Journal of Financial Regulation and Compliance
Emerald Article: Liquidity risk and performance of banking system

Ahmed Arif, Ahmed Nauman Anees

UNIVERSITY OF TORONTO LIBRARIES

Liquidity risk and performance of banking system

Ahmed Arif
Department of Management Science,
Shaheed Zulfiqar Ali Bhutto Institute of Science and Technology,
Islamabad, Pakistan, and

Ahmed Nauman Anees
Department of Learning and Development, Meezan Bank Limited,
Karachi, Pakistan

Abstract

Purpose – The purpose of this paper is to examine liquidity risk in Pakistani banks and evaluate the effect on banks' profitability.

Design/methodology/approach – Data are retrieved from the balance sheets, income statements and notes of 22 Pakistani banks during 2004-2009. Multiple regressions are applied to assess the impact of liquidity risk on banks' profitability.

Findings – The results of multiple regressions show that liquidity risk affects bank profitability significantly, with liquidity gap and non-performing as the two factors exacerbating the liquidity risk. They have a negative relationship with profitability.

Research limitations/implications – The period studied in this paper is 2004-2009, due to availability of the data. However, the sample period does not impair the findings since the sample includes 22 banks, which constitute the main part of the Pakistani banking system. Moreover, only profitability is used as the measure of performance. Economic factors contributing to liquidity risk are not covered in this paper.

Originality/value – This is the first paper addressing the liquidity risk faced by the Pakistani banking system. Past researchers and practitioners have not given the proper attention to liquidity risk. This paper helps in understanding the factors of liquidity risk and their impact on the profitability of the banking system. The authors emphasise contemporary risk managers to mitigate liquidity risk by having sufficient cash resources. This will reduce the liquidity gap, thereby reducing the dependence on repo market.

Keywords Pakistan, Banks, Risk management, Liquidity risk, Non-performing loans, Liquidity gap, Risk mitigation, Bank performance

Paper type Research paper

1. Introduction

The strength of the banking system is an essential requirement to ensure the economic stability and growth (Halling and Hayden, 2006). Banks are the main part of the financial sector in any economy, performing valuable activities on both sides of the balance sheet. On the asset side, they enhance the flow of funds by lending to the cash starved users of funds, whereas they provide liquidity to savers on the liability side (Diamond and Rajan, 2001).

Banks also facilitate the payments and settlement systems and support the smooth transfer of goods and services. They ensure productive investment of capital to stimulate the economic growth. They help to develop new industries, thereby increasing the employment and facilitating the growth. The varied nature of functions performed by the banks exposes them to liquidity risk – the risk that a bank may not meet its obligations (Jenkinson, 2008) as the depositors may call their funds at an inconvenient time, causing fire sale of assets (Diamond and Rajan, 2001), negatively affecting profitability of the bank (Chaplin *et al.*, 2000).

Over the past few years, bank managers did not pay the required attention to this vital element of liquidity risk (Committee of European Banking Supervisors (CEBS, 2008)). Lately, it has obtained a significant attention from the researchers, regulators and financial institutions after various economic and banking crises across the globe. There has been an imminent feeling that liquidity risk has not been sufficiently covered with the prevailing risk management practices (Crowe, 2009). It is said to be the assassin of banks (Ali, 2004). This claim finds support from the failure of many banks in the recent past. The banks and regulators are now having deep insight into the liquidity position of banks.

Liquidity risk not only affects the performance of a bank but also its reputation (Jenkinson, 2008). A bank may lose the confidence of its depositors if funds are not timely provided to them. The bank's reputation may become at stake in this situation. In addition to this, a poor liquidity position may cause penalties from the regulator. Therefore, it becomes imperative for a bank to keep a sound liquidity arrangement.

Liquidity risk has become a serious concern and challenge for the modern era banks (Comptroller of the Currency, 2001). High competition for consumer deposits, a wide array of funding products in wholesale and capital markets with technological advancements have changed the funding and risk management structure (Akhtar, 2007). A bank having good asset quality, strong earnings and sufficient capital may fail if it is not maintaining adequate liquidity (Crowe, 2009).

Banks should be equipped to deal with the changing monetary policy that shapes the overall liquidity trends and the banks' own transactional requirements and repayment of short term borrowing (Akhtar, 2007). There are a number of other risks faced by banks such as credit risk, operational risk and interest rate risk, which may culminate in the form of liquidity risk (Brunnermeier and Yogo, 2009).

1.1 Pakistani banking system
Pakistan's banking system is a key engine of growth and main lender to public and private sectors, similar to other regional countries' banking systems of India, Bangladesh and Sri Lanka (Perera *et al.*, 2006). State Bank of Pakistan (SBP) regulates all the banks and development financial institutions (DFIs) in Pakistan, under the Banking Companies Ordinance, 1962. Some major amendments in banking laws were made during the year 1997. Resultantly, SBP became an autonomous body for banking supervision. It is the responsibility of SBP, under section 40(A) of the said Ordinance, to monitor the performance of every bank to ensure its conformity with the defined criteria, rules and regulations. SBP has the power to take remedial steps in case of any noncompliance by the banking companies.

According to quarterly performance review of the banking system by SBP (September 2010), the Pakistani banking system consists of 40 banks, excluding DFIs and non-banking finance companies. Structurally, SBP has divided these banks into

four categories namely; public sector commercial banks (4), local private banks (25), foreign banks (7) and specialized banks (4). The structure of the Pakistani banking system is shown in Figure 1.

2. Liquidity risk

"Liquidity risk is a risk arising from a bank's inability to meet its obligations when they come due without incurring unacceptable losses" (Comptroller of the Currency, 2001). This risk can adversely affect both bank's earnings and the capital. Therefore, it becomes the top priority of a bank's management to ensure the availability of sufficient funds to meet future demands of providers and borrowers, at reasonable costs.

According to SBP:

> Liquidity risk is the potential for loss to an institution, arising from either its inability to meet its obligations or to fund increases in assets as they fall due without incurring unacceptable cost or losses.

In easier terms, liquidity risk can be defined as the risk of being unable to liquidate a position timely at a reasonable price (Muranaga and Ohsawa, 2002). There are two key dimensions of liquidity risk cited in this definition:

(1) liquidating the assets as and when required; and

(2) at a fair market value.

Banks face liquidity risk if they are not liquidating their assets at a reasonable price. The price fetching remains precarious due to frazzled sales conditions, while liquidating any of the bank's assets urgently. This may result in losses and a significant reduction in earnings.

Large-scale withdrawal of deposits may create a liquidity trap for banks (Jeanne and Svensson, 2007; Kumar, 2008), but this may not be always the primary source of liquidity risk (Diamond and Rajan, 2005; Holmstrom and Tirole, 2000). There are various other factors creating massive liquidity problems for the banks. For example, the extensive commitment based, and long-term lending may create serious liquidity issues (Kashyap *et al.*, 2002). Banks having large commitments are bound to honour them when they become due. Moreover, banks having a large exposure in long-term lending may face problems of liquidating the same during times of immense liquidity pressure.
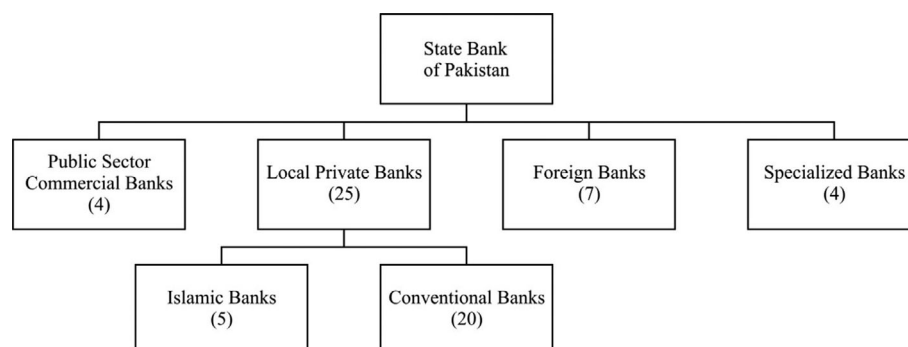

Figure 1.
Structure of Pakistani banking system

According to Goodhart (2008), there are two basic facets of liquidity risk: maturity transformation (the maturity of a bank's liabilities and assets) and the inherent liquidity of a bank's asset (the extent to which an asset can be sold without incurring a significant loss of value under any market condition). In fact, these two elements of a bank's liquidity are intertwined. Banks do not need to be worried about the maturity transformation if they have the assets that can be sold without bearing any loss. Whereas, banks having assets that are going to be matured in a shorter period may have a less need to keep the liquid assets.

Apart from the above-said maturity mismatch, liquidity risk arises due to recessionary economic conditions, causing less resource generation. This increases the demand of depositors creating liquidity risk. This may cause the failure of a given bank or even the entire banking system due to contagion effect (Diamond and Rajan, 2005). High liquidity increases the leverage and a highly leveraged bank may turn into the consumer of liquidity from the provider (Clementi, 2001).

The researchers in the past have been focusing on liquidity risk emanating from the liability side of a bank's balance sheet. Concomitantly, less attention has been given to the risks arising from the asset side. Liquidity risk may arise due to the breakdown or delays in cash flows from the borrowers or early termination of the projects (Diamond and Rajan, 2005). Moreover, liquidity risk may also originate from the very nature of banking; macro factors that are exogenous and financing and operating policies that are endogenous (Ali, 2004). A severe liquidity crisis may cause massive drowning in form of bankruptcies and bank runs (Goodhart, 2008), leading to a drastic financial crisis (Mishkin *et al.*, 2006).

SBP's 2nd quarterly report for the FY 2009-2010 shows that the continued strong credit demand from public sector enterprises (PSEs) and slow pace of retirement of outstanding commodity finance loans, exerted additional pressures on the liquidity position of financial institutions of the country. Moreover, it became difficult for SBP to manage the liquidity in Pakistan's banking system due to increase in loans to PSEs. Excessive borrowing from the Government of Pakistan has also posed a difficult challenge for the banks (SBP, 2008).

2.1 Managing liquidity risk

Liquidity risk management is an essential component of the overall risk management framework of the financial services industry, concerning all financial institutions (Majid, 2003). Ideally, a well-managed bank should have a well-defined mechanism for the identification, measurement, monitoring and mitigation of liquidity risk (Comptroller of the Currency, 2001). A well-established system helps the banks in timely recognition of the sources of liquidity risk to avoid losses.

The balance sheets of banks are growing in complexity and dependence upon the capital markets has made the liquidity risk management more challenging (Guglielmo, 2008). Guglielmo (2008) further argues that the banks having enhanced exposure in the capital markets must have a deep understanding of the risks involved. The said banks should develop the mechanism required for proper risk measurement and management. A bank should have continuous awareness about the breakdown of its various funding sources in terms of individual strata of clientele' (e.g. individual consumers, wholesalers, etc.) financial markets and instruments (Falconer, 2001).

A severe liquidity crisis may develop into a complete capitalization crisis within a short period. This situation may evolve due to fire sale risk that may arise because of taking large positions in illiquid assets. This fire sale risk may have incidental effects on the balance sheet because the institutions are obliged to mark their assets to the fire sale price. Banks can avoid this crisis by focusing on the ratios like liquid assets to total assets and liquid liabilities to total liabilities (Goddard *et al.*, 2009).

On the other hand, a bank may improve the maturity transformation by holding highly liquid assets as these assets can be sold or pledged to meet the funding risks in a short time (Goodhart, 2008). A bank may have to increase its cash reserves to mitigate the liquidity risk, but it might be costly in practice (Holmstrom and Tirole, 2000). The liquidity of an asset should be based on its capacity to generate the liquidity, instead of its trading book classification or its accounting treatment (CEBS, 2008). CEBS (2008) further emphasises to uphold a liquidity buffer, comprising of cash and liquid assets. This buffer provides a cushion to withstand the liquidity stress in a "survival period".

Moreover, the central bank imposes the condition of cash reserve requirement (a least amount that a bank is required to maintain at all times of its operations) to overcome the liquidity problems. A bank always tries to avoid the capital injection from the government because this may place a given bank at the government's mercy (Jeanne and Svensson, 2007). Therefore, banks hold minimum cash balance to avoid liquidity problems (Jenkinson, 2008).

According to Gatev and Strahan (2003), the deposits provide a natural hedge to banks against the liquidity risk. Under the stressed market conditions, the banks are perceived as a haven for investors who do not intend to issue funds against their loan commitments. The cash flows in any bank complement each other. The inflows of funds give a natural hedge to banks for outflows due to loan advancements. Therefore, banks use deposits to hedge the liquidity risk. This argument also finds support from the work of Kashyap *et al.* (2002) who provided a rationale of risk management to define the features of a commercial bank, commonly labelled as "financial intermediary" combining demand deposits with loan commitments.

One possible counter measure to reduce liquidity pressure is the transformation of illiquid assets into cash. In times of immense funding pressure, securitisation techniques are usually employed by the banking system for liquidation of assets like mortgages (Jenkinson, 2008). A bank should respond to funding shortfall by acting on the assets side of the balance sheet if it is facing restrictions on raising liquidity. It will be forced to squeeze the advancement of loans to its customers to reduce funding requirements.

Despite its features to support funding and increase liquidity, Ali (2004) has narrated two main drawbacks of the above stated policy. First, this strategy needs a bit longer period to be matured. Many of the lending decisions are taken in advance and hard to be reversed instantly, thereby not generating liquidity drainage quickly. Second, reduced lending affects a large part of the economy. In the non availability of funds to companies and households, it becomes difficult to support long-term investment and consumption in the economy.

2.2 Liquidity risk and performance of banks

Liquidity problems may affect a bank's earnings and capital and in extreme circumstances may result in the collapse of an otherwise solvent bank (Central Bank of Barbados, 2008). Banks may have to borrow from the market even at an exceptionally

high rate during a liquidity crisis. This ultimately causes a decline in the banks' earnings. Moreover, a bank's further borrowing to meet depositors' demand may place the bank's capital at stake. Thus, debt to equity ratio will rise, affecting the bank's effort to maintain an optimal capital structure.

Liquidity risk may cause a fire sale of the assets of the bank which may spill over into an impairment of bank's capital base (Diamond and Rajan, 2001; Falconer, 2001). If any of the financial institutions faces a situation in which it has to sell a large number of its illiquid assets to meet the funding requirements (perhaps to reduce the leverage in conformity with the requirement of capital adequacy), the fire sale risk may arise. This scenario may dictate to offer price discount to attract buyers. This situation will have a knock on effect on the balance sheets of other institutions as they will also be obliged to mark their assets to the fire sale price (Goddard *et al.*, 2009).

Diamond and Rajan (2001) state that a bank may refuse the lending, even to a potential entrepreneur, if it feels that the liquidity need of the bank is quite high. This is an opportunity loss for the bank. If a bank is unable to meet the requirements of demand deposits, there can be a bank run (Diamond and Rajan, 2005). No bank invests all of its resources in the long-term projects. Many of the funding resources are invested in the short term liquid assets. This provides a buffer against the liquidity shocks (Holmstrom and Tirole, 2000). Diamond and Rajan (2005) emphasise that a mismatch in depositors demand and production of resources forces a bank to generate the resources at a higher cost.

Liquidity has a greater impact on the tradable securities and portfolios. Broadly, it refers to the loss emerging from liquidating a given position (Zheng and Shen, 2008). It is essential for a bank to be aware of its liquidity position from a marketing perspective. It helps to expand its customer loans in case of attractive market opportunities (Falconer, 2001). A bank with liquidity problems loses a number of business opportunities. This places a bank at a competitive disadvantage, as a contrast to those of the competitors.

Pakistani banks faced a difficulty in lending to the private sector during 2008, due to the liquidity problems. This caused the loss of a number of business opportunities (SBP, 2010). One of the prime causes of these liquidity problems was the heavy financing to the government. The government has relied heavily on the banking system as a source of funding in Pakistan recently.

3. Conceptual framework

Liquidity risk has attracted significant attention of researchers and risk professionals alike, after the leading banking crises in recent times. Liquidity risk may have a shattering impact on a bank that may also cause a bank run (Diamond and Rajan, 2005). This risk stems from the description of banking operations (Chaplin *et al.*, 2000). It can affect the overall capital and earnings of the bank adversely. The bank may face serious consequences if it is not properly managed. The banks and the regulatory authorities are becoming increasingly vigilant to the liquidity positions of the financial institutions.

The deposits are the lifeline of the banking business. Most of the banking operations are run through deposits. If the depositors start withdrawing their deposits from the bank, it will create a liquidity trap for the bank (Jeanne and Svensson, 2007; Kumar, 2008) forcing the bank to borrow funds from the central bank or the inter-bank market

at higher costs (Diamond and Rajan, 2001). On the contrary, a bank having enough deposits in their accounts will not have the above-said problems. Therefore, to improve its profitability, it is imperative for a bank to increase its deposits. The above discussion gives rise to the following hypotheses:

H1. Increase in deposits boosts up the earnings of the bank.

Every bank tries to keep up sufficient funds to meet the unexpected demands from depositors (Majid, 2003) but maintaining the cash is extremely expensive (Holmstrom and Tirole, 2000). The banks maintaining large cash reserve may not only lose a number of opportunities in the market but also have to bear the high cost associated with cash. This situation is hypothesized as follows:

H2. Increase in cash reserves decreases the earnings of the bank.

One of the prime causes of liquidity risk is the maturity mismatch between assets and liabilities. In the banking business, the majority of the assets are funded with deposits most of which are current with a possibility to be called at any time. This situation is known as the mismatch between assets and liabilities (Central Bank of Barbados, 2008; Brunnermeier and Yogo, 2009). This mismatch can be measured with the help of the maturity gap between assets and liabilities (Falconer, 2001; Plochan, 2007). This is also called liquidity gap (Plochan, 2007). Higher liquidity gap will create liquidity risk (Plochan, 2007; Goodhart, 2008; Goddard *et al.*, 2009), therefore:

H3. Increase in the liquidity gap causes a reduction in the bank's earnings.

Many banks focus on the corporate or wholesale lending, which poses a challenge for the management to maintain the required liquidity position (Akhtar, 2007). This lending is mostly long-term, which may create liquidity problems for a bank (Kashyap *et al.*, 2002). The loan retirement process slows down in the banks during periods of poor production of resources in the economy. This situation gives rise to non-performing loans (NPLs). When NPLs experience a rapid increase, liquidity crisis becomes inevitable. In this situation:

H4. High provisioning for NPLs will cause a decrease in the bank's earnings.

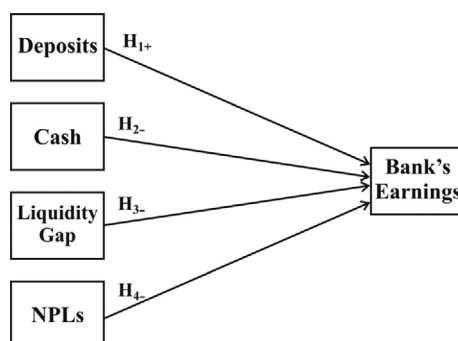The researchers have developed the following hypothesized model (Figure 2).

Figure 2.
Hypothesized model
of liquidity risk

4. Research methodology

4.1 Sources of data

The preliminary data were gathered from various secondary sources utilizing journals, books, and annual reports of the banks. Unstructured interviews were also conducted from risk managers of different banks. The purpose of these interviews was to have a general understanding of the liquidity risk management in the Pakistani banking system.

4.2 Nature of data

The data for analysis have been taken from the annual reports of banks in Pakistan. This study focuses only on conventional banks as Islamic banks and thrifts have a different risk management structure. The data have been collected for a set of 22 banks for the period 2004-2009. The availability of data dictated the choice of 22 banks that account for the majority of the total assets of the Pakistani banking system. The nature of data is panel data; a combination of time series and cross-sectional data.

Because of the small size of the sample period (2004-2009) and a small number of degrees of freedom, the researchers have transformed the cross section (22 banks) and time series (2004-2009) data into panel data yielding 132 observations thus overcoming the degrees of freedom problems.

4.3 Sample characteristics

The Pakistani banking system is divided into four categories:

(1) public commercial bank;

(2) local private banks;

(3) foreign banks; and

(4) specialized banks.

This study focuses on the first two categories being the major pie in the overall banking system. There are total 29 banks in the two selected categories, including five Islamic banks, which have been excluded from the sample as they have a different risk management system being involved in the non-interest based business operations. Two more banks have been excluded from the sample, as these banks are in the transition phase (acquisition). They are experiencing losses for the past few years. The banks included are commercial banks, including both the consumer and the corporate banks. Figure 3 provides a glimpse of the banks' sizes, measured with the help of total assets.
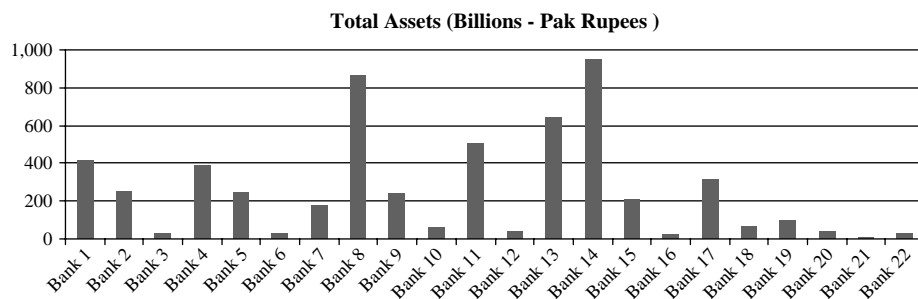

Figure 3.
Sizes of banks (total assets)

4.4 Procedure
A representative sample of private and public sector banks is taken to evaluate the impact of liquidity risk on the performance of banks.

The balance sheets, income statements and their notes have been studied to get the data for the variables mentioned in the developed model. All the taken values for selected variables are in Pak rupees (PKR). The dimensions of these variables are as follows.

4.4.1 Deposits. Deposits are accounts of the customers of banks. The data for deposits are taken from the liability side of balance sheets without any classification of current or other types of deposit accounts.

4.4.2 Cash. Data for the cash are taken from the assets side of balance sheets of banks. This includes "cash and balance with the treasury bank" only. "Accounts with other banks" have not been incorporated in cash.

4.4.3 Liquidity gap. The data for liquidity gap are obtained from the table of maturity of assets and liabilities. The liquidity gap for one month has been taken, as a negative gap in one month may create difficulties for the bank to meet the rising demands of depositors.

4.4.4 NPLs. NPLs affect the performance of a bank adversely. The provisioning for NPLs is taken from "profit and loss statement" of banks for the analysis in this study.

4.4.5 Profitability. Profitability is taken from the "profit and loss statement" of banks. This profit is calculated before tax as banks have different tax shields.

The data from aforementioned banks are collected to examine the relationship between the liquidity risk and performance of the banks. Multiple regressions have been applied to examine the relationship of variables, after testing data for normality.

5. Results and discussions
Multiple regressions are applied to test the model. Before model testing, descriptive statistics were obtained to confirm the normality of the data and the ADF test was run to satisfy the requirements of regression. Table I shows the descriptive statistics. The mean value of profitability is significantly positive, showing that the overall Pakistani banking system is enjoying a healthy profitability, whereas the mean value of the liquidity gap is significantly negative. Moreover, the normality of the data is within acceptable ranges as skewness is not high enough to affect the normality of the data and kurtosis value for all the variables is positive. Moreover, the probability of Jarque-Bera < 0.001.

The correlation matrix (as shown in Table II) depicts that profitability is positively correlated with deposits and cash whereas negatively correlated with liquidity gap

	Profitability	Deposits	Cash	Liq_Gap	NPLs
Mean	871,084.4	40,800,673	4,475,018	−13,252,289	694,816.1
Median	96,628	17,869,041	1,063,997	−2,577,406	327,010.5
SD	3,657,491	77,215,637	9,718,279	41,969,552	1,891,704
Skewness	2.044989	3.422080	3.884701	−2.440361	0.443655
Kurtosis	10.88064	16.97009	23.64498	11.59320	10.37512
Jarque-Bera	348.1764	1,068.860	2,149.057	431.3515	243.7106
Probability	0.000000	0.000000	0.000000	0.000000	0.000000

Table I.
Descriptive statistics

and NPLs. The correlation matrix is negating the existence of multicolinearity among the independent variables as all the correlations are below 0.90.

Table III shows the results of multiple regressions. The value of R^2 is 0.719, revealing 71.9 per cent variability in profitability accounted for by the developed model. The adjusted R^2 is an improved estimation of R^2 in the population. The value of adjusted R^2 is 0.707. This adjusted measure provides a revised estimate, i.e. 70.7 per cent of the variability in profitability of banks due to the fitted model.

Table III also provides the value of F-test for the null hypothesis. It shows that none of the factors of liquidity risk is related to the profitability of the banking system. In other words, R^2 is zero. Here, the null hypothesis is rejected ($F = 60.8188$, $p < 0.05$). Hence, it is concluded that at least one of the factors of liquidity risk relates to the profitability banks. As $p < 0.05$, the model fitness is authenticated; showing a strong relationship between factors of liquidity risk and the profitability of the banking system.

The estimates of the regression coefficients, standard errors of the estimates, t-statistics, and p-values are also shown in Table III. The coefficient column gives estimated regression coefficients. It can be estimated that there would be 2.5 per cent positive change in the profitability of the banking system as a result of a unit change in deposits. The t-statistic for this coefficient is 4.560875, i.e. significant. The p-value for this coefficient < 0.001, therefore, $H1$ is accepted with a 99.99 per cent confidence level. As the banks' deposits will grow, it will help the banks to increase their profitability (Diamond and Rajan, 2001; Jeanne and Svensson, 2007; Kumar, 2008):

	Profitability	Deposits	Cash	Liq._Gap	NPLs
Profitability	1.000000				
Deposits	0.693824	1.000000			
Cash	0.679218	0.836243	1.000000		
Liq._Gap	− 0.447647	− 0.526233	− 0.544237	1.000000	
NPLs	− 0.237092	0.289558	0.257240	− 0.201215	1.000000

Table II.
Correlation matrix

Variable		Coefficient	SE	t-statistic	Prob.
C		− 85,642.97	236,164.3	− 0.362642	0.7177
Deposits		0.025693	0.005633	4.560875	0.0000
Cash		0.096666	0.044943	2.150878	0.0340
Liq._Gap		− 0.010404	0.005675	− 1.833251	0.0699
NPLs		− 0.935856	0.109773	− 8.525401	0.0000
R^2	0.719164				
Adjusted R^2	0.707339				
SE of regression	2,030,089				
Durbin-Watson stat	2.062727				
Mean dependent var.	938,638.4				
SD dependent var.	3,752,604				
F-statistic	60.81882				
Prob. (F-statistic)	0.000000				

Note: Dependent variable: profitability

Table III.
Multiple regression

H1. Increase in deposits boosts up the earnings of the bank (accepted).

The profitability of the banks is increased by 9.66 per cent with a unit increase in cash and vice versa. There is a positive relationship between cash and profitability of the banking system. The *t*-value of this coefficient is 2.158, i.e. significant and $p < 0.05$. The *H2* is rejected here as the coefficient is showing a positive relationship with profitability. These results are in contradiction with Holmstrom and Tirole (2000):

H2. Increase in cash reserves decreases the earnings of the bank (rejected).

The beta coefficient of liquidity gap is -0.0104. It shows that there will be a 1.04 per cent negative change in the profitability of the banking system due to a degree change in the liquidity gap. Its *t*-statistics and *p*-values are -1.833 and 0.0699, respectively, which are insignificant. The liquidity gap shows the maturity mismatch between assets and liabilities, thus larger liquidity gap will affect the performance of the banking system negatively (Plochan, 2007; Goodhart, 2008; Goddard *et al.*, 2009). Therefore, *H3* is partially accepted with a 93.01 per cent confidence level:

H3. Increase in the liquidity gap causes a reduction in the bank's earnings (partially accepted).

The coefficient of NPLs is -0.9358 meaning a 93.58 per cent negative variation in profitability due to one degree change in NPLs. The *t*-statistics for the same is -8.5254, i.e. highly significant and $p < 0.001$. The increase in NPLs causes a decrease in profitability of banks (Kashyap *et al.*, 2002). These results lead to the acceptance of *H4*:

H4. High provisioning for NPLs will cause a decrease in the bank's earnings (accepted).

Estimated model of liquidity risk is as follows (Figure 4).

The results of this study reveal a significant impact of all the factors of liquidity risk on performance of the banking system. An increase in deposits will help the banks to increase their profitability. Banks will not have to rely on the central bank or repo market to meet the demands of other depositors. Moreover, the bank may use this depositor's funds in a productive way.
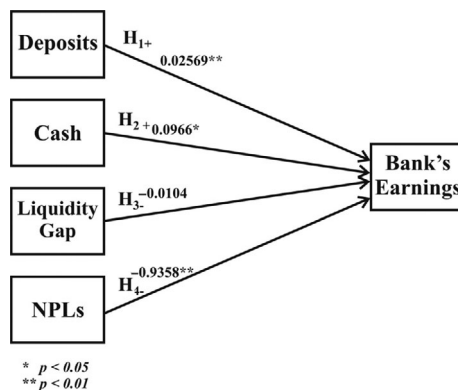

Figure 4.
Estimated model
of liquidity risk

The profitability of a bank is negatively affected due to increase in liquidity gap and NPLs. With a significant liquidity gap, the banks may have to borrow from the repo market even at a higher rate thereby pushing up the cost of banks. This increase in the cost will ultimately affect the profitability of the banks. However, the results of this study show that Pakistani banks are not relying on the repo market. They have enough cash decreasing their reliance on repo market. This helps the banks to keep the negative impact of the liquidity gap within an acceptable range. It can be concluded that the harmful effects of liquidity can be avoided by maintaining sufficient cash reserves.

High provisioning of NPLs also reduces the profitability of the banks. The large amount of provisioning of loans as NPLs negatively affects the profitability of banks. Thus, banks should periodically monitor their long-term debtors. NPLs show the presence of credit risk, which can rapidly turn into a severe liquidity crisis.

6. Conclusion
Liquidity problems may adversely affect a given bank's earnings and capital. Under extreme circumstances, it may cause the collapse of an otherwise solvent bank. A bank having liquidity problems may experience difficulties in meeting the demands of depositors. However, this liquidity risk may be mitigated by maintaining sufficient cash reserves, raising deposit base, decreasing the liquidity gap and NPLs. Adequate cash reserves will decrease the bank's reliance on the repo market. This will reduce the cost associated with over the night borrowing. Moreover, it will also help the banks to avoid fire sale risk.

It is imperative for the bank's management to be aware of its liquidity position in different buckets. This will help them in enhancing their investment portfolio and providing a competitive edge in the market. It is the utmost priority of a bank's management to pay the required attention to the liquidity problems. These problems should be promptly addressed, and immediate remedial measures should be taken to avoid the consequences of illiquidity.

This study paves the way for more detailed studies into controlling the liquidity risk and to extending the proposed model to incorporate other causes of liquidity risk. Further, the current study has focused primarily on earning of the bank as measure of the performance of bank. Further research may take a broader view of the performance and can also include economic factors.

References
Akhtar, S. (2007), "Pakistan: changing risk management paradigm – perspective of the regulator", *ACCA Conference – CFOs: The Opportunities and Challenges Ahead, Karachi*, p. 8.

Ali, S.S. (2004), "Islamic modes of finance and associated liquidity risks", *Conference on Monetary Sector in Iran: Structure, Performance and Challenging Issues, Tehran*, p. 20.

Brunnermeier, M.K. and Yogo, M. (2009), "A note on liquidity risk management", *AEA Session on Liquidity, Macroeconomics, and Asset Prices*, p. 12.

CEBS (2008), "Reducing liquidity risk – a new imperative", *Second Part of CEBS's Technical Advice to the European Commission on Liquidity Risk Management*, Aleri, Committee of European Banking Supervisors, New York, NY, p. 8.

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

Chaplin, G., Emblow, A. and Michael, I. (2000), "Banking system liquidity: developments and issues", *Financial Stability Review*, December, pp. 93-112.

Clementi, D. (2001), "Financial markets: implications for financial stability", *Banca D'Italia Conference on International Banking and Financial Systems Evolution and Stability*, MCB University Press, Bradford, pp. 13-19.

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

Crowe, K. (2009), "Liquidity risk management – more important than ever", *Harland Financial Solutions*, p. 3.

Diamond, D.W. and Rajan, R.G. (2001), "Liquidity risk, liquidity creation, and financial fragility: a theory of banking", *The Journal of Political Economy*, Vol. 109 No. 2, pp. 287-327.

Diamond, D.W. and Rajan, R.G. (2005), "Liquidity shortages and banking crises", *The Journal of Finance*, Vol. 60 No. 2, pp. 615-47.

Falconer, B. (2001), "Structural liquidity: the worry beneath the surface", *Balance Sheet*, Vol. 9 No. 3, pp. 13-19.

Gatev, E. and Strahan, P.E. (2003), "Banks' advantage in hedging liquidity risk: theory and evidence from the commercial paper market", working paper, The Wharton Financial Institutions Centre, Chestnut Hill, MA.

Goddard, J., Molyneux, P. and Wilson, J.O. (2009), "The financial crisis in Europe: evolution, policy responses and lessons for the future", *Journal of Financial Regulation and Compliance*, Vol. 17 No. 4, pp. 362-80.

Goodhart, C. (2008), "Liquidity risk management", *Financial Stability Review*, Vol. 11 No. 6.

Guglielmo, M.R. (2008), "Managing liquidity risk", *Bank Accounting & Finance*, Vol. 8.

Halling, M. and Hayden, E. (2006), "Bank failure prediction: a two-step survival time approach", *C.R.E.D.I.T. Conference, Austrian National Bank, Vienna*, p. 31.

Holmstrom, B. and Tirole, J. (2000), "Liquidity and risk management", *Journal of Money Credit and Banking*, Vol. 32 No. 3, pp. 295-319.

Jeanne, O. and Svensson, L.O. (2007), "Credible commitment to optimal escape from a liquidity trap: the role of the balance sheet", *The American Economic Review*, Vol. 97 No. 1, pp. 474-90.

Jenkinson, N. (2008), "Strengthening regimes for controlling liquidity risk", *Euro Money Conference on Liquidity and Funding Risk Management*, Bank of England, London, p. 9.

Kashyap, A.K., Rajan, R. and Stein, J.C. (2002), "Banks as liquidity providers: an explanation for the coexistence of lending and deposit-taking", *The Journal of Finance*, Vol. 57 No. 1, pp. 33-73.

Kumar, V. (2008), "Why liquidity is important for banks", available at: www.gtnews.com/article/7362.cfm#request.location# (accessed May 9, 2010).

Majid, A.R. (2003), "Development of liquidity management instruments: challenges and opportunities", *International Conference on Islamic Banking: Risk Management, Regulation and Supervision, Jakarta – Indonesia*, p. 24.

Mishkin, F.S., Stern, G. and 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*, Vol. 44 No. 4, pp. 988-1004.

Muranaga, J. and Ohsawa, M. (2002), "Measurement of liquidity risk in the context of market risk calculation", working paper, Institute for Monetary and Economic Studies, Bank of Japan, Tokyo.

Perera, S., Skully, M. and Wickramanayake, J. (2006), "Competition and structure of South Asian banking: a revenue behaviour approach", *Applied Financial Economics*, Vol. 16, pp. 789-801.

Plochan, P. (2007), "Risk management in banking", Master thesis, University of Economics, Bratislava.

SBP (2008), *Pakistan's Banking Sector Remarkably Resilient Despite Challenging Economic Environment: SBP's Financial Stability Review*, State Bank of Pakistan, Islamabad.

SBP (2010), *The State of Pakistan's Economy*, Central Board of State Bank of Pakistan. State Bank of Pakistan, Islamabad.

SBP (2010), *Quarterly Performance Review of Banking System*, Banking Surveillance Department. State Bank of Pakistan, Karachi, September.

Zheng, H. and Shen, Y. (2008), "Jump liquidity risk and its impact on CvaR", *The Journal of Risk Finance*, Vol. 9 No. 5, pp. 477-91.

Further reading

Honohan, P. and Laeven, L. (2005), *Systemic Financial Crises: Containment and Resolution*, Cambridge University Press, New York, NY.

SBP (2005), *Risk Management: Guidelines for Commercial Banks & DFIs*, State Bank of Pakistan, Karachi.

About the authors

Ahmed Arif obtained an MBA from the National University of Modern Languages, Islambad, Pakistan in 2009. He is working as a Project Manager in Speed-flo Filter Industries, Islamabad and is a Research Scholar of MS (MS) at SZABIST, Islamabad, Pakistan. He is a Visiting Lecturer at Fatima Jinnah Women University, Rawalpindi. Pakistan and at Tandlianwala College of Commerce, Pakistan. Ahmed Arif is the corresponding author and can be contacted at: lakhvera@gmail.com

Ahmed Nauman Anees has worked with four top banks in Pakistan: His eHBL, MCB, Askari Bank and Meezan Bank. His experience spans more than 14 years. He has worked with Transport for London, UK as an Analyst and with Pernect, Kuala Lumpur, Malaysia as an Executive. He holds an MBA from Quaid-i-Azam University. As a Chevening Scholar he obtained his MSc (International Banking and Finance) at the Old Royal Naval College, London, UK. He has been awarded: Banking Diploma Examination-Double State Bank of Pakistan Gold Medallist, Bank of Punjab Prize, NDFC Prize; and three prizes in the National Banking Essay Competition by The Institute of Bankers, Pakistan. For the past decade he has been a Visiting Professor at: Szabist, Islamabad, Bahria University, ISD, MAJU, PIDE, Quaid-i-Azam University, Islamabad, NAB, SBP, IBP, MCB, Askari Bank, Nibaaf, NBP.