit risk.

**Table 5: Relationship of Liquidity Risk and Credit Risk for all Banks**  
(Dependent variable: Credit Risk)

CR-All Banks	Model 1	Model 2	Model 3
LR(t)	0.226** (0.097)	0.570** (0.270)	-0.097* (0.051)
LR(t-1)	–	-0.201* (0.116)	0.042** (0.019)
LR(t-2)	–	–	0.096** (0.048)
Total Effect	0.2226	0.5675	0.0411
Return on Assets	-0.646** (0.323)	-0.898** (0.420)	-0.395** (0.181)
T. bills	0.020*** (0.005)	-0.012*** (0.003)	-0.008*** (0.002)
Capital Ratio	-0.472** (0.186)	-0.291** (0.117)	-0.582*** (0.161)
Ln GDP	-0.241**	-0.210***	-0.409***

	(0.053)	(0.058)	(0.048)
Observations	195	195	180
R-Squared	0.5160	0.6180	0.7085

Standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Considering the negative figures of ROA in Table 5, it has concluded that there exist an inverse relationship between the profitability and the credit risk i.e. high credit risk lead to low profitability. Crumley (2008) and Leung and Horwitz (2010) also viewed the negative relationship between credit risk and profitability. In this research, main motive behind the study was to investigate the risk approaches and financial crisis in the banks by assessing the credit risk, profitability risk and liquidity risk with interlinked relationships.

In the given situation, operational performance of the bank has viewed as the main fact with credit risk associated with liquidity risk and other controlling variables that are showing strong convincing correlation with each other.

#### 4.1 Relationship between the LR and CR with respect to Bank Size

This section analyzed the data, which has divided according to the size of banks. Similarly, Beltratti and Stulz (2012) divides the data according to the nature and size of banks i.e. small-scale banks and large-scale banks to investigate the impact of liquidity risk and credit risk. Table 6 and 7 observe liquidity risk and credit risk of the small banks in Pakistan.

**Table 6: Relationship of Liquidity Risk and Credit Risk for Small-Scale Banks**  
(Dependent variable: Liquidity Risk)

LR-Small Banks	Model 1	Model 2	Model 3
CR(t)	-0.192* (0.098)	0.443* (0.001)	0.295* (0.157)
CR(t-1)		-0.433* (0.231)	0.155** (0.070)
CR(t-2)			-0.392** (0.174)

Total Effect	-0.192	0.009	0.058
Return on Assets	0.594*	0.979**	1.100
	(0.330)	(0.433)	(0.486)
Total Assets	-3.22**	-3.221**	-4.541**
	(1.448)	(1.457)	(2.241)
Ln GDP	-0.024**	-0.139*	-0.104**
	(0.110)	(0.076)	(0.047)
Trading Ratio	-0.042*	-0.130**	0.238**
	(0.022)	(0.058)	(0.108)
Saving Ratio	-0.050***	-0.039**	-0.041**
	(0.017)	(0.018)	(0.020)
Observations	91	91	85

Standard errors in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Table 6 indicated the impact of liquidity risk on credit risk controlling for other variables and their influence on the operational performance of the small banks in Pakistan. When we take the liquidity risk as dependent variable, the results show a significant but negative relation between LR and CR under Model 1 for small banks. The coefficient of contemporaneous credit risk is -0.192, which shows that when CR decreases by one unit then LR increases by 0.192 units. The results do not change when we take the first lag of credit risk under the head of Model 2. The value of coefficient of the lagged credit risk is -0.433, which show significant but negative relationship between liquidity risk and credit risk.

Our results even do not change when we take the second lag of credit risk under the head of Model 3. The value of coefficient of the lagged credit risk is -0.392, which show significant but negative relationship between liquidity risk and credit risk. The highest statistics of -0.912, observed under the head of model 1 as a total effect of the liquidity risk on small banks and coefficient with credit risk prove the significance of the hypothesis. The second highest value of total effect observed under the head of model 3, which is -0.531, it has statistical significance to justify the assumption made in the study. The negative value (-0.877) of total effect, perceived under model 2 and it is least significant value to defend the hypothesis of the study. Our results are consistent with Abdullah and Khan (2012). All values are defending the significance of association between variables and are indicating the minor statistics to justify the

relation in variables as a meaningful economic bond of performance for small-scale banks in Pakistan.

**Table 7: Relationship of Liquidity Risk and Credit Risk for Small-Scale Bank**

	<b>(Dependent variable: Credit Risk)</b>		
<b>CR-Small Banks</b>	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>
LR(t)	0.151* (0.080)	0.366** (0.165)	-0.0530* (0.028)
LR(t-1)		-0.148* (0.078)	-0.012** (0.005)
LR(t-2)			0.170** (0.075)
Total Effect	0.151	0.218	0.104
Return on Assets	-0.740* (0.391)	-0.819** (0.364)	-0.644 (0.293)
T-bills	-0.002** (0.001)	-0.005** (0.002)	-0.010** (0.004)
Capital Ratio	-0.375* (0.196)	-0.362 (0.192)*	-0.406** (0.188)
Ln GDP	-0.080** (0.034)	-0.067* (0.035)	-0.116*** (0.034)
Observations	91	91	85

Standard errors in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Table 7 shows a significant relationship between dependent and independent variables, and ensuring the strength of individual variable effect on the performance of banks. A study conducted by Nikomaram et al. (2013) also shows that there is significant relationship of bank size with liquidity risk and credit risk and also found that the bank's performance has a close association with size of bank. Size of the bank has become the preferable area for the discussion in the literature.

**Table 8: Relationship of Liquidity Risk and Credit Risk for Large-Scale Bank**  
(Dependent variable: Liquidity Risk)

LR-Banks	Large	Model 1	Model 2	Model 3
CR(t)		-0.142** (0.064)	0.273* (0.145)	0.014** (0.006)
CR(t-1)		–	-0.239** (0.105)	-0.281* (0.148)
CR(t-2)		–	–	0.231** (0.108)
Total Effect		-0.412	0.035	-0.0364
Return on Assets		0.960** (0.425)	1.301** (0.573)	0.731** (0.323)
Total Assets		-1.540*** (5.610)	-1.290** (5.450)	-1.200** (5.270)
Ln GDP		-0.004** (0.002)	0.041** (0.018)	0.010** (0.004)
Trading Ratio		-0.006** (0.002)	-0.080** (0.035)	0.387*** (0.134)
Saving Ratio		-0.009** (0.004)	-0.006** (0.002)	0.0035** (0.001)
Observations		104	104	95

Standard errors in parentheses, \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

The association of liquidity risk with credit risk in large-scale banks of Pakistan has also observed in this section. In Table 8 the statistics provide the figures of coefficient that reveal the fact of total effects on the performance of the banks. Sohaimi (2013) has viewed the relationship between the banks in term of liquidity risk in the operations of the banking system of Malaysia, and found a strong influence of liquidity risk on the operation of the banks.

**Table 9: Relationship of Liquidity Risk and Credit Risk for Large-Scale Bank**

**(Dependent variable: Credit Risk)**

<b>CR-Large Banks</b>	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>
LR(t)	0.222** (0.107)	-0.006* (0.003)	-0.388** (0.171)
LR(t-1)		-0.024** (0.011)	0.229** (0.100)
LR(t-2)			0.209*** (0.075)
Total Effect	0.2223	0.009	0.0503
Return on Assets	-0.836* (0.440)	-0.875** (0.385)	-0.353** (0.155)
T Bills	0.005** (0.002)	0.004** (0.002)	-0.006** (0.002)
Capital Ratio	-1.027** (0.435)	-1.007** (0.467)	-0.914*** (0.344)
Ln GDP	- 1.102*** (0.030)	-0.100*** (0.031)	-0.216*** (0.028)
Observations	104	104	95

Standard errors in parentheses, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

In Table 9, the coefficient 0.2223 in Model 1 shows positive impact of total effect of the liquidity risk on large banks. The second highest absolute value of total effect is 0.0503, under the head of Model 3, which is involving the possibility of two lag, which is also a favorable statistic to justify the assumption made in this study. The least absolute value of correlation for total effect is 0.009, under the head of Model 2, which has two lags in the equation that is also substantial statistic to accept the hypothesis, and the remaining model 2&3 also show a positive role of total effect on credit risk.

The results indicate that bank size has a significant impact on the relationship of liquidity and credit risk. Therefore, there is a meaningful relation between liquidity and credit risk in case of bank size. Nikomaram

et al. (2013), has investigated the liquidity risk and credit risk with reference of banks in Iran; he assessed the relationship of liquidity risk and credit risk based on the size of banks. They found that the credit risk do not matter whether bank is small or large but liquidity risk has its impacts regarding the size of bank. However, in this study combine relationship of liquidity risk and credit risk is presenting the significant influence for the operations of the banks in Pakistan.

## **5. Conclusion**

Many factors influence the survival of banks. In these factors, liquidity risk and credit risk are of significant nature. This study examine the relationship between the liquidity risk and credit risk analyzed on the performance of commercial and public banks in Pakistan. The assumptions which have designed to estimate the role of the liquidity risk and credit risk are evaluated by many variables. This study takes the data of 11 commercial banks and 4 public banks and subdivided the banks into three categories i.e. small banks, large banks and overall banks. The time-period of the data is of 13 years from 2002 to 2015.

It is analyzed that the liquidity risk and credit risks are the distinctly important features for the performance of the banking sector in right direction and a keen analysis required to assess these factors to make the balance for the occurrence of these factors.

From the above stated results, this study comes up with the following policy implications:

- Liquidity risk is an endogenous determinant of bank performance. Therefore, it has different effects on bank performance in different financial system.
- The greater regulatory empowerment of private monitoring of banks will increase bank liquidity risk and credit risk in market-based financial system.
- Banks should have contingency plans for any abnormal or worst case scenarios

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