

The Determinants of Liquidity Risk: Evidence from Tunisian Banks

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Abstract

In recent years, the banking activity in Tunisia has been marked by a significant increase in granted loans compared to collected deposits. This disproportionate evolution has led to the accentuation of the tightening of bank liquidity, which negatively affected the liquidity ratio of Tunisian banks. That's why; this paper's objective is to identify the key determinants of liquidity risk of these banks in order to manage this major risk to avoid both their liquidity drying up and their bankruptcy. To do this, we used data covering ten Tunisian banks, which represent all Tunisian banking sector, observed during the period from 1980 to 2015. The econometric results, based on panel data analysis, show that the liquidity risk of Tunisian banks depends on bank's internal factors (primacy given to the activity of loan granting, level of capitalization, and size), factor related to the whole banking industry (structure of banking market) and international environment (international financial crisis). Concerning macroeconomic factors, their impacts are different. Contrary to economic growth which has a positive and significant effect, inflation impacts negatively but not significantly the liquidity risk of Tunisian banks.

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1 Introduction

In response to the 2007 crisis, the Basel Committee proposed a new regulation to counter the systematic risks of banks, including liquidity risk to prevent their bankruptcy. This crisis has highlighted weaknesses in liquidity risk management by banks, which suffered from shortness of liquidity.

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Many works have shown the negative effects of liquidity risk. Aiyar (2011), Carner and *al* (2011), Ivachina and Shufsten (2010), Beirner and *al* (2009), and Manasso and Mezes (2009) analyzed the dynamics of the liquidity risk and proved that this risk is capable of generating adverse consequences for banks operating in emerging markets. Similarly, Adrian and Brunner (2011) proposed a variance - covariance approach to test the effects of liquidity risk and demonstrated also that liquidity risk has negative effects on banks.

These negative effects prompted us to seek the main determinants of the liquidity risk to mitigate its perverse effects. The Identification of major determinants of this financial risk was the subject of several studies, which have not led to the same explanatory factors.

Some studies attribute liquidity risk to the internal characteristics of the bank itself, such as the level of capital, the size of the bank, etc. (Ahmed, et Naqvi (2011) Giannotti, Gibilaro, et Mattarocci (2010), Vadovà (2011) et Stiroh et al. (2006)). Some other studies show that the liquidity risk depends on the whole banking industry structure such as banking concentration and ownership structure of banks (Zouari et Sonia (2012), Nakan et Weinturb (2005), Dinc (2005) et Sapienza (2004)). Furthermore, some other studies include the financial crisis which caused the collapse of several financial institutions (Vodovà (2013)).

Faced with the importance of liquidity in the functioning and the survival of banks and the lack of consensus regarding the determinants of liquidity risk, the main objective of this paper is to identify the key determinants of liquidity risk of Tunisian banks so that they can manage this risk properly to avoid the drying up of liquidity and bankruptcy. More specifically, this paper aims to show that determinants of bank liquidity risk are multidimensional. The latter depends on factors internal to the bank, structure of the entire banking market and international environment in which Tunisian bank operates. The management of this risk requires therefore the intervention of several agents.

Tunisia is an interesting case study because Tunisian banks continue to give primacy to the granting of credit, and this, despite the depletion of key factors that have long supported this traditional activity. Total loans represent on average 70% of total bank assets. This strong growth in loans, not followed by a proportional change in deposits, has generated, in recent years, the deterioration of coverage rate of credits by deposits, which decreased from 108.5% in 2009 to 83.54% in 2015, threatening thus the liquidity of Tunisian banks, which has enormously been tightened.

To achieve this purpose, we used annual data concerning ten Tunisian banks, which represent all Tunisian banking sector, observed during the period from 1980 to 2015, and we focused on the analysis of panel data.

The remainder of this paper is organized as follows. In section 2, we present the literature review and hypotheses to be tested. The empirical analysis (data and model specification) is presented in section 3. The results and their interpretations are given in section 4. Finally, section 5 is devoted to the conclusion.

2 Literature Review and Hypotheses to be Tested

The studies which were conducted either to explore the main factors of liquidity risk, or to find out why a bank is more liquid or less liquid than another, did not lead to the same explanatory factors.

Vodovà (2011) conducted a study of 22 Czech banks during the period from 2006 to 2009

on the liquidity risk determinants. The results showed that the liquidity of Czech commercial banks is higher when there's a strengthening of capital or when interest rates on loans to be paid are high. Bonfim and Kim (2011) showed also that the most capitalized banks, with high capital adequacy, have low exposure to liquidity risk.

De Jonghe (2010), Liu and al. (2010), Naceur and al. (2010), García-Herrero and al. (2009), Pasiouras Kosmidou (2007), Goddard and al. (2004), Abreu and Mendes (2002), Naceur and Goaid (2001), Demirgüç-Kunt and Huizinga (1999), Berger (1995) and Bourke (1989) showed that the most successful banks are those that keep a high level of capital relative to their assets.

Having a high level of capital is a very positive signal sent to the market about the solvency of the bank and its very low credit risk; this reduces the risk of bankruptcy of the bank. A strongly capitalized bank compared to a weakly capitalized bank does not need to borrow to finance a given level of assets. The use of its self-capital to finance a project tells the market that the bank is very confident in its projects.

H1: Most capitalized banks have a lower exposure to liquidity risk.

Angora and Roulet (2011) studied the effects of balance and macroeconomic indicators on the liquidity risk, as measured by two indicators proposed by Basle Committee. This study showed that liquidity risk varies inversely with the size, the level of regulatory capital and the total bank assets. While, credit risk and some macroeconomic variables are significantly and positively associated with the risk of liquidity.

Using panel data method and based on a sample of European and North American banks over the period 2002 to 2009, Bonfim and Kim (2011) showed how banks manage their liquidity risk. The results confirm that the relationship between liquidity risk and the size depends on the type of liquidity risk measurement.

Retaining a sample of six Pakistani banks, Ahmed and Naqvi (2011) proved that there is no significant relationship between liquidity risk, profitability and size. Based on a sample of 675 Italian banks, Giannotti, Gibilaro and Mattarocci (2010) found that the major banks are less exposed to liquidity risk.

Nguyen, Skully and Parera (2012) studied the relationship between the liquidity risk and the power of markets of 47 684 banks in 113 countries. They showed that large banks with low capitalization are unable to bear a lower liquidity risk and proved also that the listed banks have more liquid assets than non-listed banks.

Stiroh and al. (2006) found negative effects of size. The larger the size is, the more the bank is difficult to manage its risks including liquidity risk. This size can result from an aggressive growth strategy, which does not necessarily lead to the improvement of the bank's performance.

Jonghe (2010) concluded that small banks are able better to withstand difficult economic conditions. Barros and al. (2007) reported that small banks are more likely to get good performance unlike large banks that are more likely to get poor performance.

H2: Big banks are more exposed to liquidity risk than small ones.

Irani, R.M. and R.R. Meisenzahl (2015) examined the impact of banks' liquidity risk management on secondary loan sales. Their study "identifies the importance of bank liquidity risk management as a motivation for loan sales, in addition to the credit risk transfer motive"³.

Studying the relationship between liquidity risk and probability of default for a sample

³Irani, R. M. and R. R. Meisenzahl (2015), p.1.

composed of 575 listed and non-listed Eurozone banks, Dorigana, C. (2013) found “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”⁴.

Fecht, F., H. P. Grüner, and P. Hartmann (2012) studied the implications of cross-border financial integration for financial stability when banks' loan portfolios adjust endogenously. They found that “after integration they can share these risks in a complete interbank market. When banks have a comparative advantage in providing credit to certain industries, financial integration may induce banks to specialize in lending. An enhanced concentration in lending does not necessarily increase risk, because a well-functioning interbank market allows to achieve the necessary diversification. This greater need for risk sharing, though, increases the risk of cross-border contagion and the likelihood of widespread banking crises”⁵.

Bonfim and Kim (2011) analyzed the relationship between banking specialization and liquidity risk. The results show that banks specializing in loans to customers are more exposed to liquidity risk.

Kimball, R. C. (1997) examined the effect of specialization on both risk and return of a sample of banks specializing in small business micro-loans (loans under \$100,000). He found that “Most specialized banks focus on relatively risky assets and are aggressive lenders, earning higher but more variable returns”⁶. He stressed also the need “to modifying the current risk-based capital requirements to address the differences between specialized and diversified banks”⁷.

H3: Banks specialized in lending activity have a higher exposure to liquidity risk.

Rauch, Steffen, Hackethal and Tyrrel (2010) conducted a study that focused on identifying key factors for liquidity creation. They concluded that bank liquidity is dependent on macroeconomic factors and conducted monetary policy. Based on Czech banks, Horvath et al (2012) found that banks, which create less liquidity in the market, have the lowest risk of liquidity.

In their study, Bunda and Desquilbet (2008) showed that the financial crisis of 2008 had a negative impact on the liquidity ratio of banks. Vaduva (2011), in his study of Czech banks, found also that the financial crisis has a negative impact on one of the four measures of bank liquidity.

Financial crisis generates strong financial instability. It causes disturbances in the banking and financial markets that lead to the failure of banks and financial institutions, with a risk of spreading to the entire financial system.

H4: During a financial crisis, banks have greater exposure to liquidity risk.

This review of the literature shows that determinants of liquidity risk differ from one study to another and depend on the sample chosen.

⁴Dorigana, C. (2013), p.42.

⁵Fecht, F., H. P. Grüner, and P. Hartmann (2012), p.1.

⁶Kimball, R. C. (1997), p.55.

⁷Kimball, R. C. (1997), p.70.

3 Empirical Analysis

3.1 Data and Methodology

To identify the key determinants of liquidity risk, we used data of ten Tunisian banks observed during the period from 1990 to 2015. The accounting and financial data are collected from annual reports of each bank.

The temporal and individual dimension of our sample allows us to use the approach of panel data which offers great potential analysis by tracking individual behavior over time. Panel data have also the advantage of increasing the sample size, this leads to increase the number of degree of freedom and reduce the problem of collinearity between explanatory variables improving hence results estimates.

3.2 Model Specification and Definition of Variables

The econometric model to be tested can be written as follows:

$$LIQR_{i,t} = \beta_0 + \beta_1 RCDT_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 CAP_{i,t} + \beta_4 CRISIS_{i,t} + \beta_5 HHI_{i,t} + \beta_6 EG_{i,t} + \beta_7 INF_{i,t} + \epsilon_{i,t}$$

Where;

LIQR: Liquidity risk, which represents the dependent variable in the model, is measured by total loans to total deposits. *RCDT*: Credit risk measured by total loans to total assets. *SIZE*: Size of bank measured by neperien logarithm of total assets of each bank. *CAP*: Capital adequacy ratio measured by total equity to total assets. *CRISIS*: Dummy variable which represents international financial crisis. It takes 0 before 2008 and 1 after. *HHI*: Herfindahl-Hirschman Index is a variable which measures the concentration of the banking market. It is equal to the sum of the squared market shares of ten Tunisian banks included in the article. In this study, we used total assets to calculate the market share. *EG*: Economic growth measured by annual growth rate of *GDP*. *INF*: Inflation rate measured by consumption price index.

4 Results and Interpretations

Table 1 below summarizes the descriptive statistics of the variables used in this study.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
LIQR	260	1.198	0.377	0.551	2.597
RCDT	260	0.718	0.142	0.030	1.501
SIZE	260	14.779	0.623	13.475	16.169
CAP	260	0.081	0.037	-0.016	0.249
CRISIS	260	0.308	0.462	0	1
HHI	260	0.111	0.009	0.088	0.123
EG	260	0.040	0.023	-0.024	0.079
INF	260	0.042	0.015	0.020	0.082

The average liquidity risk is equal to 119.8%. Granted credits grow faster than collected deposits. Total loans represent on average 71.8% of bank assets. This high average value shows the role still played by Tunisian banks in financing the economy through the credit channel. The capital adequacy ratio has an average value equal to 8.1%. Tunisian banks are undercapitalized suffering from lack of capital.

The average Herfindahl-Hirschman Index (HHI) is equal to 11.1%, meaning that the Tunisian banking market tends towards a competitive structure.

Table 2 below presents the correlation matrix which gives information on the level and the nature of linkages between variables by determining the coefficients of linear correlations of them taken two by two.

Table 2. Correlation matrix

	LIQR	RCDT	SIZE	CAP	CRISIS	HHI	EG	INF
LIQR	1.0000							
RCDT	0.2129	1.0000						
SIZE	-0.1709	0.1625	1.0000					
CAP	0.1907	0.3330	-0.1103	1.0000				
CRISIS	0.1119	0.4762	0.4858	0.0758	1.0000			
HHI	0.2482	-0.4506	-0.4687	-0.1172	-0.6504	1.0000		
EG	0.0878	-0.2915	-0.3541	-0.0397	-0.5379	0.4732	1.0000	
INF	0.1095	-0.0186	0.0915	-0.2768	0.1923	0.1240	0.0529	1.0000

These results reveal a weak correlation between the different variables of our econometric model, rejecting the existence of multicollinearity problem. The correlation matrix shows that the liquidity risk is positively linked to all the variables except for the size of banks. The Hausman test favors the random effect model. The estimation results are reported in Table 3 below.

Table 3. Estimation Results of Random Effect Model

LIQR	Coef.	Std. Err.	Z	P>z
RCDT	0.482	0.181	2.66	0.008*
SIZE	-0.111	0.041	-2.71	0.007*
CAP	1.134	0.619	1.83	0.067**
CRISIS	0.424	0.065	6.56	0.000*
HHI	22.729	3.028	7.51	0.000*
EG	1.669	0.995	1.68	0.093**
INF	-0.349	1.455	-0.24	0.810
_cons	-0.307	0.792	-0.39	0.698
Hausman test		8.17		
Prob > chi 2		0.317		
Wald chi 2 (7)		112.62		
Prob > chi 2		0.000		
Number of Obs.		260		

* and ** denote level of significance at 1% and 10%.

The estimation results show that all variables of the model are positively correlated with the dependent variable (liquidity risk) except two variables; size of banks (SIZE) and inflation rate (INF).

The size of Tunisian banks impacts negatively and significantly the liquidity risk. In Tunisia, the small size of banks is a determinant of liquidity risk, as they remain specialized banks giving importance to the lending activity, despite the reforms and laws that encourage banks to intervene on the different capital markets. Tunisian banks have not turned into universal banks that do everything.

The inflation rate has a negative effect but not significant on the liquidity risk of banks. Inflation causes a redistribution of income in favor of borrowers and to the detriment of lenders. This is why banks restrict their lending activities in inflationary contexts.

The credit risk (RCDT) is positively and significantly correlated to the liquidity risk. The increase of this kind of risk leads to the drying up of bank liquidity and the increase of liquidity risk threatening so the bank's sustainability. This result confirms hypothesis 3 that assumes that banks specializing in lending activity are heavily exposed to liquidity risk. That's why Tunisian banks must revise the primacy given to the balance sheet intermediation, based mainly on the provision of credit and collection of deposits.

Estimation results of random effect model find that the capital adequacy ratio (CAP) acts positively and significantly, with level of significance at 10%, on the banks' liquidity risk. The most capitalized banks are the most exposed to liquidity risk, rejecting thus hypothesis 1.

Tunisian banks continue to give priority to the activity of granting credits, and this is, despite the exhaustion of the factors that supported it. The fierce competition that characterizes Tunisian banking market pushes banks to take more risks in granting credits sometimes without sufficient guarantees, which are incommensurate with respect to collected deposits, threatening so their liquidity.

Our results show also that financial crisis affects positively and significantly the liquidity risk of Tunisian banks which operate in an open environment, verifying thus hypothesis 4. Part of balance sheets of Tunisian banks is denominated in foreign currencies which, in a period of crisis, affect their liquidity. Furthermore, Tunisian banks have correspondent accounts with foreign banks to meet the needs of their customers abroad. This result converges with that of Bunda and Desquilbet (2008), which showed that the financial crisis of 2008 had a negative impact on the liquidity ratio of banks.

The index of concentration (HHI) acts also positively and significantly on the liquidity risk of banks. This result can be explained by the competitive structure of the Tunisian banking market, prompting banks to provide more credit to snatch more market share.

The economic growth affects furthermore positively and significantly the Tunisian banks' liquidity risk. The increase in the incomes of Tunisian households, resulting from this economic growth, allowed them to apply for specialized financial services such as consumer loans, housing loans, leasing, etc. This increases bank lending and deteriorates banks' liquidity risk.

5 Conclusion

The objective of this paper is to identify and analyze the main determinants of liquidity risk of Tunisian banks to avoid both their liquidity drying up and their bankruptcy. To do this, we used annual data of ten Tunisian banks observed during the period from 1980 to

2015 and panel data analysis as an econometric method.

Empirical results show firstly that granting loans (RCDT), size of banks (SIZE), international crisis (CRISIS) and structure of banking market (HHI) are the key determinants of Tunisian banks' liquidity risk.

Credit risk is positively and significantly correlated to the liquidity risk. This result confirms the one of Bonfim, and Kim (2011), who analyzed the relationship between banking specialization and liquidity risk, and found that banks specializing in granting loans are the most exposed to liquidity risk.

The main activity of Tunisian banks remains the granting of loans, despite the reforms that have led banks to develop new businesses and to intervene in various capital markets for both their own accounts as well as those of their customers. Banking assets remained dominated by loans, which evolved faster than collected deposits. This result validates hypothesis H3 which supports the idea that banks specialized in lending business are the most exposed to liquidity risk.

Our results show also that size of Tunisian banks impacted negatively and significantly their liquidity risk, rejecting thus hypothesis 2. The small size exposed Tunisian banks to a high liquidity risk. This is due to the low rate of supervision, which limits their negotiation margin in the different markets. This is why they mechanically turn to banking intermediation, which destabilizes their liquidity. These findings contradicted those of Nguyen, Skully and Parera (2012), Jonghe (2010), Barros et al. (2007), Stiroh and al (2006), etc.

Moreover, our findings prove that financial crisis affects positively and significantly the liquidity risk of Tunisian bank, and converge to those of Vaduva (2011), Bunda and Desquilbet (2008), which revealed that during a financial crisis, banks have greater exposure to liquidity risk.

Our outcomes indicate that there is a positive and significant relationship between the liquidity risk of banks and the index of concentration (HHI). The competitive structure of the banking market encourages Tunisian banks to extend more loans, regardless of the collected deposits, to grab additional market share.

In addition to the four key determinants mentioned above, the liquidity risk of Tunisian banks depends furthermore on their level of capitalization and economic growth, but at a significance level of 10%.

Indeed, capital adequacy ratio (CAP) is positively and significantly related to banks' liquidity risk, rejecting thus hypothesis 1. This conclusion contradicts the results found by Bonfim and Kim (2011), Vodová (2011), De Jonghe (2010), Liu and al. (2010), Naceur and al. (2010), García-Herrero and al. (2009), Pasiouras and Kosmidou (2007), Goddard and al. (2004), Abreu and Mendes (2002), Naceur and Goaid (2001), Demirgüç-Kunt and Huizinga (1999), Berger (1995) and Bourke (1989), which showed that a significant level of capital reduces the risk of the bank's liquidity.

The economic growth (EG) impacts also positively and significantly Tunisian banks' liquidity risk. While the rate of inflation (INF) has a negative effect but not significant. From the results found in this paper, we can propose recommendations for Tunisian banks to reduce this major financial risk that has an impact on both their performance and sustainability. Tunisian banks must revise the primacy accorded to the lending activity, strengthen their own funds and recruit qualified staff. The number of qualified employees - staff of banks- ratio is very low. This is why market activities have remained less developed than balance sheet intermediation, since they are more complicated and require specific skills.

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