Measuring Liquidity Risk Management and Impact on Bank Performance in Iran

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A bank as a business units needs to have liquid assets which can be easily converted into cash at short notice .Thus the concept of liquidity risk management is important for any commercial banks. The impact of liquidity position in management of banks have remained significant, though very elusive in the process of investment analysis vis-à-vis bank portfolio management. In addition, liquidity risk management affects banking performance. In this paper, according to existing theoretical and empirical literature, the suitable system for measuring liquidity risk management is defined. Then, the effect of liquidity risk management on the profitability and survival of banks has been investigated. For this purpose, a model is estimated using panel data method and the financial statements of banks for the period 2005-2017. The results of the study show that there is a significant relationship between risk management and profitability and bank survivability. As poor liquidity risk management reduces the profitability and survival of banks.

Keywords: Liquidity Risk Management, Survival, Profitability, Panel Data.
JEL Classification*: G2, G21, G210

1 Introduction

Liquidity becomes a major risk in banking operation and the liquidity management should be given priority by regulators for bank management. In the modern theory of financial intermediation, banks exit in economy because of the important role in creating liquidity and transferring their risk. The existence of non-money market makes the problem even more critical. In 2008, financial crisis in the U.S. and others countries created specific liquidity problems in the market as solvency problems. During this crisis many banks struggled to maintain their liquidity even with extensive supports. The fundamental role of banking makes them inherently vulnerable to liquidity risk.

During the financial crisis, many banks experienced difficulties because they did not manage their liquidity in a prudent manner. Failure of liquidity risk management is one of the main causes of the financial crisis (KPMG

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International 2009; Sabato 2010; Holland 2010). Liquidity risk in banking is one of the risks that need to be addressed by the bank beside credit and market risk. According to Vento and Ganga (2009), liquidity symbolizes the ability of banks to compete keeping the balance of inflow and outflows over time. With the existence of liquidity risk, banks need to be cautious with their cash flow so that their profits can be maintained without being affected by liquidity risk.

Liquidity risk affects the performance and reputation of a bank (Jenkinson, 2008). The bank may lose the confidence of its accountholders if funds are not provided to them well in time. Consequently, the regulator may also impose penalties on the banks. Therefore, it is necessary for banks to manage and keep comprehensive liquidity at every stage to safeguard the risk. Liquidity risk has been a serious challenge for banks lately (Comptroller of the Currency, 2001). Extraordinary competition for customer deposits, a wide collection of funding products in corporate and capital markets with technological improvements have changed the finance structure and risk management arrangement (Akhtar, 2007)

In Iran, there are 34 banks with a mandate from the Central Bank and 5 credit institutions. The banks are including three state-owned commercial banks, five state-owned specialty banks, twenty private banks, two Gharz-Al Hasaneh banks, two foreign banks and one bank with joint Iranian foreign ownership.

Banks have faced a shortage of liquidity in recent years in response to withdrawal of deposits. As their financial frailty is increasing, to control liquidity risk management, the Central Bank of Iran has provided guidance on liquidity risk management to banks. But despite this, there are many shortcomings in liquidity risk management of banks. It requires the design of a mechanism for assessing liquidity risk management. In this paper, according to theoretical and empirical literature, liquidity risk criteria have been selected. In the second step, by designing a liquidity rating mechanism, the status of banks is expressed based on liquidity risk management.

In step three, the effect of liquidity risk management on bank performance is examined. For assessing the performance of banks, we use, return on asset and survival indices. To design this mechanism, the latest published data by the Iran Banking Institute has been used for the period of 2006-2017. The rest of the paper is organized into four sections: Theory, review of relevant literature; methodology and empirical results; and conclusions.

2 Theory

2.1 Liquidity Risk Management System of Banks

Over the years, different theories have been formulated in ensuring the availability and sufficiency of liquidity at any point in time. The following theories are considered in the validation of this study;

1) Liquidity Asset Theory: This focuses on the asset side of the balance sheet and argues that banks must hold large amount of liquid assets against possible demand or payment cushion of readily marketable short term liquid assets against unforeseen circumstances (Ngwu, 2006).

2) Shiftability Theory: This is based on the proportion of banks liquidity that is maintained if it holds assets that could be shifted or sold to other lenders or investors for cash. Also, these assets could be shifted to the Central Bank for cash without material loss in case of necessity than relying on maturities to solve their liquidity problems (Ngwu, 2006).

3) Anticipated Income Theory: This theory is of the view that banks liquidity can be estimated and met if scheduled payments are based on the income of the borrower. It emphasizes that banks should relates loans repayment to income rather than relying heavily on collaterals. That is, bank liquidity can be influenced by the maturity pattern of loans through customers' installments rather than those secured by real estate (Ngwu, 2006).

4) Commercial Loan Theory: Also called the Real Bills Theory states that banks should advance short term self-liquidating productive loans to business firms. In other words, banks should finance the movement of goods through the successive process of production so that once these goods are sold, the loans will liquidate themselves. Such loans are termed inventory or working capital loan (Ngwu, 2006).

5) Liabilities Management Theory: This theory advocates that a bank can meet its liquidity requirement by bidding the market for additional funds. In other words, they can borrow money from the money market to meet their liquidity needs instead of granting self-liquidating loans (Ndifon Ojong et al, 2014).

2.2 Liquidity Risk Management and Bank Performance

There is relevant literature related to an aggregate shortage of liquidity (Allen & Gale, 2000). They view liquidity shortages arising from the banks' liability side, so the inherent constraint in demand deposit is regarded as the reason of bank systemic fragility. In the findings of Allen and Gale (2000), banks are linked through pooled investment and interbank loans. If banks find out that

the liquidity demand exceeds the supply, linked banks fail and contagion then occurs. However, earlier researchers, in their arguments, have not given much attention to the notion that banks create liquidity for depositors.

Liquidity risk reduces the ability of the bank to meet its financial obligations as they come due. When this risk remains unchecked, banks will lose customers thereby reducing the volume of deposits. When deposits reduce, the bank will have insufficient funds for other investments; this significantly reduces the level of profitability.

Again, a high liquidity risk causes a run on the bank. This run is caused by the panic withdrawal of deposits from the bank. This, adversely, affects the potentials of the bank by keeping away would-be-customers and potential investors from the bank. Consequently, the bank's operations reduce drastically and results in a significant reduction in profit (Ndifon Ojong, et al, 2014).

Liquidity glitches may disturb a bank's earnings and capital and in extreme conditions may result in the failure of an otherwise solvent bank (Central Bank of Barbados, 2008). Banks may have to borrow from the market even at an extraordinarily high rate during a liquidity crunch. This eventually causes a weakening in the bank's earnings. Additionally, a bank's more borrowing to meet savers' demand may place the bank's capital at pale. So, debt to equity ratio will increase, affecting the bank's effort to preserve an optimum capital level. Liquidity risk leads to prompt sale of the assets of the bank which may damage bank's capital base (Diamond & Rajan, 2001; Falconer, 2001).

If any of the banks encounters a situation in which it has to trade a large number of its illiquid assets to meet the backing wants (to decrease the leverage in conformism with the prerequisite of capital adequacy), the fire-sale risk may rise. This situation may call for price reduction to attract consumers which may have effects on the balance sheets of other organizations as they will also be indebted to mark their assets to the fire-sale price (Goddard et al., 2009).

A bank may reject the advancing, even to a prospective financier, if it feels that the liquidity need of the bank is moderately high (Diamond & Rajan, 2001). It is an opportunity loss for the bank, if a bank is powerless to meet the supplies of demand deposits. It shows bank runs (Diamond & Rajan, 2005). No bank advances all of its assets in the long-term schemes. Many of the funding resources are financed in the short term liquid assets. This provides a barrier against the liquidity jolts (Holmstrom & Tirole, 2000). A disparity in depositors demand and invention of resources sails a bank to make the resources at a higher price (Diamond & Rajan, 2005). Liquidity has a grander

influence on the tradable portfolios and securities. Generally, it denotes to the loss developing from liquidating a given situation (Zheng & Shen, 2008). It is vital for a bank to be alert of its liquidity station from a marketing viewpoint. It helps to grow its client loans in case of attractive market chances (Falconer, 2001). A bank with liquidity glitches loses a number of business opportunities. This places the bank at a modest disadvantage, as a divergence to those of the competitors.

There are two basic aspects of liquidity risk (Goodhart, 2008), maturity renovation i.e., the bank's assets and liabilities' maturity and essential liquidity of a bank's asset that is the level of assets which can be sold out without experiencing a significant loss under any market situation. These elements of a bank's liquidity are entangled. Banks do not required to be concerned about the maturity renovation if they have the assets that can be traded without bearing any loss.

Apart from the above-mentioned maturity disparity, liquidity risk also arises due to deteriorating economic circumstances; causing less reserve cohort and alarm the savers. This may show the disappointment of a bank, in fact the entire banking system due to Poisson Effect (Diamond & Rajan, 2005).

Earlier, many scholars have been converging on liquidity risk originating from the balance sheet liability side of a bank. Concurrently, less consideration has been given to the possibilities arising from the asset side. Liquidity risk may rise due to the failure or delays in cash flows from the debtors or early end of the missions (Diamond & Rajan, 2005). A Spartan liquidity disaster may cause enormous drowning in form of insolvencies and bank runs (Goodhart, 2008), leading to a radical monetary crisis (Mishkin et al., 2006).

2.3 Liquidity Risk Management Techniques

The framework for the management of liquidity risk has 3 aspects: measuring and managing net funding requirements, market access and emergency plans. Forecast possible future events is an important part of the liquidity risk management. An analysis of web funding includes the development of a maturity ladder and calculation of the accumulative web surplus or deficit funds within the hand-picked dates.

The banks ought to do regular estimation of the expected future money flows instead of focusing solely on written agreements within which liquidity will scroll forwards or backward. For instance, the money outflows will be hierarchical consistent with the date on which the liabilities come due, inside

the primary date a liability holder could exercise a possibility of early redemption, or the primary date that the contingencies will be known. An analysis whether or not a bank is sufficiently liquid depends upon the behavior of the flows in numerous conditions. Management of the liquidity risk ought to involve many possibilities. The state of affairs of "business continuity" has set a benchmark for money flows within the record of the traditional course of business.

This state of affairs is generally applied to the management of the bank's deposits. A second state of affairs considerations the liquidity of a bank in a crisis scenario within which a major portion of its liabilities cannot be returned or replaced - which means the contraction of bank record. This state of affairs applies to several provisions of existing money or liquidity measures of management. A 3rd state of affairs refers to a general market crisis, within which liquidity affects the whole industry, or at minimum, a major part of it. Liquidity management during this state of affairs relies on credit quality, with vital variations in funding access between banks. For the purpose of liquidity management, an implicit assumption will be created that the Central Bank can guarantee access to some kind of finance. The central banks in fact has an interest in learning this state of affairs due to the requirement to form a buffer of total liquidity for the banking sector, and practically to unfold the burden of liquidity issues among the key banks. (Farooq et al., 2015)

3 Literature Review

Anghelache and Bodo (2018), argue that in bank management, special attention must be paid to identifying the premises for its occurrence and, in this way, to provide measures to prevent or, at least, to limit the effects of liquidity risk. Indicators, such as liquidity ratio, liquidity index, loan / deposit ratio, and others, offer the ability to permanently monitor the degree of liquidity, on the basis of which the future liquidity risk may be identified. Of all the banking risks, liquidity risk has the most profound and immediate effects on the stability of the banks.

The Focus of Murithi and Munyua (2017), examine the effect of liquidity risk on financial performance of commercial banks in Kenya. The period of interest is between 2005 and 2014 for all the 43 registered commercial banks in Kenya. Liquidity risk is measured by Liquidity Coverage Ratio and Net Stable Funding Ratio while financial performance is measured by return on equity. Data is collected from commercial bank's financial statements filed with the Central Bank of Kenya. Panel Data techniques of random effects estimation and Generalized Method of Moments (GMM) are used to remove

time invariant unobserved firm specific effects and to mitigate potential endogeneity problems.

Pairwise correlations analysis between the variables are carried out. Wald and F- tests are used to determine the significance of the regression while the coefficient of determination within and between are used to determine how variation in dependent variable is explained by independent variables. Findings indicate that NSFR is negatively associated with bank profitability both in the long run and the short run while LCR does not significantly influence the financial performance of commercial banks in Kenya both in the long run and the short run. However, the overall effect is that liquidity risk has a negative effect on financial performance. Therefore bank's management must pay the required attention to the liquidity risk management.

The main purpose of Ly (2015) research is to investigate the relationships between liquidity risk, regulation, supervision and bank performance by using a panel data of EU27 countries over 2001-2011. This study finds that liquidity risk is negatively associated with bank performance. Capital regulation, official supervision, and policies on restriction of bank activity are positively related to bank performance while deposit insurance, private monitoring practices have negative relationship with bank performance. Capturing capital requirement and increasing power of official supervisors are much preferred in the market-based than bank-based countries.

The Purpose of Farooq et al. study (2015) is to analyze the problem of estimating the extent of bank liquidity that conventional banks should keep to guarantee the fulfilment of all its monetary obligations, and at the same time modify them to maximize investments and profits. The study tested the connection between bank liquidity risk and performance in conventional banks in Pakistan. Within the bank liquidity risk and performance model, we have a tendency to regard liquidity risk as endogenous determinant of bank performance, and apply panel instrumental variables regression to estimate this model. Regression analysis is applied for estimating the relationships among variables.

This research also highlights that the literature on current state of firm performance with respect to liquidity risk management is very limited especially in Pakistan which requires scholarly research contribution to better understand and conceptualize characteristics and complexities surrounding liquidity risk management in banking sector. The contribution of this research is to propose a conceptual framework for further research in context of Pakistan. Conclusions and future implications for theory and practice are discussed in last section.

Zolkifli, et al. (2015) present the determinants of liquidity risk and performance in conventional and Islamic bank. The data had collected from 2008 to 2014 and panel data analysis is used. The results reveal that the most significant factor is the capitalization. Capitalization also has a strong relationship with performance using parsimonious model. Based on finding, the ideal bank is Bahrain conventional bank. Problem of liquidity risk related to regulatory requirement will decrease and this will gives banks to increase their profitability and improve their financial performance.

Ferrouhi (2014) aims to analyze the relationship between liquidity risk and financial performance of Moroccan banks and to define the determinants of bank's performance in Morocco during the period 2001–2012. He first evaluates Moroccan banks' liquidity positions through different liquidity and performance ratios then he applies a panel date regression to identify determinants of Moroccan banks performance. He calculates 4 ratios of bank performance, 6 liquidity ratios and analyzes 5 specific determinants and 5 macroeconomic determinants of bank performance. Results show that Moroccan bank's performance is mainly determined by 7 determinants: liquidity ratio, size of banks, squared logarithm of total assets, external funding to total liabilities, share of own bank's capital to the bank's total assets, foreign direct investments, unemployment rate and the realization of the financial crisis variable.

Banks' performance depends positively on size of banks, foreign direct investments and the realization of the financial crisis and negatively on external funding to total liabilities, share of own bank's capital to the bank's total assets and unemployment rate while the dependence between bank performance and liquidity ratios and bank performance and squared logarithm of the total assets depend on the model used.

Ndifon Ojong et al,.2014 aim at evaluating the impact of credit risk and liquidity risk management on the profitability of deposit money in banks of Nigeria with particular reference to First Bank of Nigeria Plc. Descriptive research design is used for the study where questionnaires are administered to a sample size of eighty (80) respondents. The data obtained are presented in tables and analyzed using simple percentages. The formulated hypotheses are tested using the Pearson product moment correlation. The results of the study revealed that there is a significant relationship between credit management and bank profitability and there is a significant relationship between bank liquidity and profitability among banks in Nigeria. Based on the findings, it is recommended that banks should set up effective system of internal controls to monitor the risk control mechanisms in use in order to ensure complete

compliance with bank philosophy. Again, banks should always maintain a balance between deposit-loan ratios in order to avoid asset-liabilities mismatch.

The main objective of Cucinelli'study, (2013) is to analyze the type of relationship that exists between liquidity risk- measured with the liquidity coverage ratio and the net stable funding ratio - and the probability of default. The sample is composed of 575 listed and non-listed Eurozone banks and the methodology applied is OLS regression based on panel data. The results show a relationship only between the liquidity coverage ratio and credit rating, while there is no relationship between the long term liquidity measure and probability of default. In relation to the crisis, the results highlight divergent bank liquidity management only in the short term.

4 Methodology and Empirical Result

The purpose of this paper is to investigate the effect of liquidity risk management on the performance of banks of Iran. For this purpose, a model is estimated using panel data method and the financial statements of banks[1] for the period 2005-2017.To measure liquidity risk, we calculate ratios. Given the lack of access to the information required to calculate the liquidity risk, the ratios introduced in this paper are merely a proxy of the standard approach to calculating liquidity risk. Therefore, the indication of these ratios for policy making may lead to a deviation in the performance and efficiency of the bank managers' ultimate goal.

Liquid asset to total asset measures the ability of a bank to absorb liquidity shocks. A high ratio means a high ability to absorb shocks. Liquid assets to short term liabilities measures the ability of a bank to cope with a high demand of short term liquidity. A high ratio means that the bank is liquid at short-term. Liquid assets to deposits measure bank's liquidity in case that bank cannot borrow from other banks. A high ratio means that the bank is able to cope with long term liquidity risk. Loan to total assets measures the share of loans in total assets. It shows the percentage of the bank's assets related to illiquid loans. When this ratio is high, it means that the bank is less liquid. Loans to deposit plus short term liabilities indicates the relationship of illiquid assets and liquid liabilities. When this ratio is high, it means that the bank is less

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liquid. The ration of bank's loans minus customer deposits to total assets measures liquidity risk exposure. Define as the difference between bank loans and customer deposits, financing gap is divided by total assets.

The following steps have been taken to measure liquidity risk management. First, we consider the medium of the banking network as a critical threshold for all indicators. This criterion has been selected because a specific threshold for liquidity risk indicators in the banking system of Iran is not defined. In this method, the amount of each indicator for each bank is compared with the average size of those indicators in Iran's banking system. Therefore, a virtual variable is defined in which, if the operation of the bank in the indices is better than the average of the banking network, then the numerical value is one and the other is zero.

In the second step, the rank of banks that have better status than all other banks, in each of the six indicators is considered one. If the bank is better than the average of banking network in 4 or 5 of the indicators, the rank is 2. If the bank is better than the average of banking network in 3 of the indicators, the rank is 3. If the bank is better than the average of banking network in 1 and 2 of the indicators, the rank is 4. If the bank did not have a better status than the average banking network in any of the indices, it would be ranked 5.

Banks that are ranked 1 and 2, are low risk and have good liquidity risk management. If the rank of banks is 3, they are medium risk banks and have average liquidity risk management and banks with 4 and 5 rating, are high risk and have poor liquidity risk management.

In this paper, return on asset, return on equity and net interest margin are used as indicators of profitability. Then based on the results of the model, return on asset is used as an indicator of profitability.

The different stages of modeling are as follows. First, liquidity risk management indicators have been defined. In the second step, a unit root test was performed for each of the variables. In the third step, statistical analysis is performed. In the fourth step, using the F-Limer test, the pool model is selected and at the end the model is estimated. The variables used in this article, are presented in Table 1.

The results of the unit root test are shown in Table 2. For the unit root test, four statistics, PP-Fisher, ADF- Fisher, Im, Pesaran and Shin W-Stat, Levin, Lin& Chu are used. The results show that the variables used in this paper are static at the level and significance at the 5% level. Statistical analysis of variables is presented in Table 3 and 4.

Iran's banks register an average of 18.37 percent for liquid assets to total asset, 287.92 percent for liquid assets to short term liabilities, 70.82 percent

for liquid assets to deposit, 93.53 percent for loan to total assets, 122.32 percent for loans to (deposit + short term liabilities) and -11.46 percent for bank's loan minus customer deposits to total assets from 2006 to 2017, as seen in Table 3. The liquidity risk indices are distributed in a leptokurtic manner (K=9.8, 68.91, 163.33, 4.24, 95.95 and 3.8) respectively and some positively skewed (S=2.09, 7.43, 12.33, -1.20, 8.15 and 0.69).

Table 1
Introducing Variables

	indicators	Symbol
Liquidity Risk	Liquid Asset to Total Asset	Lr1
	Liquid Assets to Short Term Liabilities	Lr2
	Liquid Assets to Deposits	Lr3
	Loan to Total Assets	Lr4
	Loans to (deposit+ short term liabilities)	Lr5
	(Bank's Loans –Customer Deposits) to Total Assets	Lr6
Liquidity Risk Management	If rank of LR=1,2, then LRM=1, otherwise, LRM=0	LRM1
	If rank of LR=3, then LRM=1, otherwise, LRM=0	LRM2
	If rank of LR=4,5, then LRM=1, otherwise, LRM=0	LRM3
Profitability	Return on Asset	Pro1
	Return on Equity	Pro2
	Net Interest Margin	Pro3
Survival	Net Worth to Assets	surv
Performance	Capital Adequacy	Perform1
	Efficiency=Cost to income	Perform2
	Bank Size	Perform3
	Total Debt over Total Asset	Perform4
	Off Balance Sheet Items to Total Assets	Perform5
	Bank Age	bage
	Bank Ownership Type	bown

Source: Research Findings.

If skewness is negative, the data are negatively skewed or skewed left, meaning that the left tail is longer. If skewness = 0, the data are perfectly symmetrical. If skewness is less than −1 or greater than +1, the distribution is highly skewed. The Jaque-Bera test supports that the liquidity risk is not

normally distributed (JB=533.35, 37475.02, 215995, 60.64153, 73115, 37 and 22.47360). This distribution further shows that half of the banks in Iran have a liquidity risk index that is higher than 14.10, 130.28, 22.60, 99.24, 119.01 and 19.87 percent. Data show that while some banks have less than 10 percent liquidity risk index, others have as high as 111.71 percent.

Table 2
Unit Root Test

Indicators	PP-Fisher, Chi square	ADF- Fisher, Chi-Square	Im, Pesaran & Shin W-Stat	Levin, Lin & Chu
Lr1	178.970	139.379	-9.53440	-43.6453
	(0.000)	(0.000)	(0.000)	(0.000)
Lr2	197.122	199.969	-20.7459	-70.0078
	(0.000)	(0.000)	(0.000)	(0.000)
Lr3	173.837	186.723	-25.2855	-105.302
	(0.000)	(0.0001)	(0.000)	(0.000)
Lr4	108.493	115.415	-4.56118	-8.98685
	(0.0001)	(0.000)	(0.000)	(0.000)
Lr5	140.018	121.349	-8.91144	-53.7281
	(0.000)	(0.000)	(0.000)	(0.000)
Lr6	137.121	104.016	-4.45454	-18.5166
	(0.000)	(0.0004)	(0.000)	(0.000)
Pro1	145.312	120.447	-8.74390	-48.8362
	(0.000)	(0.000)	(0.000)	(0.000)
Pro2	134.725	94.4447	-3.21034	-8.62965
	(0.000)	(0.0030)	(0.0007)	(0.000)
Pro3	138.649	115.133	-8.02841	-46.9434
	(0.000)	(0.000)	(0.000)	(0.000)
surv	186.174	162.180	-19.0810	-84.9043
	(0.000)	(0.000)	(0.000)	(0.000)
Perform1	202.553	157.137	-12.4064	-43.6286
	(0.000)	(0.000)	(0.000)	(0.000)
Perform2	116.012	114.304	-5.59766	-25.3628
	(0.000)	(0.000)	(0.000)	(0.000)
Perform3	109.020	70.6108	-0.70304	-7.93652
	(0.0001)	(0.1643)	(0.2410)	(0.000)
Perform4	203.728	172.254	-17.1857	-49.3847
	(0.000)	(0.000)	(0.000)	(0.000)
Perform5	154.821	125.533	-5.58924	-14.1408
	(0.000)	(0.000)	(0.000)	(0.000)

Source: Research Findings.

Table 3
Descriptive Statistics of Liquidity Risk Indicators

	Lr1	Lr2	Lr3	Lr4	Lr5	Lr6
Mean	18.37782	287.9284	70.82426	93.53301	122.3219	-11.46677
Median	14.10592	130.2846	22.60062	99.24519	119.0124	-19.87357
Maximum	92.21803	7378.904	4801.990	136.1833	894.4176	96.64822
Minimum	1.591581	6.074725	1.886783	0.000000	0.000000	-111.7168
Std. Dev.	12.87878	686.4756	354.3637	27.08281	66.10246	38.46401
Skewness	2.091861	7.430714	12.33342	-1.208920	8.156108	0.695349
Kurtosis	9.890152	68.91375	163.3300	4.241713	95.95896	3.896581
Jarque-Bera	533.3588	37475.02	215995.4	60.64153	73115.37	22.47360
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000013
Sum	3620.430	56721.90	13952.38	18426.00	3620.430	56721.90
Sum Sq. Dev.	32509.14	92364761	24612428	143761.8	32509.14	92364761
Observations	197	197	197	197	197	197
Cross Sections	30	30	30	30	30	30

Source: Research Findings.

Moreover in Table 3, profitability, measured in terms of ROA (pro1), is fairly low at 1.41 percent. ROA, likewise, is not normally distributed as indicated by the Jarque-Bera test (JB=1235.72), with a leptokurtic (K=14.16) and positively skewed distribution (S=2.38), indicating that half of the Iranian banks have ROA higher than 1.03 percent. Data show that some banks have ROA as high as 13.68 percent while others have even less than zero. ROE (pro2) is averaged at 14.78 percent; it is highly leptokurtic (K=16.64). Data also show that the maximum ROE is 119.38 percent. The distribution is highly negatively skewed (S=-0.26), with half of the Iranian banks having a ROE higher than 14.89 percent. Similarly, the distribution is not normal as indicated by the Jarque-Bera test (JB=1562.23).

Table 5 depicts that, Iranian banks have a 6.94 percent mean survival (surv), which is far above the 1 percent required by Basel Committee. This indicates that Iranian banks are well-net worth. While half of the Iranian banks have higher than 5.09 percent survival, some have a negative survival ratio (minimum of 0.10). Survival is not normally distributed as indicated by the Jarque-Bera test (JB=5525.44), with a leptokurtic (K=27.56) and positively skewed distribution (S=3.75), indicating that half of the Iranian banks had survival rate higher than 5.09 percent. Data show that some banks have as high as 66.81 percent survival while others have even less than zero.

Table 4
Descriptive Statistics of Profitability Indicators

	PRO1	PRO2	PRO3
Mean	1.419111	14.78392	2.141176
Median	1.037563	14.89409	1.343576
Maximum	13.68267	119.3839	50.00922
Minimum	-3.577631	-107.6125	-4.934964
Std. Dev.	1.810478	18.52395	4.381147
Skewness	2.386821	-0.266582	7.349118
Kurtosis	14.16968	16.64739	75.26756
Jarque-Bera	1235.727	1562.234	45548.59
Probability	0.000000	0.000000	0.000000
Sum	285.2414	2971.568	430.3764
Sum Sq. Dev.	655.5660	68627.36	3838.890
Observations	201	201	201
Cross Sections	30	30	30

Source: Research Findings.

Table 5 shows that Iranian banks have a 10.62 percent mean capital adequacy ratio (perform1), which is far above the 8 percent required by Basel Committee. This indicates that Iranian banks are well-capitalized and have the high capacity to withstand shocks that could possibly happen by loan defaults. While half of the Iranian banks have higher than 6.67 percent capital adequacy ratio, some have a less than 1 capital adequacy ratio (minimum of 0.12), implying the insufficiency of capital. Also, their shareholders have yet to infuse the required capital to cover the bank's capital deficiency or prepare a capital build up plan acceptable to the BSP.

Cost to income (perform2) have a 79.49 percent mean. This indicates that Iranian banks are high cost. Half of the Iranian banks have higher than 79.88 percent cost to income and some have a less than 3.5 percent that shows they are highly efficient banks. The Jarque-Bera test shows that cost to income is not normally distributed (JB=57587.32), with a Kurtosis=84.07 and positively skewed distribution (S=8.69). Half of the Iranian banks have cost to income higher than 76.88 percent. Data show that some banks have as high as 814.7 percent survival while others have even less than zero.

Off balance sheet asset to total asset is an off balance sheet exposure index that has a 14.36 percent mean. Half of the Iranian banks have higher than 9.8 percent and others have less than 1.15 percent. Maximum of this indicator is 93.72 percent. It is not normally distributed (JQ=1370.35), with Skewness = 2.9 and Kurtosis=14.3.

Table 5

Descriptive Statistics of Survival and Performance Indicators

	SURV	PERFORM1	PERFORM2	PERFORM3	PERFORM4	PERFORM5
Mean	6.943683	10.62457	79.49711	5.126549	88.98777	14.36075
Median	5.090303	6.679907	76.88165	5.134530	93.20056	9.825785
Maximum	66.81527	67.84395	814.7800	6.217641	111.0325	93.72872
Minimum	-10.10097	0.120348	-3.515788	3.770502	0.000000	1.155428
Std. Dev.	7.235673	10.50491	74.13081	0.552405	12.52832	13.03590
Skewness	3.758428	2.452756	8.690995	-0.116033	-3.133919	2.993691
Kurtosis	27.56117	9.682526	84.07998	2.291692	17.53122	14.30686
Jarque-Bera	5525.440	575.5317	57587.32	4.652774	2097.454	1370.935
Probability	0.000000	0.000000	0.000000	0.097648	0.000000	0.000000
Sum	1395.680	2135.539	15978.92	1030.436	17886.54	2886.510
Sum Sq. Dev.	10470.99	22070.63	1099075.	61.03034	31391.75	33986.92
Observations	201	201	201	201	201	201
Cross Sections	30	30	30	30	30	30

Source: Research Findings.

Using the Eviews 9 software, panel data model is estimated and required tests are performed. In this paper 6 model are estimated. In 3 models, ROA is dependent variable and in other 3 models, survival is dependent variable. Models are estimated using three liquidity risk management indicators, LRM1, LRM2 and LRM3.

The studied models in this paper can be estimated as Pooled or Panel. Therefore, F-Limer test is used to diagnose this. The null hypothesis of this test is to estimate the model as Pooled. The results of the test indicate that the null hypothesis cannot be rejected and the model is estimated as a pooled model. The results of F-Limer test are shown in Table 5. The numbers outside and in parentheses indicate the amount of test statistic and probability related to it, respectively.

Table 6

F-Limer Test

	Pro1-lrm1	Pro1-lrm2	Pro1-lrm3	Surv-lrm1	Surv-lrm2	Surv-lrm3
F	0.896323	0.85498	0.830954	0.565921	0.560153	0.598836
	(0.5294)	(0.5750)	(0.5883)	(0.8241)	(0.8287)	(0.7973)
Chi-Square	8.624187	8.141188	8.003528	5.533677	5.475903	5.849355
	(0.3047)	(0.5200)	(0.5338)	(0.7855)	(0.7910)	(0.7549)

Source: Research Findings.

The model is:

$$LRM_{ikt} = \sum \beta_j X_{jkt} + \varepsilon_{it} \tag{1}$$

where *LRM* is liquidity risk management indicators for i=1,2,3, k=1….30, and t=2006…2017. β_j is coefficient. X_{jkt} is independent indicator.

The results of the model are shown in Table 7. The numbers in parentheses are the t-statistics and the numbers in brackets are probs. The sign * shows, indicators are significant in 10 percent. The results show, if LRM1is 1 and 2, bank has good liquidity risk management and the negative relationship will exist between profitability and LRM1 and positive relationship between survival and LRM1. Hence, each time LRM is 1, 2, the liquidity risk indicators are less than average of the banking network. It indicates, risk managers control liquid asset portfolio and it's indicators. These banks are risk averse and they save liquid asset more than average of banking network.

Any banks that have rank LRM=3, (LRM2), have medium liquidity risk. In this situation, these banks keep more liquidity than others and they are risk lover. They supply credit more than banking network. This situation increases profitability. Then, relationship between liquidity risk management and profitability is positive.

If the liquidity risk management rank is 4 and 5, (LRM3), have poor liquidity risk management. So it maintains a high level of loan to total assets, means bank's loans minus customer deposits to total asset is high with low level of other indicators. This shows that bank's liquidity portfolio quality is weak. If loan increases, probability of non-performing or past due increases, which explains the maintenance of a corresponding higher level of loan loss provisioning and reserving. Consequently, if a bank's loan portfolio is saddled with non-performing and/or past due loans, the yield in the form of interest income from these loans decreases, resulting in lower net income, and therefore, lower ROA. Conversely, if a bank prudently lends, there is a high probability that it is profitable. On the other hand, the net wealth of the bank will also be reduced due to the reduction in capital because of the increase in NPL, thus the bank's survival shrinks accordingly.

Relationships between profitability and capital adequacy (perform1) and between survival and capital adequacy is positive and significant. Equity holders of commercial banks have too much concern about capital adequacy as being an important factor in the determination of their earnings. The more capital adequacy, the more health and stability in banks and they can better engage in profitable activities and they survive more than others.

Table 7
Results of the Model

	Pro1-lrm1	Pro1-lrm2	Pro1-lrm3	Surv-lrm1	Surv-lrm2	Surv-lrm3
LRM1	-0.215738 (-1.740403) [0.0296]	……….	……….	1.223677 (1.888056) [0.0603]	……….	……….
LRM2	……….	0.337025 1.804240) [0.0725]	……….	……….	0.208523 0.346565) [0.7292*]	……….
LRM3	……….	……….	-0.207523 (-0.864805) [0.3881*]	……….	……….	-0.550600 (-2.075768) [0.0391]
Perform1	0.068518 (4.531869) [0.0000]	0.070353 (4.709831) [0.0000]	0.072893 (4.753584) [0.0000]	0.561306 (14.30107) [0.0000]	0.568164 (14.37908) [0.0000]	0.579798 (14.68600) [0.0000]
Perform2	-0.002900 (-2.230627) [0.0267]	-0.003164 (-2.368821) [0.0187]	-0.003066 (-2.280729) [0.0235]	0.001052 (0.244731) [0.8069*]	0.000553 (0.127255) [08989*]	0.000163 (0.038013) [0.9697*]
Perform3	-0.049935 (-0.279963) [0.7798*]	-0.023719 (-0.137655) [0.8906*]	0.035273 (0.193240) [0.8469*]	2.475130 (4.570910) [0.0000]	2.284159 (4.271459) [0.0000]	2.609214 (4.728994) [0.0000]
Perform4	0.021738 (2.308294) [0.0219]	0.018039 (2.034542) [0.0431]	0.016549 (1.780085) [0.0764]	-0.125323 (-4.356741) [0.0000]	-0.109226 (-3.954053) [0.0001]	-0.123765 (-4.377308) [0.0000]
Perform5	0.003525 (0.455381) [0.6493*]	0.002169 (0.280251) [0.7795*]	0.004346 (0.566783) [0.5714*]	0.116610 (5.000191) [0.0000]	0.111868 (4.717589) [0.0000]	0.109418 (4.707951) [0.0000]
Surv	0.026786 (1.266009) [0.2068*]	0.023147 (1.112531) [0.22671*]	0.021090 (0.997157) [0.3198*]	……….	……….	……….
Bage	-0.011018 (-2.457962) [0.0147]	-0.011591 (- 2.640325) [0.0089]	-0.012595 (-2.791018) [0.0057]	0.016621 (1.112211) [0.2673*]	0.020654 (1.388227) [0.1665]	0.014529 (0.966454) [0.3349]
Bown	-0.303485 (-3.554720) [0.0005]	-0.286581 (-3.368790) [0.0009]	-0.286797 (-3.312374) [0.0011]	-1.390683 (-5.201061) [0.0000]	-1.444288 (-5.405203) [0.0000]	-1.332735 (-4.931160) [0.0000]
Pro1	……….	……….	……….	-0.423509 (-0.867392) [0.3867*]	-0.569663 (-1.157753) [0.2482*]	-0.577896 (-1.198904) [0.2318*]
Pro2	……….	……….	……….	-0.010523 (-0.400085) [0.6895*]	-0.010608 (-0.400725) [0.6890*]	-0.007167 (-0.272838) [0.7852]
Pro3	……….	……….	……….	0.315399 (2.011227) [0.0455]	0.3362923 (2.314725) [0.0215]	0.346501 (2.242065) [0.0259]
R-Squre	0.444830	0.450339	0.444207	0.774346	0.772476	0.775902

*note. * means significance at 0.1 level. Source:* Research Findings.

Cost to income (perform2), has not significant effect on survival but has significant and negative effect on profitability. The higher the bank's cost, the

less profitable. The size of the bank (perform3) has positive and significant effect on profitability and survival. The larger the size of a bank, the more diversification of the activities, and thus, while having income from different activities, it will have longer survival because of the distribution of risk.

Debt to asset (perform4) has significant and positive effect on profitability and negative effect on survival. The more the bank's debt to assets, shows the bank has more resources and can create more asset and more profits. But if this ratio is larger than one, it means that the net wealth is negative and survival of bank decreases over time.

Off balance sheet asset to total asset (perform5) has significant and positive effect on survival but does not have significant effect on profitability. If the bank maintains more liquidity, it will allocate fewer resources to profitable assets, and thus the bank's profitability will decrease. On the other hand, keeping enough liquid assets would make enough resources for bank, in the face of sudden withdrawal of deposits, and save it from failing.

The longer the age of bank, the lower the profitability of the bank. This is because banks over 15 years old are banks with a government structure whose business models are not profitable. Government ownership also has a negative impact on the profitability and survival of banks in Iran. ROA and ROE (pro1 and pro2) are not significant but net interest margin (pro3) is significant and has positive effect on survival.

5 Conclusion

As the extension of deposit has always been at the core of banking operation, the focus of banks' risk management has been liquidity risk management. Liquidity risk management incorporates decision making process; before the liquidity decision is made, follows with liquidity commitments including all monitoring and reporting process.

In this paper, the effect of liquidity risk management on the performance of banks in Iran has been investigated. Return on asset and survival index are used as benchmarks for banks' performance. According to the empirical studies, six criteria are selected as liquidity risk indicators. To define liquidity risk management, for each of the liquidity risk criteria, the critical threshold is defined. Then, given the critical threshold, banks are divided into three groups, high risk, medium risk and low risk. As a result, banks with weak, medium and strong liquidity risk management are identified. The results of the survey show that poor liquidity risk management would reduce bank profitability and survivability.

The results show there are negative relationship between profitability and LRM1 and positive relationship between survival and LRM1. These banks are risk averse and they save liquid asset more than average of the banking network.

The relationship between LRM2 and profitability is positive. In this situation, these banks keep more liquidity than others and they are risk lover.

If the liquidity risk management rank is 4 and 5 (LRM3), it has poor liquidity risk management, which show that bank's liquidity portfolio quality is weak. Consequently, the yield in the form of interest income from these loans decreases, resulting in lower net income, and therefore, lower ROA. On the other hand, the net wealth of the bank will also be reduced due to the reduction in capital because of the increase in NPL, thus the bank's survival shrinks accordingly.

The model designed in this paper will help bank supervisors to identify banks with poor liquidity risk management. It is suggested that bank supervisors define standard criteria for assessing liquidity risk management and periodically review banks' risk management. It is recommended that banks, by applying the existing standards, define appropriate liquidity risk criteria and, by designing appropriate liquidity risk management mechanisms, identify their risk profile. It is also suggested that banks consider their liquidity risk profile in assessing profitability and sustainability.

References

Akhtar, S. (2007). *Pakistan: Changing Risk Management Paradigm - Perspective of the Regulator*. ACCA Conference - CFOs: The Opportunities and Challenges Ahead, Karachi.

Allen, F., & Gale, D. (2000). Financial Contagion. *Journal of Political Economy*, 108(1), 1-33.

Anghelache, C., & Bodo, G. (2018). Liquidity Risk Analysis at Financial Banking Institutions. *Romanian Statistical Review*, Supplement nr. 1/ 2018.

CEBS (2008). *Reducing Liquidity Risk - A New Imperative*. CEBS's Technical Advice to the European Commission on Liquidity Risk Management, Aleri, Committee of European Banking Supervisors, New York, NY.

Central Bank of Barbados (2008). *Liquidity Risk Management Guideline*, Bank Supervision Department, Central Bank of Barbados, Bridgetown.

Comptroller of the Currency (2001). *Liquidity: Comptroller's Handbook, Comptroller of the Currency: Administrator of the National Banks*, Washington, DC.

Cucinelli, D. (2013). The Relationship between Liquidity Risk and Probability of Default: Evidence from the Euro Area. *Risk Governance and Control: Financial Markets and Institutions*, 3(1), 42-50.

Diamond, D. W., & Rajan, R. G. (2001). Liquidity Risk, Liquidity Creation, and Financial Fragility: A Theory of Banking. *The Journal of Political Economy*, 109(2), 287-327.

Diamond, D. W., & Rajan, R. G. (2005). Liquidity Shortages and Banking Crises. *The Journal of Finance*, 60(2), 615-47.

Falconer, B. (2001). Structural Liquidity: The Worry Beneath the Surface. *Balance Sheet*, 9(3), 13-19.

Farooq, U., Maqbool, M. Q.; Afzal Humanyun, A., Shahid Nawaz, M., & Abbas, M. (2015). An Empirical Study on Impact Liquidity Risk Management on Firm Performance in the Conventional Banking of Pakistan. *Journal of Business and Management*, 17(2), 110-118.

Ferrouhi, E. M. (2014). Bank Liquidity and Financial performance: Evidence from Moroccan Banking Industry. *Verslas: Teorija Ir Praktika/ Business: Theory and Practice*, 15(4), 351-361.

Goddard, J., Molyneux, P., & Wilson, J. O. (2009). The Financial Crisis in Europe: Evolution, Policy Responses and Lessons for the Future. *Journal of Financial Regulation and Compliance*, 17(4), 362-80.

Goodhart, C. (2008). Liquidity Risk Management. *Financial Stability Review*, 11(6). 95-111.

Holland, J. (2010) Banks, Knowledge and Crisis: A Case of Knowledge and Learning Failure. *Journal of Financial Regulation and Compliance*, 18(2), 87-105.

Holmstrom, B., & Tirole, J. (2000). Liquidity and Risk Management. *Journal of Money Credit and Banking*, 32(3), 295-319.

Jenkinson, N. (2008). *Strengthening Regimes for Controlling Liquidity Risk*, Euro Money Conference on Liquidity and Funding Risk Management, Bank of England, London.

KPMG International (2009). *International Annual Review 2009*, KPMG International.

Ly, K. C. (2015). Liquidity Risk, Regulation and Bank Performance: Evidence from European Banks. *Global Economy and Finance Journal*, 8(1), 11-33.

Mishkin, F. S., Stern, G., & Feldman, R. (2006). How Big A Problem Is Too Big To Fail? A Review of Gary Stern and Ron Feldman's 'Too Big to Fail': The Hazards of Bank Bailouts. *Journal of Economic Literature*, 44(4), 988-1004.

Murithi, J., & Munyua, K. (2017). Liquidity Risk and Financial Performance of Commercial Banks in Kenya. *International Journal of Economics and Finance*, 9 (3), 256-265.

Ndifon Ojong, E., Inah Bassey, O., & Aneozeng Awo, E. (2014). The Impact of Credit and Liquidity Risk Management on the Profitability of Deposit Money Banks in Nigeria. I*nternational Journal of Economics, Commerce and Management*, 11(9), 32-45.

Ngwu, T. C. (2006). *Bank Management*. Owerri: Bob Publishers.

Sabato, G. (2010) Financial Crisis: Where Did Risk Management Fail? *International Review of Applied Financial Issues and Economics*, 2, 315-327.

Vento, G. A., & La Ganga, P. (2009). Bank Liquidity Risk Management and Supervision: Which Lessons from Recent Market Turmoil. *Journal of Money, Investment and Banking*, 10, 79-126.

Zheng, H., & Shen, Y. (2008). Jump Liquidity Risk and Its Impact on CvaR. *The Journal of Risk Finance*, 9(5), 477-91.

Zolkifli, N. A., Abdul Hamid, M. and Janor, H. (2015). Liquidity Risk and Performance: The Case of Bahrain and Malaysian Banks. *Global Economy and Finance Journal*, 8(2), 95-11.