FABA
Finance, Accounting and Business Analysis
ISSN: 2603-5324

Finance, Accounting and Business Analysis
Volume 7 Issue 1, 2025
http://faba.bg/
ISSN 2603-5324
DOI: https://doi.org/10.37075/FABA.2025.1.05

Macroeconomic and Bank-Specific Factors Affecting Bank Liquidity in South Africa: An MSM-VAR Approach

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Info Articles

History Article:
Submitted 6 January 2025
Revised 2 March 2025
Accepted 26 March 2025

Keywords:
Bank Liquidity,
Macroeconomic Factors,
Bank-Specific Factors,
MSM-VAR

JEL: F65, G21, G32

Abstract

Purpose: The study aims to determine if macroeconomic and bank-specific factors affect bank liquidity differently under different regimes in South Africa.

Design/Methodology/Approach: This research used the Markov Switching Mean Vector Autoregressive (MSM-VAR) approach from 2000Q1 to 2021Q4. The study employed a two-regime model, with regime one indicating low liquidity volatility and regime two indicating high liquidity volatility.

Findings: The findings show that macroeconomic and bank-specific factors react differently to liquidity based on market conditions. GDP growth has positive effects on bank liquidity in both regimes, while exchange rate risk, credit risk, and bank return on equity have negative effects. Inflation has a negative impact on liquidity in regime one and a positive impact in regime two. Bank size has positive effects on liquidity in regime one and negative effects in regime two.

Practical Implications: The study reveals the interplay between macroeconomic and bank-specific factors in shaping bank liquidity, providing insights for policymakers, bank management, and investors to respond to liquidity dynamics during economic fluctuations.

Originality/Value: The MSM-VAR approach analyzes South African banking sector liquidity dynamics, providing insights for policymakers, financial institutions, and investors to improve liquidity management strategies.

Paper Type: Research Paper.

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INTRODUCTION

Bank liquidity is crucial for financial stability in emerging economies like South Africa. Moussa and Trabelsi (2023) define liquidity as an institution's capacity to fund assets and meet financial obligations. As stated by Molefe and Muzindutsi (2016), banks serve as economic intermediaries by accepting deposits from individuals, companies, financial institutions, and governments with excess savings. It is essential that bank assets can be converted into cash promptly to satisfy these demands (Van Schalkwyk and Witbooi 2017). The literature on macroeconomic and bank-specific factors affecting bank liquidity across various countries presents a range of findings, emphasizing both commonalities and differences in liquidity determinants across regions. Many studies concur that bank-specific factors, such as capital adequacy, non-performing loans (NPL), bank size, and profitability, significantly influence liquidity. For instance, Ebenezer et al. (2017) and Mashamba (2014) find that capital adequacy positively impacts bank liquidity, while NPL has a negative effect. Similarly, Mdaghri and Oubdi (2022) highlight the positive influence of capital and bank size on liquidity creation. Tahir et al. (2023) and Singh and Sharma (2016) also identify profitability and capital adequacy as key drivers of liquidity, noting that profitability has a positive impact. Al-Qudah (2020) and Antony (2023) demonstrate that deposit growth positively influences liquidity, whereas NPL and bank size negatively affect it. Regarding macroeconomic factors, Tahir et al. (2023) found no significant relationship between GDP and Islamic bank liquidity, while Singh and Sharma (2016) report a positive relationship between inflation and liquidity. These findings highlight the importance of considering a range of factors when analyzing liquidity creation within the banking sector.

South Africa has one of the most advanced and liquid financial markets in Africa, supported by impartial policy formation, a diverse economy, and robust financial institutions (IMF 2022). Corporate and institutional deposits dominate the funding base, contributing over 70% of total funding, while retail deposits play a modest role (IMF 2022). Nevertheless, the South African economy faces significant macroeconomic challenges that threaten its banking sector's stability and liquidity. Over the last decade, economic growth has steadily declined (SARB 2020). Structural constraints such as infrastructure bottlenecks and low productivity have hindered post-pandemic recovery, keeping GDP growth below potential levels (World Bank 2024). The nation faces stark inequality, evidenced by a Gini coefficient of 0.67, one of the highest globally (World Bank 2024). Additionally, high unemployment, poor educational outcomes, stagnating manufacturing output, and declining export volumes exacerbate the economic strain (SARB 2020).

Given these challenges, a significant gap exists in understanding how macroeconomic factors—such as slowing growth, fiscal constraints, and structural inefficiencies—interact with bank-specific factors like funding structures, risk management, and asset quality to affect bank liquidity. While prior research has examined the relationship between economic growth and banking resilience (Sambaza 2016), the asymmetric effects of these variables in South Africa's distinct socio-economic context have received limited attention. There is limited research on the specific impact of macroeconomic and bank-specific factors on bank liquidity in South Africa. Luvuno (2018) found that GDP and bank size positively influence liquidity, whereas non-performing loans and loan growth negatively affect it. Inflation shows both positive and negative, though minimal, effects on liquidity. Umar and Sun (2016) analyzed BRICS countries, including South Africa, and concluded that liquidity in BRICS banks is shaped by macroeconomic factors such as interest rates, inflation rates, and national savings rates. However, they found no effect of bank size on liquidity. While this study offers a broad perspective on BRICS, it does not address South Africa's unique dual economy, structural constraints, or the asymmetric effects of these factors on its banking sector. A linear model is used in both studies, potentially simplifying the relationships between variables. It remains unclear how liquidity behaves in non-linear dynamics and during regime switches between periods of economic expansion and contractions. Similarly, international studies often assume a linear relationship. Several studies have employed panel data analysis, using methods such as fixed effects and random effects models (e.g., Tahir et al. 2023; Javid 2016; Singh and Sharma 2016). However, these static models (e.g., OLS, Fixed Effects) are unable to capture structural breaks or non-linearities. In contrast, MSM-VAR can effectively model non-linear effects, such as liquidity responding differently to GDP growth during economic expansions and recessions.

This study adds a unique perspective to the literature. First, it analyses the impact of macroeconomic and bank-specific factors on bank liquidity in South Africa, considering how these relationships evolve under different economic regimes. Second, it fills a methodological gap: While several studies (e.g., Mdaghri and Oubdi 2022) use advanced econometric techniques, the Markov-Switching Means Autoregressive (MSM-VAR) approach remains underexplored in liquidity studies, especially in emerging markets like South Africa. The study applies the MSM-VAR approach, enabling a dynamic, regime-sensitive understanding of liquidity determinants in South Africa's banking sector. Third, it presents empirical results, showing that macroeconomic and bank-specific factors react differently to liquidity based on market conditions. Fourth, the results suggest that policymakers should consider the varied responses of these factors when implementing liquidity management strategies. Lastly, to the best of the author's knowledge, this is the first study to apply MSM-VAR to the nexus between macroeconomic and bank-specific factors and bank liquidity. By using this innovative approach, it provides valuable insights into how different factors influence liquidity management strategies in varying market conditions. Overall, the findings illuminate the complex interplay between macroeconomic and bank-specific factors in liquidity management.

Following the introduction, Section 2 presents a literature review of research on macroeconomic and bank-specific factors influencing bank liquidity. Section 3 provides the theoretical development of the variables. Section 4 details the research methodology. Section 5 examines empirical findings and discusses the results, while Section 6 concludes the paper.

LITERATURE REVIEW

The studies reviewed examine the determinants of bank liquidity, focusing on both macroeconomic and bank-specific factors across different regions and time periods. Most studies agree that both internal and external factors significantly influence bank liquidity, although the direction and strength of their effects vary. There is a literature gap in the context of South Africa. Below is a synthesis of the relevant studies.

The impact of bank size on liquidity is mixed. Antony (2023) uses pooled OLS, fixed effect, and random effect approaches to investigate the factors that influence liquidity risk for Indian commercial banks between 2013 and 2022. The results show a positive relationship between liquidity risk and factors like bank size. Based on a study by Lalone et al. (2023), the size of a bank has a significant impact on its liquidity. Using a fixed and random effect (FRE) model, Vu et al. (2021) examined data from 40 banks between 2006 and 2019 and found that bank size has a negligible impact on bank deposits. Similarly, Moussa (2015) found that bank size did not significantly affect bank liquidity in 18 Tunisian banks from 2000 to 2010 using a panel method. Based on Pham and Pham's (2021) analysis of the variables influencing the liquidity of Vietnamese banks since 2007, it appears that bank size contributes to a decrease in liquidity. Mahmood et al. (2019) used the fully modified ordinary least square (FMOLS) to analyze macro- and bank-specific variables in Pakistan from 2000 to 2017, indicating that bank size has a detrimental effect on liquidity. It was found by Sopan and Dutta (2018) that factors like bank size adversely affect Indian banks' liquidity.

Tasnova (2022) used the Pooled Ordinary Least Squares method, fixed and random effect estimates, and implemented the GLS random effect method, confirming that nonperforming loans have a positive effect on liquidity in 29 listed commercial banks in Bangladesh. Bhati et al. (2019) found that non-performing assets did not influence bank liquidity ratios in India from 1996 to 2016.

Mdaghri and Oubdi (2022) found that profitability plays an important role in bank liquidity creation in MENA countries using a Fixed Effects model and the new Method of Moments Quantile Regression (MMQR). A study by Tahir et al. (2023) examines the variables affecting Pakistani Islamic banks' liquidity conditions. Using a fixed-effect model, the study analyzed Pakistani Islamic banks during the post-financial crisis period of 2009–2020 and discovered that profitability had a favorable impact on their liquidity. A fixed and random effect (FRE) model was applied to a dataset of 40 banks from 2006 to 2019, indicating that bank deposits were positively impacted by profitability (Vu et al. 2021). Based on balanced panel data, Javid (2016) conducted regression analysis using random effect panel data in the Pakistani banking sector, confirming a positive correlation. By using the Pooled Ordinary Least Squares method, fixed and random effect estimates, and the GLS random effect method, Tasnova (2022) verified that profitability has a favorable impact on liquidity for 29 Bangladeshi listed commercial banks. OLS, fixed effect, and random effect estimates were applied to a dataset of 59 Indian banks from 2000 to 2013, and Singh and Sharma (2016) discovered that profitability had a favorable impact on bank liquidity. Sopan and Dutta's (2018) study found that profitability negatively impacts liquidity in Indian banks.

By applying the GLS random effect method, fixed and random effect estimates, and the pooled ordinary least square method, Tasnova (2022) verified that capital adequacy improves liquidity for 29 Bangladeshi listed commercial banks. A dataset of 59 Indian banks from 2000 to 2013 was examined by Singh and Sharma (2016), and they found that capital adequacy had a positive impact on bank liquidity. On the other hand, Tahir et al. (2023) examined factors affecting the liquidity position of Islamic banks in Pakistan. The study found that capital adequacy ratios had a negative influence on Islamic banks' liquidity using a fixed-effect model on Pakistani Islamic banks for the post-financial crisis period 2009–2020. Similarly, Pham and Pham (2021) examined the factors that have affected Vietnam's banks' liquidity since 2007, and the results showed that capital had a negative impact on Vietnam's banks' liquidity.

Sopan and Dutta's (2018) study found that GDP has a negative impact on liquidity in Indian banks. Utilizing FMOLS, Mahmood et al. (2019) investigated macro- and bank-specific variables in Pakistan from 2000 to 2017. The findings indicate that a bank's liquidity is negatively impacted by GDP. In contrast, Antony (2023) examines the determinants of liquidity risk for Indian commercial banks from 2013 to 2022 using pooled OLS, fixed effect, and random effect methods. The findings show that liquidity risk is positively affected by GDP. In a study of Bangladeshi state-owned commercial banks, Lalone et al. (2023) discovered that GDP is associated with profitability. Vu et al. (2021) used an ERE model on a dataset of 40 banks from 2006 to 2019, showing that GDP has a positive effect on bank deposits. Pham and Pham (2021) looked at the factors that have affected Vietnam's banks' liquidity since 2007, and the results show that GDP has a positive impact on Vietnam's banks' liquidity.

In Bangladesh, Lalon et al. (2023) found that inflation is correlated with the liquidity of state-owned commercial banks. Pham and Pham (2021) examined factors affecting the liquidity of Vietnam's banks since 2007 and found that inflation positively impacts liquidity. After performing OLS, fixed effect, and random effect estimates on a dataset of 59 banks from 2000 to 2013, Singh and Sharma (2016) discovered that inflation positively impacts Indian banks' liquidity. The inflation rate positively impacts bank liquidity in India, according to Sopan and Dutta (2018). Using panel data analysis, pooled least squares, fixed effects models, and random effects models, Al-Qudah (2020) found that inflation positively affected the liquidity of 13 listed commercial banks in Jordan from 2011 to 2018. In contrast, Bhati et al. (2019) found that inflation negatively influenced bank liquidity ratios in India from 1996 to 2016.

The effect of monetary policy on liquidity is explored in studies such as Mahmood et al., (2019) and Mdaghri and Oubdi (2022), which suggest that expansionary monetary policy (lower interest rates) enhances liquidity by lowering funding costs, while restrictive policies have the opposite effect. Bhati et al. (2019) also show that macroeconomic factors, such as interest rates, play significant roles in determining liquidity ratios in India.

In South Africa, a panel regression method was used to study twelve commercial banks from 2006 to 2016. Based on Luvuno's (2018) research, size, GDP, and capital adequacy positively affect commercial banks' liquidity. Conversely, non-performing loans and loan growth negatively impact liquidity, while inflation has negligible effects. Similarly, Umar and Sun's 2016 study found that liquidity factors in BRICS countries (Brazil, Russia, India, China, and South Africa) were not significantly affected by bank size. However, the financial crisis notably impacted funding liquidity, with inflation, interest rates, and national savings rates identified as significant factors. Stock liquidity was influenced by stock price, profitability, volatility, trading volume, and GDP, while the market index and market capitalization did not have a significant impact.

THEORETICAL DEVELOPMENT

Bank Liquidity

Moussa and Trabelsi (2023) define liquidity as the ability of a bank to quickly settle accounts and meet short-term obligations through cash and assets. For banks to extend credit and avoid financial difficulties, high liquidity is essential. Banks must balance profitability and liquidity by regularly assessing their liquidity, managing risk, and adhering to sound financial practices. This study examines the influence of macroeconomic and bank-specific factors on bank liquidity, offering insights to inform decisions and enhance financial stability.

Macroeconomic Factors

Economic Growth (RGDP): Economic growth represents the expansion of domestic economic activity and income (Nguyen & Bui 2019). GDP change reflects economic stability and evaluates government initiatives and reforms. Bank liquidity, or a bank's ability to meet short-term obligations, is linked to economic growth. Many studies have confirmed a positive relationship between GDP and liquidity (e.g., Antony 2023; Lalone et al. 2023; Vu et al. 2021). It is expected that the relationship between RGDP and liquidity will be positive in both states or regimes.

Inflation Rate (INF): Inflation affects the real value of money, influencing liquidity restrictions (Vodova 2014; Moussa 2015). As inflation lowers the true value of money, liquidity restrictions become more rigid, restricting investment and consumption and hindering economic growth. Central banks must monitor inflation levels to maintain stable banking systems and economies. Understanding the relationship between bank liquidity and inflation is crucial for effective management. It is expected that inflation and liquidity will be negatively related under both market conditions (regimes).

Exchange Rate Risk (EXR): Exchange rates can impact banks' liquidity because volatile rates enhance banking sector volatility. Banks use exchange rate fluctuations, hedge techniques, and derivatives to manage liquidity risk, protect against foreign exchange rate risk, and ensure sufficient cash for contractual obligations. The relationship between exchange rate risk and liquidity is expected to vary based on market conditions.

Bank-Specific Factors

Credit Risk (CR): Credit risk is related to liquidity risk through borrower defaults and fund withdrawals

(Diamond and Dybvig 1983). When a borrower defaults, credit risk rises, reducing the liquidity of lender assets and increasing borrowing costs. This leads to higher interest rates for borrowers, resulting in less borrowing and reduced liquidity, or vice versa. It is expected that liquidity and credit risk will vary according to market conditions.

Bank Size (BS): Total assets are a common measure of a bank's size (Demirguc-Kunt and Huizinga 1999; Melese 2015; Singh and Sharma 2016). Bank size significantly impacts financial health, with larger banks being more resilient, diverse, and better equipped to manage liquidity during market instability.

Return on Equity (ROE): The ROE of a bank represents its profitability, while its liquidity reflects the bank's ability to meet short-term obligations. A bank's financial stability is determined by ROE and liquidity, with high ratios improving profitability and reducing risk. Balancing these is crucial for long-term success and stakeholder trust. The relationship between ROE and liquidity is expected to vary based on market conditions.

METHODS

Data Source

This study analyzes macroeconomic and bank-specific factors affecting bank liquidity in South Africa. Data were obtained from the South African Reserve Bank (SARB) and the Johannesburg Stock Exchange (JSE) for the period from 2000Q1 to 2021Q4.

Unit Root Tests for Stationarity

The study uses the Augmented Dickey-Fuller (ADF) (1981) test and the Phillips-Perron (PP) (1981) test to confirm the stationarity of the variables and determine their order of integration. Brooks (2008) emphasizes the importance of these tests in analyzing structural breaks, trends, and stationarity in data. The ADF and PP tests ensure the data is suitable for further statistical analysis by verifying the stationarity of the variables. Breaks and trends may reveal potential outliers or anomalies that could affect the study's findings.

The Johansen Cointegration Test

The Johansen Cointegration Test is a statistical method used to determine whether a long-term equilibrium relationship exists among multiple time series variables. In this study, the test assesses whether key macroeconomic indicators and bank-specific factors are cointegrated with bank liquidity over time. Various macroeconomic factors (such as GDP growth, inflation risk, and exchange rate risk) and bank-specific variables (including credit risk, bank size, and return on equity) may influence liquidity levels in the banking system. While these variables may show short-term fluctuations, the Johansen Cointegration Test helps identify whether they share a stable long-term relationship. If a cointegration relationship exists, it indicates that, despite short-term deviations, these variables are interconnected and will revert to equilibrium over time.

Markov Switching Mean Vector Autoregressive

MSM-VAR is one of the two classes of Markov Switching Vector Autoregressive (MS-VAR) models, the other being the Markov-Switching Intercept VAR Model (see Krolzig 1997). Both classes capture the dynamic interactions between multiple time series variables while allowing for shifts in relationships over time. The MSM-VAR allows for regime switches in the VAR coefficients, reflecting different economic or market conditions. This flexibility makes MS-VAR models well-suited to capturing non-linearities and changes in relationships that traditional VAR models may struggle to address. The MSM-VAR model is particularly effective for analyzing the dynamic relationships between macroeconomic and bank-specific factors across different economic regimes, such as periods of high liquidity or market stability and low liquidity or market instability. The model assumes that the behavior of these variables can switch between different regimes depending on the underlying state of the economy or banking environment.

MSM-VARs can be characterized as follows:

$$Y_t = \mu S_t + X_t \, \beta S_t + \epsilon_t \quad (1)$$

Where

- The bank liquidity variable at time t is denoted by Y_t
- S_t is a measure of the market's state or regime at time t (for example, 1 represents a high-liquidity, stable market, while 0 indicates a low-liquidity, unstable market).
- A vector of explanatory variables (for example, macroeconomic indicators, bank-specific factors) is denoted by X_t

- βS_t is the state-dependent coefficient vector
- ϵ_t is the error term.

Markov Process for Regime Switching:

S_t, the regime variable, follows a discrete Markov process, determining the probability of switching from one regime to another. To define transition probabilities between regimes, we use the following formula:

$$P\ (S_t = j\ |S_{t-1} = i)\ pij \tag{2}$$

Where:

- A switch from regime i to regime j is represented by pij
- P is a transition matrix arranged according to the transition probabilities pij

Expanded Model for Liquidity Analysis in Banks:

There are two types of factors that can be included in the vector Y_t for analyzing liquidity in South African banks: macroeconomic factors and factors specific to the bank:

$$\mathrm{Y_t = RGDP_t, INF_t, EXR_t, CR_t, BS_t, ROE_t} \tag{3}$$

An MSM-VAR model shows how interactions between these variables change with economic regimes. For instance, in a low liquidity regime, such as during a financial crisis, the effects of inflation or high credit risk on liquidity may be more pronounced than in a high liquidity regime.

Example of MSM-VAR in Liquidity Analysis:

Suppose the model identifies two regimes:

- Regime 1: Periods of high liquidity (expansionary economic condition).
- Regime 2: Periods of low liquidity (financial stress or contractionary economic condition).

For Regime 1:

$$Y_t\ \ A_1^{(1)} Y_{t-1} + A_2^{(1)} Y_{t-2}\ C^{(1)} + \epsilon_t^{(1)} \tag{4}$$

For Regime 2:

$$Y_t\ \ A_1^{(2)} Y_{t-1} + A_2^{(2)} Y_{t-2}\ C^{(2)} + \epsilon_t^{(2)} \tag{5}$$

The model estimates distinct dynamics for each regime, enabling liquidity to respond differently to shocks in macroeconomic factors or bank-specific variables.

RESULTS AND DISCUSSION

Descriptive Statistics

Table 1 summarizes descriptive statistics for all variables used in this study. Variables include bank liquidity, RGDP, inflation rate, exchange rate, credit risk, bank size, and return on equity. The mean bank liquidity was 16.38, indicating a high level of liquidity. The RGDP had a mean of 2.33, suggesting moderate economic growth. The inflation rate averaged 108.05%, indicating high inflation. The average exchange rate was 86.98, reflecting the instability of the domestic currency. Credit risk had a mean of 3.46, indicating low risk in the banking industry. The mean bank size was 98.23, representing the average size of the banks studied. The average return on equity was 14.28%, demonstrating bank profitability. The study revealed high inflation and volatile exchange rates, but the banking industry remained stable with low credit risk and an average bank size.

Regarding skewness, it is positive for INF, EXR, CR, and ROE, indicating comparable behavior among these variables. In contrast, LIQ, RGDP, and BS have negative skewness, meaning INF, EXR, CR, and ROE are positively skewed, showing a greater concentration of values at the lower end of the distribution. Conversely, LIQ, RGDP, and BS exhibit negatively skewed distributions, indicating a greater concentration of values at the higher end. These changes in skewness illustrate the different behaviors and properties of the variables.

Table 1. Descriptive Statistics Summary

Description	LIQ	RGDP	INF	EXR	CR	BS	ROE
Mean	16.37583	2.328409	108.0484	86.97864	3.456818	98.22568	14.27913
Median	17.32435	2.500000	101.7150	84.40000	3.300000	99.30700	14.45212
Maximum	22.09582	5.600000	174.9900	108.9900	5.900000	100.0000	28.91479
Minimum	2.871962	-6.300000	58.14000	64.68000	1.100000	90.46090	4.570380
Std. Deviation	4.570762	2.248062	35.06533	11.68720	1.2776111	2.678353	6.283023
Skewness	-0.898018	-1.143259	0.336017	0.174620	0.075491	-1.872170	0.546211
Kurtosis	39,42014	5.318787	1.789708	1.843576	2.223244	4.808261	2.889533
Jarque-Bera	12.10576	38.88478	7.026933	5.350715	2.295864	63.39628	4.420486
Probability	0.002366	0.000000	0.029793	0.068882	0.317292	0.000000	0.109674
Observations	88	88	88	88	88	88	88

Source: Author`s calculation using Eviews 14.

The kurtosis coefficient measures the shape of distributions. Distributions with kurtosis coefficients greater than 3 are leptokurtic, while those with coefficients less than 3 are platykurtic. Mesokurtic distributions have a kurtosis coefficient of 3. LIQ, RGDP, and BS are leptokurtic because their values exceed 3, indicating a higher peak than a normal distribution. Conversely, since the kurtosis values for INF, EXR, and ROE fall below 3, these variables are platykurtic, exhibiting lighter tails than a normal distribution. This indicates that the values of INF, EXR, and ROE are spread over a wider range and are less likely to be concentrated around the mean.

Unit Root Test Results

Unit root tests are statistical assessments that determine whether a time series is stationary. These tests identify the presence of a unit root, indicating non-stationarity. The augmented Dickey-Fuller and Phillips-Perron tests are the most used unit root tests.

Table 2. ADF and PP Unit Root Test Results

Variables	ADF Test		PP Test	
	t-statistic	Status	t-statistic	Status
*ln*LIQ	-4.961932***	I(1)	-3.105286**	I(1)
lnRGDP	-3.322135**	I(1)	-5.798362***	I(1)
*ln*INF	-5.866137***	I(1)	-5.883608***	I(1)
*ln*EXR	-7.464003***	I(1)	-7.478403***	I(1)
*ln*CR	-4.319999***	I(1)	-12.21163***	I(1)
*ln*BS	-4.319199***	I(1)	-6.504042***	I(1)
*ln*ROE	-4.481221***	I(1)	-10.01642***	I(1)

Source: Author`s calculation using Eviews 14.

Table 2 shows the results of the ADF and PP unit root tests. All variables are integrated at level I(1). Consequently, there is evidence of a long-run equilibrium relationship between the variables. The results suggest that the null hypothesis of non-stationarity can be rejected for all variables, implying that they are suitable for further investigation.

Correlation Coefficients Results

The correlation coefficients between the dependent and independent variables are shown in the correlation matrix (Table 3). High collinearity among independent variables can lead to faulty regression models, making it difficult to isolate specific effects and inflating standard errors. These issues must be recognized and addressed before interpreting the matrix.

RGDP -0.003662, INF 0.284276, EXR -0.040107, CR 0.026609, BS 0.702747, and ROE 0.558220. LIQ and RGDP have a correlation of -0.003662, indicating a modest negative association. The positive correlations for INF, CR, BS, and ROE suggest moderate to high positive relationships with LIQ, while the negative correlation between LIQ and EXR indicates a weak negative association. The correlations among the independent variables are all less than 0.95, indicating minimal multicollinearity. Lower correlations suggest that the variables are less dependent on each other, allowing for more reliable analysis and enhancing confidence in statistical models and forecasts based on these variables.

Table 3. Correlation Coefficients Test Results

Variables	LIQ	RGDP	INF	EXR	CR	BS	ROE
LIQ	1.000000						
RGDP	-0.003662	1.000000					
INF	0.284276	-0.632893	1.000000				
EXR	-0.040107	0.636099	-0.655890	1.000000			
CR	0.026609	-0.575647	0.374317	-0.238237	1.000000		
BS	0.702747	-0.219050	0.564480	-0.069178	0.173193	1.000000	
ROE	0.558220	0.370466	-0.062748	0.274776	-0.298292	0.563605	1.000000

Source: Author`s calculation using Eviews 14.

VAR Lag Length Selection Criteria

An overfitted model can suffer from autocorrelated errors when there are too few or too many lags. To minimize these issues, information criteria are utilized. In this study, both the Schwarz Criterion (SC) and the Akaike Information Criterion (AIC) were applied. Based on the lag length selection results, length 2 was selected.

Cointegration Test Results

The Johansen Cointegration Test is a statistical tool used to determine whether a set of variables is cointegrated, indicating a long-term relationship. It can also count the number of cointegrated links between variables. This test is commonly used in econometrics for regression analysis.

Table 4. LIQ Johansen Juselius Test for Cointegration

Hypothesized No. of CE9s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Max-Eigen Statistic	0.05 Critical Value
None*	0.544310	221.1146 ***	125.6154	66.80507***	46.23142
At most 1*	0.467719	154.3095***	95.75366	53.59966***	40.07757
At most 2*	0.443349	100.7099***	69.81889	49.79439***	33.87687
At most 3*	0.249934	50.91547**	47.85613	24.44550	27.58434
At most 4	0.186711	26.46997	29.79707	17.566887	21.13162
At most 5	0.080131	8.903097	15.49471	7.099514	14.26460
At most 6	0.020995	1.803583	3.841465	1.803583	3.841465

Note: *** and ** represent statistically significant at 1% and 5% levels.
Trace test indicates 4 cointegrating eqn(s) at the 0.05 level.
Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level.
Source: Author`s calculation using Eviews 14.

Table 4 displays the Johansen cointegration findings based on trace and maximum eigenvalue statistics to identify the integration sequence. The cointegrated time-series variables exhibit a long-run equilibrium connection; at the 5% critical value, the trace statistics reveal four cointegrated vectors, while the maximum eigenvalue statistics show three. Both trace and maximum eigenvalue statistics reject the null hypothesis that none of the variables are cointegrated, indicating that the cointegrated variables are statistically significant. This implies that the long-run equilibrium link between the variables is stable.

MSM-VAR Estimate Results

The study utilized two regimes, one with low volatility and the other with high volatility, like Agyemang-Badu et al. (2024). A stable market or a state with low volatility or high liquidity is represented by regime 1, whereas an unstable market or a crisis with high volatility or low liquidity is represented by regime 2. Table 5 shows MSM-VAR results.

The relationship between economic growth (RGDP) and bank liquidity (LIQ) in South Africa is positive in both regime one (0.252825) and regime two (12.44829). However, this relationship is much stronger in regime two, indicating that economic growth has a larger impact on bank liquidity during periods of high volatility and unstable market conditions. This suggests that during times of economic uncertainty, South African banks may rely more heavily on economic growth to maintain liquidity levels. Consequently, banks may need to adopt different liquidity management strategies based on the prevailing regime to mitigate potential risks and ensure stability. These results align with findings from Antony (2023) and Lalon et al. (2023), who reported that GDP positively influences bank liquidity in Indian commercial banks and state-owned commercial banks of Bangladesh, respectively. The studies indicate that economic growth significantly influences bank liquidity levels in various regions, highlighting the need for South African banks to monitor economic indicators and adjust their liquidity management strategies for operational stability.

The study reveals a negative relationship (-0.058618) between inflation and bank liquidity in regime one in South Africa. Inflation negatively impacts bank liquidity during stable market conditions, meaning that an increase in inflation results in a decrease in bank liquidity. This finding suggests that banks may struggle to maintain adequate levels of liquidity when faced with higher inflation rates. These findings align with the study by Bhati et al. (2019), who found that inflation adversely affects bank liquidity in Indian banks, and Pham and Pham (2021) in Vietnam. In contrast, there is a positive effect (1.011321) in regime two, suggesting inflation positively impacts bank liquidity during unstable market conditions. This implies that during times of economic instability, such as periods of high inflation, banks may see an improvement in their liquidity levels. Conventional wisdom holds that inflation always negatively impacts bank liquidity. This unexpected result challenges this belief. This is consistent with Moussa's (2015) findings that inflation significantly impacts bank liquidity in Tunisia, Sopan and Dutta's (2018) in India, and Al-Qudah (2020) in Jordan. The study emphasizes the significance of considering various economic regimes in macroeconomic analysis, providing valuable insights for policymakers and financial institutions in managing liquidity risk.

Table 5. LIQ Johansen Juselius Test for Cointegration

Variables	**Coefficient**	**Std. Error**	**z-Statistics**
Regime 1: low volatility			
C	-14.64968	25.8278	-0.56721
RGDP	0.252825	0.10957	2.30748
INF	-0.058618	0.02554	-2.29491
EXR	-0.016728	0.01977	-0.84627
CR	-0.196079	0.24867	-0.78852
BS	0.435512	0.25446	1.71152
ROE	-0.062325	0.06059	1.71152
Regime 2: high volatility			
C	113.7426	37.7925	3.00966
RGDP	12.44829	2.59409	4.79871
INF	1.011321	0.28522	3.54581
EXR	-0.028677	0.06045	-0.47437
CR	-2.715756	2.04857	-1.32568
BS	-2.196915	0.56562	-3.88405
ROE	-0.175051	0.11293	-1.55003
Common			
LIQ(-1)	0.677358	0.13572	4.99086
LIQ(-2)	0.210270	0.13794	1.52436
SIGMA-LIQ	0.669298	0.10248	6.53094
Transition Matrix Parameters			
Variable	Coefficient	Std. Error	z-Statistics
P11-C	3.667654***	0.719915	5.094565
P21-C	-1.361965*	0.761510	-1.788505
Determinant resid covariance		2.368881	
Log likelihood		-118.5199	
Akaike info criterion		3.198137	
Schwarz criterion		3.740377	
Number of coefficients		19	

Source: Author`s calculation using Eviews 14.

The relationship between exchange rate risk (EXR) and bank liquidity in South Africa is negative in both regime one (-0.016728) and regime two (-0.028577). The findings indicate that fluctuations in exchange rate risk have a more pronounced effect on bank liquidity during periods of high volatility (regime two). This suggests that the depreciation of the Rand reduces bank liquidity. Exchange depreciation negatively impacts the economy by reducing liquidity in foreign-denominated assets, affecting lending and economic activity, emphasizing the need for careful risk management.

In South Africa, credit risk (CR) and bank liquidity have negative relationships in both regimes (-0.196079 and -2.715756). This suggests that during times of market stability, credit risk has a smaller impact on bank liquidity compared to periods of volatility. These results align with Al-Harbi's (2017) findings of a negative relationship between credit risk and bank liquidity in less-developed countries. Policymakers and regulators in South Africa should consider these findings when implementing measures to ensure banking sector stability. By understanding the impact of credit risk on bank liquidity, policymakers can promote long-term sustainability in the financial industry, benefiting both banks and the economy.

The relationship between bank size and bank liquidity in South Africa varies by market regime. In regime one, the relationship is positive (0.435512), indicating that larger banks tend to have higher liquidity under low volatility and stable conditions. This may stem from economies of scale, as larger banks benefit from lower transaction costs and a larger customer base. Similarly, Antony (2023) and Lalon et al. (2023) found that bank size positively impacts bank liquidity for Indian commercial banks and Bangladeshi state-owned commercial banks. Conversely, in regime two, the relationship is negative (-2.196915), suggesting that in times of high volatility and instability, larger banks may struggle to maintain adequate liquidity. This is consistent with findings by Pham and Pham (2021), Mahmood et al. (2019), and Sopan and Dutta (2018), which identified a negative link between bank size and liquidity in Vietnamese banks, Pakistan, and India, respectively. Overall, the study shows that large banks may struggle to maintain adequate liquidity during high volatility and instability, emphasizing the need for careful risk management and adequate buffers.

The study reveals a negative relationship between bank return on equity (ROE) and bank liquidity in South Africa, with a negative correlation in both regime one (-0.062325) and regime two (-0.175051). This relationship persists during low volatility and stable market conditions and is more pronounced during high volatility and unstable conditions (regime two). The findings indicate that bank-specific factors, such as ROE, significantly affect liquidity levels in South African banks, emphasizing the need for policymakers and regulators to consider these results. This is consistent with Al-Qudah (2020) and Delechat et al. (2014), who noted that profitability negatively impacts bank liquidity in Jordanian commercial banks and Central America, respectively. The study underscores the importance of bank-specific factors in assessing liquidity levels in financial institutions, aiding regulators in assessing and mitigating risks in the banking sector.

LIQ(-1) is 0.677358, LIQ(-2) is 0.210270, and SIGMA-LIQ is 0.669298. Based on these results, macroeconomic and bank-specific factors influence South African banks' liquidity. The positive values of LIQ(-1) and LIQ(-2) suggest that past liquidity levels significantly affect current liquidity. Additionally, the SIGMA-LIQ value of 0.669298 indicates a moderate level of volatility in liquidity within the South African banking sector. Overall, these findings highlight the complexity of liquidity management in South African banks and the need for a thorough analysis of both internal and external factors.

P11-C and P21-C are the parameters of the transition matrix, respectively, with P11-C significant at the 1% level and P21-C significant at the 10% level for bank liquidity (LIQ). These findings indicate a high probability of remaining in a state of high bank liquidity, while the likelihood of transitioning from low to high bank liquidity is relatively low. This suggests that once a bank achieves a strong liquidity position, it is likely to maintain that position for a considerable time. Additionally, the negative coefficient for P21-C indicates that transitioning from low liquidity to high liquidity is less likely, though still possible.

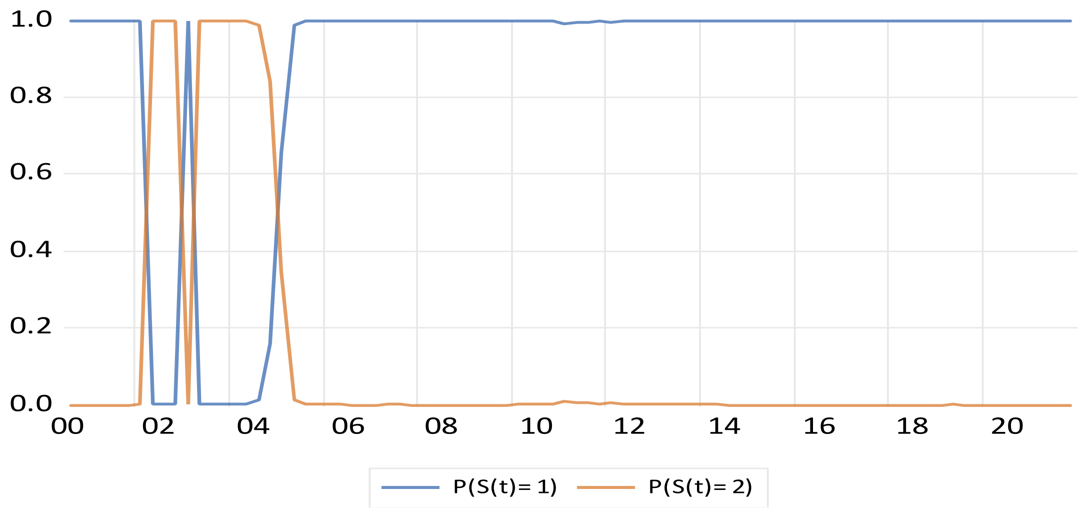
The transition matrix parameters show that external factors, such as economic conditions and market shocks, significantly influence bank liquidity more than internal factors. The positive coefficient of P11-C indicates that changes in external factors increase the likelihood of transitions between different liquidity states in the banking system. In contrast, the negative coefficient of P21-C suggests that internal factors have a weaker effect on liquidity transitions, likely because banks manage their internal operations more effectively. This analysis highlights the importance of considering both external and internal factors when evaluating bank liquidity.

The determinant residual covariance is 2.368881, the log likelihood is -118.5199, the Akaike information criterion is 3.198137, and the Schwarz criterion is 3.740377. These statistical measures provide insight into the relationships between macroeconomic and bank-specific factors affecting liquidity in South African banks. The determinant residual covariance indicates significant covariance among the determinants. The negative log likelihood suggests that the model fits the data well. The Akaike information criterion and the Schwarz criterion indicate that the model is a good fit and has strong explanatory power.

Probability Plot

Probability plots are useful tools for identifying deviations from normality in data distribution, helping to assess model assumptions and validate results on liquidity in South African banks.

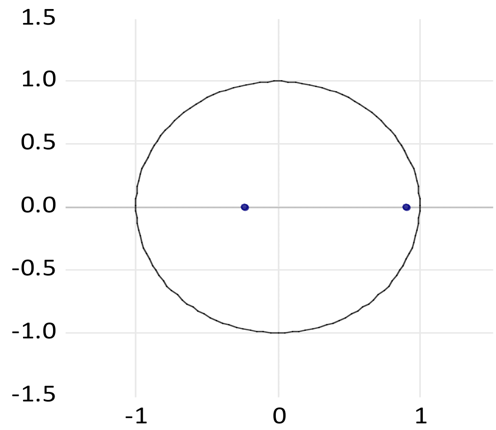
The results indicate that regime one is more dominant, with a probability of 0.881285, compared to regime two, which has a probability of 0.118715. This suggests that South African banks generally operate in a low-volatility, stable market environment. However, monitoring transitions between regimes is important to understand how changes in macroeconomic and bank-specific factors may affect liquidity in the future. Overall, the MSM-VAR model provides valuable insights into the dynamics of liquidity in South African banks and can inform risk management strategies.



Source: Author`s calculation using Eviews 14.
Figure 1. LIQ Smoothed Probabilities in the MSM-VAR model.

Inverse Root of AR

The VAR model used in this study is stable and suitable for analyzing the macroeconomic and bank-specific factors that influence liquidity risk in South African banks.



Source: Author`s calculation using Eviews 14.
Figure 2. LIQ Inverse Roots of AR Characteristic Polynomial

Figure 2 shows that no points are found outside the circle, as indicated by the inverse root of the AR characteristic polynomial. It emphasizes the importance of considering both external and internal factors when predicting liquidity levels in South African banks using the VAR model.

Transition Probability

The possibility of switching between regimes or states within a system or process is called transition probability. The transition probability of liquidity in South African banks is shown in Table 6.

Table 6. Transition Probability.

South Africa	Regime 1	Regime 2
Regime 1	0.975100	0.024900
Regime 2	0.203921	0.796079
Durations	40.15993	4.903857

Source: Authors' Estimation using EViews 13

The results of this study indicate a high probability (0.975100) that South African banks would remain in regime one if they were in that regime during the previous period, suggesting strong market stability. In contrast, the probability of transitioning from regime two to regime one is significantly lower at 0.203921, implying that once market conditions become volatile, they are likely to stay that way. Additionally, the expected duration of each regime provides insights into the persistence of market conditions and their effects on bank liquidity in South Africa. The study reveals that South African banks maintain stability in specific regimes, highlighting the importance of understanding market dynamics for informed decision-making and enhancing sector resilience.

CONCLUSION

The purpose of this study is to provide critical insights into liquidity dynamics of South African banks in varying market conditions by examining factors that affect macroeconomic conditions and bank-specific factors from 2000Q1 to 2021Q4. The results of the ADF and PP unit root tests confirm that the variables are integrated at I(1), indicating a long-term equilibrium relationship suitable for further analysis. Utilizing the MSM-VAR model, the study captures the complex interactions between the variables under two distinct regimes: low liquidity volatility (regime one) and high liquidity volatility (regime two). Based on the findings, these regimes influence bank liquidity differently. GDP growth consistently improves liquidity in both regimes, while exchange rate risk, credit risk, and return on equity exert negative effects. There is a negative impact of inflation on liquidity in regime one, and a positive impact on liquidity in regime two. Similarly, bank size enhances liquidity during low volatility periods but reduces it during high volatility periods.

Policymakers should focus on achieving economic stability by implementing policies that promote GDP growth and reduce inflation. Stabilizing exchange rates can minimize liquidity risks. There is a need to strengthen bank capital buffer regulations. Enhancing transparency and accountability can mitigate credit and exchange rate risks. Encouraging economic diversification can safeguard the banking sector against macroeconomic shocks.

To reduce risks associated with high liquidity volatility, investors should diversify their portfolios and prioritize banks with strong internal controls and resilience to macroeconomic shocks. It's important to monitor macroeconomic indicators such as GDP growth, inflation, and exchange rate trends. In addition, regime-switching models can help evaluate the performance and stability of banks under varying economic circumstances.

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