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Factors Influencing Liquidity Risk of Banks in Haiti

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Abstract

This study investigates the drivers of liquidity risk in the Haitian banking sector, a critical yet under-researched area of financial stability. Using data from 7 banks (5 private and 2 public) over 308 observations between 2013 and 2023, the study employs key liquidity ratios—liquid assets to total assets and liquid assets to deposits—as measures of risk. Panel data regression techniques, including Pooled OLS, Fixed Effect, and Random Effect models, are utilized, with the Hausman test favoring Fixed Effect models. The findings indicate that capital adequacy, asset quality (non-performing loans ratio), efficiency (cost-to-income ratio), deposits (total deposits to total assets), and net interest margin (as a percentage of interest income) positively and significantly influence liquidity risk. In contrast, profitability (return on assets) and bank size show no significant impact. These results underscore the importance of managing capital adequacy, asset quality, and deposit growth to mitigate liquidity risk. Practitioners and the Central Bank can leverage these insights to strengthen the resilience and stability of the Haitian banking sector.

Keywords

Liquidity Risk, Bank-Specific Factors, Panel Data Techniques, Financial Stability, Banking Sector, Haiti

1. Introduction

Maturity transformation is a fundamental function of banks (Distinguin et al., 2013), where short-term liabilities are used to finance long-term assets. Due to the nature of short-term liability contracts, depositors can withdraw their funds at any time, creating the potential for liquidity risk. This risk occurs when a bank cannot meet unexpected withdrawal demands because of insufficient liquid assets (Mohammad et al., 2020).

More broadly, liquidity risk arises from a mismatch between the demand for and supply of funds (Alzoubi, 2017). On the supply side, funds are generated from customer deposits, repayments of credit facilities, borrowing from financial markets, interest and non-interest income, and asset sales. On the demand side, funds are needed for customer withdrawals, credit applications, and operational expenses. Rose & Hudgins (2013) define the difference between the supply and demand for funds as the "net liquidity position," which must be carefully managed to mitigate liquidity risk. If not managed effectively, liquidity risk can lead to financial distress, bank runs, or failures, with significant adverse effects on the broader economy.

The global financial crisis of 2007-2009 highlighted the critical importance of understanding, measuring, and managing liquidity risk (Mohammad et al., 2020). In Haiti, the issue is particularly pressing due to the country's economic instability, structural challenges, and political uncertainties. The Haitian banking sector, which depends on short-term deposits to finance medium- and long-term loans, may face persistent mismatches between resources and uses, exacerbating liquidity risks. This gap underscores the need for effective liquidity management to ensure the stability of the sector.

Despite the importance of liquidity risk, empirical research on its management in the Haitian banking sector remains limited. This study aims to fill that gap by investigating the determinants of bank liquidity risk in Haiti. Specifically, it focuses on bank-specific factors such as capital adequacy, asset quality, profitability, bank size, efficiency, deposits, and net interest margin—factors that stem from managerial decisions within the bank, as opposed to external influences from the broader economic environment (Elouali & Oubdi, 2020).

This study contributes to a deeper understanding of liquidity risk management in Haiti and provides practical insights for improving bank stability. The paper is organized as follows: Section 2 reviews the relevant literature and formulates hypotheses; Section 3 outlines the data and methods used for analysis; Section 4 presents and discusses the findings; and Section 5 concludes the study.

2. Literature Review and Hypotheses

2.1. Liquidity Risk and Its Measurement

Liquidity risk refers to the possibility that a bank may be unable to meet its short-term financial obligations. Two main approaches are commonly used to measure bank liquidity risk: the liquidity gap approach (or cash flow approach) and the liquidity ratio approach (or stock approach).

The liquidity gap approach focuses on the maturity structure of a bank's assets and liabilities, assessing liquidity management through cash flow analysis. In contrast, the liquidity ratio approach employs ratios to relate key financial variables, offering a snapshot of liquidity risk (Edem, 2017). Among these, the stock approach is more widely adopted in empirical research. Commonly used ratios include:

a) Total Loans to Deposits Ratio: This measures the proportion of a bank's loans to its deposits, reflecting the efficiency of deposit utilization in generating loans (Zaghdoudi & Hakimi, 2017; Naoaj, 2023; Antony, 2023).

b) Liquid Assets to Total Assets Ratio: This evaluates the proportion of a bank's assets that are highly liquid, providing insight into its capacity to meet short-term obligations without triggering a liquidity crisis (Addou & Bensghir, 2021; Elouali & Oubdi, 2020; Antony, 2023).

Other ratios, such as the Liquid Assets to Deposits Ratio, are also used to assess liquidity risk. This ratio gauges a bank's ability to cover its deposits—assumed as a key short-term liability—using its most liquid assets, under the assumption that external borrowing is not feasible during a liquidity shortfall (Vodová, 2013).

2.2. Bank-Specific Factors

The literature review highlights that various scholars have utilized bank-specific factors as explanatory variables to assess liquidity risk. Aligning with the focus of this study, the following factors are retained:

2.2.1. Capital Adequacy

Capital adequacy measures a bank's ability to meet its obligations and absorb potential losses, reflecting its financial strength and stability. This metric ensures a bank can withstand adverse economic conditions and continue its operations. It is commonly assessed using the total equity to total assets ratio, where a higher ratio indicates a stronger financial position compared to banks with lower ratios (Assfaw, 2019). Empirical studies highlight the relationship between capital adequacy and liquidity risk, though the direction of this relationship varies:

- Negative Relationship: Leykun (2016) found that the capital adequacy ratio significantly and negatively affects the liquidity risk of commercial banks in Ethiopia. Similarly, Fatima & Naseem (2021), using panel data regression, observed a negative and statistically significant impact of capital adequacy on liquidity risk in commercial banks in Pakistan.
- Positive Relationship: In contrast, Elouali & Oubdi (2020) reported a positive and statistically significant effect of capital adequacy on liquidity risk, suggesting that a strengthened capital structure increased liquidity risk in Islamic banks. Supporting this view, Effendi et al. (2017), Tabash (2018), and Ben Jedidia (2020) also found a significant positive relationship between capital adequacy and liquidity risk ratios.

Given the theoretical expectation that higher capital levels mitigate liquidity risk, this study hypothesizes:

H1: Well-capitalized banks experience lower liquidity risk.

2.2.2. Asset Quality

Asset quality evaluates the health of a bank's loan portfolio and its exposure to default risk. It is commonly measured using the Non-Performing Loans (NPL) ratio, calculated as the ratio of non-performing loans to gross loans (Sifrain, 2024).

This metric represents the share of loans that fail to generate expected returns, often due to borrower defaults. A higher NPL ratio indicates poorer asset quality and increased default risk, whereas a lower NPL ratio signifies higher-quality assets, fewer defaults, and more stable cash flows, which enhance a bank's liquidity position. Empirical studies have identified asset quality as a key determinant of bank liquidity risk:

- Positive Relationship: Mennawi & Ahmed (2020), using Pearson correlation and multiple regression analysis, demonstrated that asset quality, measured by the NPL ratio, has a positive and significant effect on liquidity risk in Islamic banks. Similarly, Elouali & Oubdi (2020) found that poor asset quality exacerbates liquidity risk in Islamic banks.
- Negative Relationship: Conversely, Irawati & Puspitasari (2019), and Fatima & Naseem (2021) reported a negative and statistically significant relationship between asset quality and liquidity risk, suggesting that improved asset quality reduces liquidity risk by enhancing liquidity levels.

Considering that lower NPL ratios improve bank liquidity and reduce liquidity risk, this study formulates the following hypothesis:

H2: Asset quality, as measured by the NPL ratio, positively influences banks' liquidity risk.

2.2.3. Profitability

Profitability measures a bank's financial performance, highlighting its ability to generate income relative to expenses and other costs. It is a vital indicator of the bank's financial health, operational efficiency, and capacity to deliver returns to shareholders. One commonly used metric for profitability is the Return on Assets (ROA), which evaluates how efficiently a bank uses its assets to generate profit (Assfaw, 2019). ROA is calculated as the ratio of net income to total assets, with a higher ROA indicating stronger performance and more effective asset utilization in generating profits. The relationship between profitability and liquidity risk is a critical aspect of financial management, given the close interaction between these factors.

- Negative Relationship: Tuti et al. (2022), using a panel regression model, found that ROA is negatively and significantly associated with the liquidity risk of Sharia Rural Banks in Indonesia. This finding aligns with other studies, such as Arfiyanti & Pertiwi (2020), and Bani & Yaya (2016), which also report a negative and significant influence of ROA on liquidity risk in banks.
- Positive Relationship: In contrast, Akhtar et al. (2011) and Iqbal (2012) found that ROA has a positive and significant effect on the liquidity risk of Islamic banks.

A higher ROA indicates greater retained earnings, which can be used to strengthen the bank's capital buffer. This enhanced capital position improves the bank's ability to create liquidity, thereby reducing liquidity risk. Based on this reasoning, the study proposes the following hypothesis:

H3: Profitability, as measured by ROA, negatively affects bank liquidity risk.

2.2.4. Bank Size

Bank size refers to the scale and scope of a bank's operations and is often measured by total assets, which encompass loans, investments, and other holdings. This measure reflects the overall value of a bank's resources and serves as a standard indicator of its operational scale. The relationship between bank size and liquidity risk has been extensively examined, yielding mixed results:

- Positive Relationship: Antony (2023), using a panel data regression model, found that bank size positively and significantly affects liquidity risk, measured by the loan-to-deposit ratio, in Indian commercial banks. Similarly, the findings suggest that larger banks in the Indonesian banking sector face heightened liquidity challenges due to the increasing complexity and scope of their operations.
- Negative Relationship: Conversely, Naoaj (2023) and Alzoubi (2017) observed a negative effect of bank size on liquidity risk, indicating that larger banks tend to maintain higher liquidity positions and, consequently, face lower liquidity risk.

As banks grow larger, their operations often become more complex, potentially exposing them to greater liquidity challenges. Based on this premise, the study formulates the following hypothesis:

H4: Bank size has a positive influence on liquidity risk.

2.2.5. Efficiency

Bank efficiency reflects the ability of a bank to use its resources effectively—such as capital, labor, and technology—to achieve financial and operational objectives. It measures the bank's capacity to manage assets and liabilities, optimize processes, control costs, and mitigate risks while maximizing profitability. A commonly used metric for efficiency is the cost-to-income ratio, calculated as the ratio of operating expenses to operating income. A lower cost-to-income ratio indicates better efficiency, as the bank is more adept at controlling costs relative to its income. The relationship between bank efficiency and liquidity risk has been investigated in several studies:

- Negative Relationship: Pasha (2024) found that higher efficiency levels significantly reduce liquidity risk, particularly in Egyptian banks exposed to greater liquidity challenges. This suggests that efficient banks manage liquidity risk more effectively by optimizing their resources.
- Insignificant Relationship: In contrast, Antony (2023) reported that efficiency does not have a significant effect on the liquidity risk of Indian commercial banks, indicating regional or structural variations in the efficiency-liquidity risk dynamic.

Given that improved efficiency can enhance liquidity levels and reduce liquidity risk, this study hypothesizes the following:

H5: Efficiency, as measured by the cost-to-income ratio, is negatively and significantly associated with a bank's liquidity risk.

2.2.6. Deposit

Deposits represent a significant portion of a bank's liabilities and are a primary source of funding for its operations. They play a crucial role in determining a bank's liquidity position. A higher proportion of deposits provides a stable and low-cost funding base, enhancing the bank's ability to meet its liquidity needs. Conversely, a lower reliance on deposits may indicate greater dependence on alternative funding sources, such as wholesale funding or debt, which can be more volatile and costly, thereby increasing liquidity risk. Deposit reliance is often measured by the total deposits to total assets ratio, where a higher ratio indicates a strong deposit base, reducing liquidity risk by ensuring more stable funding. A lower ratio suggests greater reliance on less stable funding sources, which may heighten liquidity risk, especially during periods of financial stress. Empirical evidence supports the relationship between deposits and liquidity risk:

- Leykun (2016), using a Fixed Effect unbalanced panel data estimation technique, found that the total deposits to total assets ratio has a negative and significant impact on the liquidity risk of commercial banks in Ethiopia.

Given that a stable deposit base reduces the likelihood of liquidity shortfalls, this study proposes the following hypothesis:

H6: Deposits, as measured by the total deposits to total assets ratio, have a negative and significant effect on a bank's liquidity risk.

2.2.7. Net Interest Margin

Net Interest Margin (NIM) is a critical measure of a bank's profitability, reflecting the difference between the interest earned on assets (such as loans) and the interest paid on liabilities (such as deposits). It indicates how effectively a bank manages its interest income relative to its interest expenses. Empirical studies have explored the impact of NIM on bank liquidity risk, yielding contrasting results:

- Positive Relationship: Muharam & Kurnia (2015), in a comparative study of three conventional and three Islamic banks in Indonesia (2007-2011), found that NIM has a positive and significant effect on the liquidity risk of Islamic banks.
- Negative Relationship: Sharma & Gounder (2011) reported a negative relationship between NIM and liquidity risk. They argued that a higher NIM enhances profitability, allowing banks to build stronger liquidity buffers. Increased earnings enable banks to accumulate more liquid assets, which can be used to meet short-term obligations, thereby reducing liquidity risk.

The argument supporting a negative relationship is that a higher NIM strengthens a bank's ability to generate profits, which improves its liquidity position and mitigates liquidity risk. Based on this reasoning, the study proposes the following hypothesis:

H7: Net interest margin negatively affects a bank's liquidity risk.

Table 1 displays the description of the variables included in this study and their expected effect.

Table 1. Description of variables and expected relationship.

Variable	Corresponding determinant	Measure	Expected effect
Dependent variables			
Liquidity risk_1	Liquid assets to total assets ratio	$LA = \frac{\text{Liquid Assets}}{\text{Total Assets}}$	N/A
Liquidity risk_2	Liquid assets to deposits ratio	$LD = \frac{\text{Liquid Assets}}{\text{Total Deposits}}$	N/A
Independent variables			
Capital Adequacy	Capital adequacy ratio	$CAR = \frac{\text{Total Equity}}{\text{Total Assets}}$	(−)
Asset Quality	Non-performing loan ratio	$NPL = \frac{\text{Non-Performing Loans}}{\text{Gross Loans}}$	(+)
Profitability	Return on Assets ratio	$ROA = \frac{\text{Net income}}{\text{Average Total Assets}}$	(−)
Bank Size	Natural logarithm of total assets	$SIZE = \text{Ln}(\text{Total Assets})$	(+)
Efficiency	Cost-to-Income ratio	$OIR = \frac{\text{Operating Expenses}}{\text{Operting Income}}$	(+)
Deposit	Total deposits to total assets ratio	$DAR = \frac{\text{Total deposits}}{\text{Total assets}}$	(−)
Net Interest Margin	Net Interest Margin as percentage of Interest income	$NIM = \frac{\text{Interest Income} - \text{Interest Expenses}}{\text{Interest Income}}$	(−)

3. Data and Methodology

3.1. Source of Data

This study utilizes quarterly data from the Central Bank of Haiti database (https://www.brh.ht/supervision-bancaire/rapports-statistiques-2/) spanning from 2013 to 2023. The sample includes all Haitian banks, totaling 8 banks (5 private, 2 public, and 1 foreign bank). However, due to insufficient data for some variables, the foreign bank was excluded, resulting in a final sample of 7 banks, totaling 308 observations. The statistical analysis is conducted using R Software.

3.2. Research Method

The two main methods for analyzing both time series and cross-sectional data in panel data research are the Fixed Effects (FE) model and the Random Effects (RE) model (Gujarati, 2003). Consequently, this study employs Pooled OLS (Ordinary Least Squares) regression, Fixed Effects (FE) model and Random Effects (RE) model. It uses the panel data model structure that was employed by Antony

(2023), which is expressed by the following equation:

$$Y_{it} = \alpha + \beta X_{it} + u_{it} \tag{1}$$

where Y_{it} is the dependent variable (Liquidity risk) for bank i at time t, X_{it} is a vector of independent variables for bank i at time t, α is the intercept, β is a vector of coefficients for the independent variables, u_{it} is the error term, which may be decomposed into two components to handle the panel data structure

$$u_{it} = u_i + \varepsilon_{it} \tag{2}$$

where u_i denotes the individual-specific effects (unobserved factors affecting each bank that are constant over time, ε_{it} represents the idiosyncratic error (time-varying shocks or errors that affect the dependent variable for bank i at time t.

The operational form of Equation (1) can be expressed as follows:

$$\text{Liquidity risk} = f\left(\text{Bank} - \text{specific variables}\right) \tag{3}$$

As shown in Table 1, liquidity risk is measured by LA and LD. The bank-specific variables include Capital Adequacy (CAR), Asset Quality (NPL), Profitability (ROA), Bank Size (SIZE), Efficiency (OIR), Deposit (DAR) and Net Interest Margin (NIM). To investigate the factors affecting liquidity risk in Haitian banks, two models are specified by expanding the variables employed in Equation (3):

$$\begin{aligned} \text{LA}_{it} = {} & \alpha_i + \beta_1 \text{CAR}_{it} + \beta_2 \text{NPL}_{it} + \beta_3 \text{ROA}_{it} + \beta_4 \text{SIZE}_{it} \\ & + \beta_5 \text{OIR}_{it} + \beta_6 \text{DAR}_{it} + \beta_7 \text{NIM}_{it} + u_{it} \end{aligned} \tag{4}$$

$$\begin{aligned} \text{LD}_{it} = {} & \alpha_i + \beta_1 \text{CAR}_{it} + \beta_2 \text{NPL}_{it} + \beta_3 \text{ROA}_{it} + \beta_4 \text{SIZE}_{it} \\ & + \beta_5 \text{OIR}_{it} + \beta_6 \text{DAR}_{it} + \beta_7 \text{NIM}_{it} + u_{it} \end{aligned} \tag{5}$$

where i denotes an individual bank, t indicates quarter, β_1 to β_7 represent the coefficients of the independent variables, u_{it} is the error term.

The models are built using Pooled OLS, FE and RE regressions. The Hausman test is used to decide between the FE and RE models. Since the p-value is less than 0.05 (p-value = 0.00 < 0.05), the FE model is then selected. This indicates the individual-specific effects are correlated with explanatory variables, making RE biased and inconsistent.

4. Results and Discussion

4.1. Descriptive Statistics

Table 2 presents descriptive statistics for both the dependent and independent variables over the period 2013-2023. LA ratio (Liquid assets to total assets): The mean of 47.0% indicates that, on average, banks are relatively capable of meeting their short-term liabilities. The standard deviation of 12.3% suggests significant variation in liquidity management across banks. LD ratio (Liquid assets to deposits): The mean of 58.2% shows that, on average, over half of banks' deposit obligations are held in liquid form. The standard deviation of 13.6% reflects considerable differences in how banks manage liquidity, with some holding significantly more or less in liquid assets relative to deposits.

Table 2. Descriptive statistics of the data.

Variable	Observation	Mean	Median	Std. Dev.	Minimum	Maximum
LA	308	47.0%	47.5%	12.3%	13.0%	72.0%
LD	308	58.2%	58.0%	13.6%	20.0%	88.0%
CAR	308	6.9%	8.0%	4.2%	−10.0%	14.0%
NPL	308	13.7%	4.0%	22.4%	0.0%	91.0%
ROA	308	1.5%	2.0%	2.7%	−17.0%	31.0%
SIZE	308	17.1	17.4	1.3	14.6	19.4
OIR	308	67.1%	63.5%	30.9%	−278.0%	225.0%
DAR	308	80.0%	82.0%	6.8%	57.0%	98.0%
NIM	308	78.2%	79.0%	11.2%	34.0%	98.0%

Source: Author's own calculation.

CAR (Capital Adequacy Ratio): The mean of 6.9% is below the regulatory threshold of 8%, indicating that the banking sector may struggle to absorb large losses during downturns, raising the risk of insolvency. The standard deviation of 4.2% suggests substantial variation in capitalization across banks, with some banks at significant risk if financial shocks occur. NPL (Non-Performing Loans) ratio: With a mean of 13.7%, a notable portion of loans are overdue or unlikely to be recovered. The standard deviation of 22.4% shows that NPL ratios vary widely across banks, with some banks having extremely high or low ratios compared to the average. ROA (Profitability): The mean of 1.5% indicates solid profitability, with the standard deviation of 2.7% suggesting significant variation in profitability across banks, with some showing much higher or lower returns. Bank size (SIZE): The mean of 17.1 suggests that most banks are of moderate size, with a standard deviation of 1.3, indicating relatively low variation in size, suggesting most banks operate at similar scales. OIR (Efficiency): With a mean of 67.1%, this suggests some inefficiency, as typical OIR values range between 40% - 60%. The high standard deviation of 30.9% indicates that some banks are highly efficient (low OIR), while others are much less efficient (high OIR).

DAR (Deposit to Assets Ratio): The mean of 80% suggests that most Haitian banks rely heavily on customer deposits for financing, which is considered stable due to the low cost and dependability of deposits. The low standard deviation of 6.8% relative to the mean indicates that banks have similar levels of deposit reliance. NIM (Net Interest Margin): The mean of 78.2% indicates a relatively high net interest margin, signaling strong profitability from interest-earning assets. The standard deviation of 11.2% shows moderate variability in NIM across the sector, suggesting different approaches to interest rate management and profitability.

4.2. Pearson Correlation Matrix and Variance Inflation Factor

Table 3 displays the correlation between the dependent and independent variables. It reveals a negative relationship between LA and CAR, as well as a negative correlation between LD and CAR. Additionally, LA and LD are negatively correlated with ROA. In contrast, both LA and LD show positive correlations with NPL, SIZE, OIR, DAR, and NIM.

Table 3. Pairwise correlation matrix.

Variable	LA	LD	CAR	NPL	ROA	SIZE	OIR	DAR	NIM
LA	1								
LD	0.96	1							
CAR	−0.50	−0.41	1						
NPL	0.52	0.49	−0.87	1					
ROA	−0.19	−0.17	0.42	−0.36	1				
SIZE	0.05	0.06	0.51	−0.50	0.23	1			
OIR	0.33	0.29	−0.52	0.49	−0.17	−0.31	1		
DAR	0.62	0.40	−0.40	0.22	−0.10	0.12	0.22	1	
NIM	0.18	0.13	0.13	−0.24	0.06	0.31	−0.16	0.33	1

Source: Author's own calculation.

Moreover, the weak correlations observed between the independent variables in Table 3 suggest the absence of multicollinearity issues. The Variance Inflation Factor (VIF) test, presented in Table 4, further examines the presence of multicollinearity in the dataset. For all independent variables, except CAR (with a VIF of 6.224), the VIF values are below 5, indicating moderate correlations between the variables. The VIF of 6.224 is not considered problematic, as it is well below the threshold of 10 (Hair Jr. et al., 1995; Shrestha, 2020). Therefore, we can confidently conclude that multicollinearity is not a concern among the independent variables.

Table 4. VIF values of all the independent variables.

Variable	VIF
CAR	6.224
NPL	4.630
ROA	1.235
SIZE	1.669
OIR	1.406
DAR	1.708
NIM	1.311

Source: Author's own calculation.

4.3. Estimation Results

The regression analysis presented in **Table 5** explores the relationship between liquidity risk (proxied by the LA ratio) and several independent variables. The findings indicate that CAR is positively associated with LA, with statistical significance at the 10%, 5%, and 10% levels for the Pooled OLS, Fixed Effect, and Random Effect models, respectively. This suggests that an increase in CAR is linked to an increase in LA. These results contradict hypothesis H1. Instead, they align with the findings of Elouali & Oubdi (2020). Haiti experiences frequent economic shocks, political instability, and natural disasters, all of which can trigger sudden and unpredictable liquidity demands. Even with high capital adequacy, banks may struggle to maintain sufficient liquid assets to meet unexpected withdrawals or funding needs. This could explain the unexpected positive relationship between capital adequacy and liquidity risk in the Haitian banking system.

Table 5. Results of models with LA as dependent variable.

Variable	Pooled OLS				Fixed Effect				Random Effect			
	Coef.	Std. Error	t-value	Pr(>|t|)	Coef.	Std. Error	t-value	Pr(>|t|)	Coef.	Std. Error	t-value	Pr(>|t|)
Constant	−0.807	0.085	−9.542	0.000***	−0.774	0.09	−8.61	0.000***	−0.807	0.085	−9.542	0.000***
CAR	0.664	0.264	2.51	0.013*	0.854	0.279	3.06	0.002**	0.664	0.264	2.51	0.012*
NPL	0.393	0.042	9.301	0.000***	0.373	0.046	8.152	0.000***	0.393	0.042	9.301	0.000***
ROA	−0.133	0.184	−0.725	0.469	−0.257	0.198	−1.294	0.197	−0.133	0.184	−0.725	0.469
SIZE	0.023	0.004	5.136	0.000***	0.007	0.006	1.275	0.203	0.023	0.004	5.136	0.000***
OIR	0.03	0.017	1.788	0.075	0.037	0.018	2.104	0.036*	0.03	0.017	1.788	0.074
DAR	0.843	0.084	9.982	0.000***	0.941	0.091	10.367	0.000***	0.843	0.084	9.982	0.000***
NIM	0.124	0.045	2.752	0.006**	0.297	0.059	5.024	0.000***	0.124	0.045	2.752	0.006**
R^2	0.616				0.657				0.616			
Adj. R^2	0.607				0.649				0.607			
p-value	0.000				0.000				0.000			
Hausman					0.000							

Note: *** significant at 0.01, ** significant at 0.05, * significant at 0.1. Source: Author's own calculation.

The findings indicate that the NPL ratio has a positive relationship with LA (Liquidity to Assets ratio), with statistical significance at the 1% level across all models (Pooled OLS, Fixed Effect, and Random Effect). These results confirm hypothesis H2, suggesting that as NPLs increase, liquidity risk tends to rise. This is because higher levels of non-performing loans negatively impact a bank's liquidity position, prompting banks to hold higher liquid assets to mitigate the risks associated with rising NPLs. These findings align with the study by Elouali & Oubdi (2020).

There is no significant association between ROA and LA across any of the models (Pooled OLS, Fixed Effect, and Random Effect), indicating that profitability does not have a direct influence on liquidity risk in this context.

Regarding bank size (SIZE), the results indicate a positive and significant relationship with liquidity risk in the Pooled OLS and Random Effect models. This suggests that as bank size increases, liquidity risk also rises. These findings support hypothesis H4 and are consistent with the study by Kasana et al. (2022).

OIR is found to be positively associated with LA, with statistical significance at the 10% level in the Fixed Effect model. This suggests that as banks become more efficient, their liquidity risk may increase rather than decrease. One possible explanation is that more efficient banks may achieve higher efficiency by reducing liquidity buffers or relying on more volatile, short-term funding sources. This finding does not support hypothesis H5.

Regarding DAR, the findings indicate a positive and statistically significant relationship with LA at the 1% level, based on Pooled OLS, Fixed Effect, and Random Effect models. This suggests that as banks increase their deposits relative to total assets, their liquidity risk also rises. Banks with a high DAR rely more heavily on deposits as their primary source of funding. Since deposits, particularly demand deposits, can be withdrawn suddenly, banks may face liquidity risk, potentially needing to liquidate assets quickly to cover withdrawal demands. These results contradict hypothesis H6, instead indicating that an increased reliance on deposits can heighten liquidity risk.

NIM also shows a positive and significant influence on LA, with statistical significance at the 5% level in Pooled OLS and Random Effect, and at the 1% level in the Fixed Effect model. This suggests that an increase in NIM is associated with an increase in liquidity risk. This could imply that banks may engage in riskier strategies to achieve higher NIM, which in turn exposes them to potential liquidity mismatches. These findings are consistent with Muharam & Kurnia (2015), who also explored the relationship between NIM and liquidity risk. These results reject hypothesis H7.

Table 6 presents the regression models for liquidity risk measured by LD. The findings indicate a positive and statistically significant effect of CAR on liquidity risk (LD) at the 5% significance level, consistent across all three estimation techniques (Pooled OLS, Fixed Effect, and Random Effect). This positive relationship suggests that as CAR increases, liquidity risk (LD) also increases. This contradicts hypothesis H1, which assumes that higher CAR enhances a bank's ability to manage short-term obligations efficiently. The observed results do not support this assumption and instead imply that higher CAR may encourage riskier financial practices, which increase liquidity risk.

In terms of asset quality, NPL shows a positive and statistically significant association with LD, at the 1% level across all three models (Pooled OLS, Fixed Effect, and Random Effect). This finding supports hypothesis H2. High levels of NPLs reduce cash inflows and raise the costs associated with liquidity management, thus increasing the bank's liquidity risk.

Table 6. Results of models with LD as dependent variable.

Variable	Pooled OLS				Fixed Effect				Random Effect			
	Coef.	Std. Error	t-value	Pr(>|t|)	Coef.	Std. Error	t-value	Pr(>|t|)	Coef.	Std. Error	t-value	Pr(>|t|)
Constant	−0.612	0.112	−5.466	0.000***	−0.600	0.120	−4.991	0.000***	−0.612	0.112	−5.466	0.000***
CAR	0.974	0.350	2.784	0.006**	1.204	0.373	3.228	0.001**	0.974	0.350	2.784	0.005**
NPL	0.500	0.056	8.933	0.000***	0.487	0.061	7.965	0.000***	0.500	0.056	8.933	0.000***
ROA	−0.171	0.243	−0.706	0.481	−0.355	0.265	−1.338	0.182	−0.171	0.243	−0.706	0.480
SIZE	0.030	0.006	5.204	0.000***	0.014	0.008	1.843	0.066	0.030	0.006	5.204	0.000***
OIR	0.039	0.022	1.764	0.079	0.048	0.024	2.006	0.046*	0.039	0.022	1.764	0.078
DAR	0.478	0.112	4.283	0.000***	0.578	0.121	4.761	0.000***	0.478	0.112	4.283	0.000***
NIM	0.169	0.060	2.833	0.005**	0.381	0.079	4.811	0.000***	0.169	0.060	2.833	0.005**
R^2	0.450				0.482				0.450			
Adj. R^2	0.437				0.470				0.437			
p-value	0.000				0.000				0.000			
Hausman					0.000							

Note: *** significant at 0.01, ** significant at 0.05, * significant at 0.1. Source: Author's own calculation.

Regarding ROA, the results from all three models (Pooled OLS, Fixed Effect, and Random Effect) indicate that it does not have a statistically significant impact on liquidity risk, as measured by LD. This finding suggests that profitability does not directly influence liquidity risk in this context.

Bank size (SIZE) has a positive and statistically significant association with liquidity risk (LD) at the 1% level, based on the results of the Pooled OLS and Random Effect models. This suggests that larger banks tend to have higher liquidity risk, possibly due to their larger scale of operations and exposure to more complex activities that increase liquidity risk.

OIR is positively correlated with LD, with statistical significance at the 10% level, but only in the Fixed Effect model. This suggests that, in certain contexts, as banks improve efficiency (as measured by OIR), liquidity risk may increase, possibly due to the reliance on more volatile funding sources or a reduction in liquidity buffers.

DAR shows a positive and statistically significant effect on LD at the 1% level across all three models (Pooled OLS, Fixed Effect, and Random Effect), contrary to the expected relationship. This positive relationship suggests that as DAR increases, so does liquidity risk. This may be because banks are increasingly funding their assets with deposits, especially demand deposits, which are more likely to be withdrawn suddenly, creating pressure on the bank to hold higher liquid assets, thus increasing liquidity risk.

Finally, NIM also has a positive and statistically significant effect on LD, at the

5% level in the Pooled OLS and Random Effect models and at the 1% level in the Fixed Effect model. This result is unexpected because traditional financial theory often suggests an inverse relationship between NIM and liquidity risk, where higher NIM implies better profitability and potentially reduced liquidity risks. However, the observed findings suggest that higher NIM may expose banks to greater liquidity mismatches, possibly due to riskier lending or investment strategies aimed at achieving higher margins.

The findings from the three estimation methods—Pooled OLS, Fixed Effect, and Random Effect—demonstrate a consistent positive and statistically significant impact of the Capital Adequacy Ratio (CAR) on liquidity risk, measured by the Liquid Assets to Total Assets Ratio (LA) and the Liquid Assets to Deposits Ratio (LD), across different significance levels (10% and 5%). This highlights the robustness of the relationship between CAR and liquidity risk. Asset quality (NPL) exerts a strong and significant positive influence on liquidity risk (LA and LD) across all three methods, with results consistently significant at the 1% level. Profitability, as measured by Return on Assets (ROA), does not have a significant effect on liquidity risk (LA and LD). Bank size (SIZE) is positively and significantly associated with liquidity risk (LA and LD) at the 1% level but only under the Pooled OLS and Random Effect models. Efficiency shows a positive and significant influence on liquidity risk (LA and LD) at the 10% level, but only under the Fixed Effect model. Lastly, both the Total Deposits to Total Assets Ratio (DAR) and Net Interest Margin (NIM) exhibit a strong positive relationship with liquidity risk (LA and LD) across all three methods, with significance at the 1% and 5% levels.

5. Conclusion

This study explores the determinants of liquidity risk in the Haitian banking sector, a critical component of financial stability that remains under-researched. Utilizing a dataset covering 308 observations from 7 banks (5 private and 2 public) between 2013 and 2023, the study evaluates liquidity risk through key ratios: liquid assets to total assets and liquid assets to deposits. The analysis investigates the impact of bank-specific factors—capital adequacy, asset quality, profitability, bank size, efficiency, deposits, and net interest margin—using Pooled OLS, Fixed Effect, and Random Effect panel data regression techniques. The results of the Hausman test suggest the selection of Fixed Effect models over Random Effect models.

The findings from Fixed Effect models reveal that the capital adequacy ratio exerts a positive and significant influence on liquidity risk, as reflected in both liquidity metrics: liquid assets to total assets and liquid assets to deposits. This indicates that banks with higher capital ratios are more likely to suffer from liquidity shortfall. Asset quality (Non-performing loans ratio) has a strong and significant positive impact on liquidity risk (liquid assets to total assets and liquid assets to deposits), suggesting that the deterioration of the loan portfolio increases the liquidity risk of banks.

Profitability, as measured by Return on Assets (ROA), and bank size do not have a significant effect on liquidity risk, as measured by both liquid assets to total assets and liquid assets to deposits ratio. In contrast, efficiency shows a positive and significant influence on liquidity risk (liquid assets to total assets and liquid assets to deposits ratios). In addition, both the deposits (total deposits to total assets) and net interest margin as a percentage of interest income exhibit a strong positive relationship with liquidity risk (liquid assets to total assets and liquid assets to deposits ratios), indicating that liquidity risk tends to increase with an increase in deposits and net interest margin.

By addressing this research gap, the study offers valuable insights into the internal drivers of bank liquidity risk in Haiti. These findings highlight the critical importance of effective management strategies for capital adequacy, asset quality, and deposit growth to mitigate liquidity risk. Practitioners and the financial regulator can use these insights to develop targeted interventions aimed at enhancing the resilience and stability of the banking sector. Furthermore, the study emphasizes the need for future research to explore external determinants and macroeconomic influences, as well as their interplay with internal factors, to provide a more comprehensive understanding of liquidity risk dynamics in Haiti.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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