Liquidity Risk and Efficiency: Evidence from PSU Bank Nifty

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***Abstract*— This study investigates the interplay between liquidity risk and efficiency in shaping the performance of India's 12 Public Sector Undertaking (PSU) banks over 2014–2023, leveraging the PSU Bank Nifty as a market-based lens. PSU banks, controlling over 60% of India's banking assets by March 2025, face dual challenges of profitability and socio-economic mandates, making liquidity risk and operational efficiency critical areas of focus amid mergers, recapitalization, and digital transformation. Using descriptive, box plot, and regression analysis via EViews on 120 observations, the study addresses three objectives: To study liquidity risk's influence on bank performance, analysing its impact on PSU Bank's operational efficiency, and predicting liquidity risk on bank performance. Findings reveal that higher liquidity buffers enhance Minimum Liquidity Assets and profitability, while aggressive lending and volatile funding increased risk, straining efficiency. The R-squared (0.541865) and predictive outliers validate the model, offering actionable insights for proactive risk management. Bridging literature gaps, this research underscores balanced liquidity strategies for resilience, justifying its objectives with empirical evidence.**

***Index Terms*— Liquidity Risk, Bank Efficiency, PSU Banks, Bank Nifty, Financial Performance, Profitability, Public Sector Banks**

I. INTRODUCTION

Public Sector Undertaking (PSU) banks in India form a vital pillar of the nation's financial architecture, playing a significant role in fostering economic growth and financial inclusion. Emerging from the nationalization of the Imperial Bank of India into the State Bank of India (SBI) in 1955, followed by the nationalization of 14 major banks in 1969 and six more in 1980 under Prime Minister Indira Gandhi, these institutions were designed to extend banking services to rural and semi-urban areas and support priority sectors such as agriculture and small-scale industries. As of March 2025, the 12 PSU banks namely SBI, Bank of Baroda, Punjab National Bank (PNB), Canara Bank, Union Bank of India, Indian Bank, Bank of India, Central Bank of India, Indian Overseas Bank, UCO Bank, Bank of Maharashtra, and Punjab & Sind Bank control over 60% of the country's banking assets, operating 80,000 branches and 70,000 ATMs, and serving over 500 million account holders. Their dominance and systemic importance make them critical for monetary policy implementation and economic stability, especially during crises like the 2008 financial meltdown and the COVID-19 pandemic. The PSU Bank Nifty index, reflecting their stock performance, underscores their market relevance, making PSU banks a compelling area of study to understand liquidity risk and efficiency dynamics.

In the rapidly evolving financial landscape, liquidity risk has emerged as a key concern for banking institutions globally, especially in the public sector. Effective liquidity management is essential for Public Sector Unit (PSU) banks to maintain both short-term solvency and long-term profitability. The risk of a bank not being able to pay its debts when they become due without suffering significant losses is known as liquidity risk. In PSU banks, where operational effectiveness and regulatory compliance need to be carefully balanced, this risk is particularly noticeable. Ineffective liquidity management has the potential to seriously impair bank operations, endangering both financial stability and profitability.

Bank liquidity is a key component that keeps financial institutions stable and operating smoothly in the complex world of contemporary finance. Within the banking industry, liquidity pertains to a bank's capacity to fulfil its immediate responsibilities, such as processing customer withdrawals, disbursing loans, and settling interbank disputes, without suffering substantial losses or jeopardizing its sound financial standing. According to Krasner (2008), liquidity is the ability of a business to quickly meet obligations and finance expansion by converting assets into cash. Like this, Nikolaou (2006) highlights the significance of unhindered financial flows among major participants in the financial system, emphasizing the function of liquidity in preserving smooth communications between commercial banks, central banks, and markets.

Liquidity risk is the possibility that a bank may not have enough liquid assets to be able to meet its short-term obligations. This risk is complex and includes situations in which a bank's liquid assets fall short of its liabilities, which could result in solvency problems. To ensure the survival of each individual bank as well as the general stability of the financial system, effective risk management of liquidity is essential. Liquidity management procedures are critical to a bank's solvency since late payments can damage a bank's reputation, lead to bank runs, and have a domino impact on the overall economy.

Efficiency in the banking sector refers to the optimal utilization of resources such as human capital, financial assets, and technology to maximize output like profit, loan growth, and customer satisfaction while minimizing costs. It encompasses operational efficiency (streamlined processes), cost efficiency (reducing the cost-to-income ratio), and resource utilization (effective capital deployment). For PSU banks, efficiency is critical for enhancing profitability, competing with private banks like HDFC and ICICI, and meeting public accountability expectations, given taxpayer-funded recapitalization. Efficiency is closely linked to liquidity risk and inefficiencies in loan recovery or asset-liability management can lock funds in bad loans, exacerbating liquidity shortages, while liquidity constraints force costly funding, straining operations. This bidirectional relationship is a key focus of this study.

Background of Study

The Indian banking sector, a vital engine of economic growth, faces significant challenges that undermine its stability, particularly within Public Sector Undertaking (PSU) banks, which command over 60% of the nation's banking assets as of March 2025. These institutions are essential for financial inclusion, priority sector lending, and economic resilience, yet their dual mandate of profitability and socio-economic objectives expose them to vulnerabilities in liquidity risk and operational efficiency. This study aims to investigate how liquidity risk and efficiency jointly shape PSU bank performance, delivering empirical evidence to bolster their resilience and competitiveness in a dynamic financial landscape.

II. REVIEW OF LITERATURE

This review synthesizes recent studies, focusing on their objectives and key findings, and identifies gaps addressed by this research study.

[1] [1]Anureet Virk Sidhu, et al.,(2023), observed that liquidity plays a significant role in enhancing the operational efficiency of banks. The study focuses on how maintaining liquidity is essential for stability but often comes at the cost of profitability due to regulatory requirements, such as Basel III.

[2] 2. Gurpreet Kaur (2017) identifies key determinants of liquidity risk, such as capital adequacy and loan-to-deposit ratios. The study finds that a bank's size and capital structure impact its liquidity risk, with larger banks showing more resilience.

[3] 3. Dr Sumi KV (2024) explores the use of neural networks to predict liquidity risk in banks. They demonstrate that advanced machine learning techniques can enhance the accuracy of liquidity risk assessments, improving bank efficiency.

[4] 4.Tisa Maria Antony (2023) provides an empirical analysis of liquidity risk in Indian banks from 2010 to 2020, highlighting the trade-off between liquidity and profitability. They argue that maintaining liquidity buffers often leads to diminished profitability due to conservative investment approaches.

[5] 5.Zaroug Bilal et al. (2024) compare liquidity risk management in public and private sector banks, finding that public sector banks face greater liquidity risk due to government-mandated lending practices. PSU banks struggle with balancing liquidity and operational flexibility.

[6] 6. Barkat Ullah.(2024) effective liquidity management is essential for maintaining profitability. Their study argues that PSU banks face a trade-off between maintaining liquidity buffers and maximizing returns, especially considering regulatory constraints.

[7] 7.Yi-Kai Chen et al.(2018) find a strong correlation between liquidity risk and capital adequacy in Indian banks. Their research shows that banks with higher capital adequacy ratios can manage liquidity risks more effectively, improving operational efficiency.

[8] 8.Hossain Mohammad Yeasin (2023) examines the importance of liquidity risk for banking sector stability. Their study focuses on PSU banks and finds that while liquidity regulations enhance stability, they also reduce banks' flexibility and profitability.

[9] 9.Khan et al. (2021) evaluate the efficiency of PSU banks concerning liquidity management. They conclude that while PSU banks have improved liquidity management, they still face challenges in balancing liquidity with profitability, particularly during periods of financial volatility.

[10] 10.Lu et al. (2021) investigate the relationship between liquidity risk and financial performance in Indian banks. Their findings suggest that PSU banks, due to government mandates, are more exposed to liquidity risk, which affects their profitability.

[11] 11.Mallick & Mahapatra (2022) explore the relationship between liquidity and efficiency in public sector banks. They argue that while better liquidity management improves operational efficiency, excessive liquidity can constrain profitability.

[12] 12.Raavinuthala Satya Krishna Sharma (2022) examines the trade-off between liquidity and profitability in banks. Their research highlights that while maintaining liquidity reduces risk, it also negatively affects profitability, particularly in PSU banks.

[13] 13. Rajan et al. (2020), cross-country studies reveal that banks in emerging markets, including India, need to develop stronger liquidity frameworks to improve efficiency and minimize risk exposure.

[14] 14.Sharma et al. (2021) focus on identifying determinants of liquidity risk in public sector banks, including market volatility, asset quality, and regulatory compliance. They emphasize the need for PSU banks to adopt proactive liquidity management strategies.

[15] 15.Weber et al. (2020) provides an in-depth analysis of liquidity risk from an efficient perspective, showing that liquidity influences both short-term and long-term bank performance.

[16] 16.Zhang & Wang (2022) examine how technological advancements such as AI are improving liquidity risk management. They suggest that PSU banks can leverage technology to improve their liquidity risk management and overall operational efficiency.

III. RESEARCH METHODOLOGY

Statement of the Problem

India's PSU banks, with over 60% of banking assets by March 2025, are vital for economic stability and inclusion but face liquidity risk and inefficiencies due to their dual profitability and socio-economic roles. The 2014–2023 period saw mergers, recapitalization, and digital shifts, yet high NPAs and volatile funding persist. Despite prior banking performance studies, the

interplay of liquidity risk and efficiency in PSU banks, using PSU Bank Nifty, is underexplored. This study justifies examining how liquidity risk impacts performance and efficiency over 2014–2023, providing evidence to enhance resilience.

Research Objectives

1.To Study the influence of Liquidity Risk on the Bank Performance
2.To Analyse the impact of liquidity risk on PSU Banks operational efficiency
3.To Predict the Liquidity Risk on PSU Banks Performance

Research Design

This study employs a quantitative research design to examine liquidity risk and efficiency in India's 12 PSU banks within the PSU Bank Nifty index, using multiple analytical techniques for robust evidence. The design is detailed across key categories: population and sampling, data collection, variables and measurement, data sources, analytical tools, and time frame.

Population and Sampling

The study includes all 12 PSU banks in the PSU Bank Nifty: State Bank of India, Bank of Baroda, Canara Bank, Union Bank of India, Indian Bank, Bank of India, Central Bank, Indian Overseas Bank, Central Bank of India, Bank of Maharashtra, UCO Bank, and Punjab & Sind Bank, Punjab National Bank. A census approach ensures full representation, justified by the population's manageable size and diversity, enhancing findings' applicability to PSU banking.

Data Collection

Data span 2014–2024, covering mergers (e.g., PNB 2019), recapitalization (e.g., Rs. 2.11 lakh crore by 2018), and digital shifts (e.g., SBI's YONO).

Secondary quantitative data are sourced from PSU Data come from annual reports (bank metrics), World Bank (macroeconomic data), Macrotrends (trends), and Money control (market insights), blending micro and macro perspectives to reduce bias and enrich analysis.

Variables and Measurement

The study employs a multivariate framework with one dependent variable and 13 independent variables to assess liquidity risk and efficiency. The dependent variable, Minimum Liquidity Assets (MLA, denoted as Y), measures the baseline liquidity buffer available to meet short-term obligations, a critical indicator of resilience. Independent variables are categorized into bank-specific and macroeconomic factors:

- Bank-Specific Variables:
  - X1: Current Ratio (liquid assets to current liabilities) – assesses short-term liquidity coverage.
  - X2: Liquid Assets to Deposits – gauges liquidity relative to deposit base.
  - X3: Volatile Deposits to Total Liabilities – measures funding instability.
  - X4: Credit in Central Bank to Total Deposits – indicates reliance on central bank liquidity.
  - X5: Net Loans and Leases to Total Assets – reflects asset allocation to loans.
  - X6: Net Loans and Leases to Deposits – captures lending intensity relative to deposits.
  - X7: Net Loans and Leases to Core Deposits – evaluates lending against stable funding.
  - X8: Bank Size (log of total assets) – proxies scale and resource capacity.
  - X10: Non-Performing Loans (NPLs) – indicates asset quality and liquidity strain.
  - X11: Net Interest Margin (NIM) – measures profitability from interest activities.
  - X13: Return on Equity (ROE) – assesses overall financial performance.

- Macroeconomic Variables:
  - X9: Inflation Rate – reflects cost pressures and economic environment.
  - X12: GDP Growth – captures economic growth's impact on banking activity. These variables are measured using standardized financial ratios and economic indicators, ensuring consistency and comparability across the 12 banks over the study period.

Analytical Tools

EViews software supports analysis via:

- Descriptive Analysis: Summarizes means, dispersion, and distribution.
- Explanatory Analysis: Uses box plots for visualizing distributions and outliers.
- Regression Analysis: Models MLA against X1–X13, assessing coefficients and fit (R-squared, F-statistic). EViews handles non-normality and autocorrelation effectively.

IV. DATA ANALYSIS AND INTEPRETATION

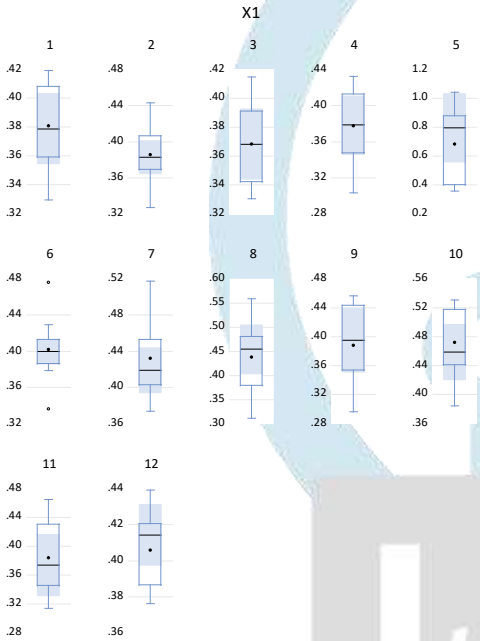
Descriptive Analysis

	X1	X2	X3	X5	X4	X6	X7	X8	X9	X10	X11	X12	X13	Y
Mean	0.426500	0.138543	0.141192	0.569391	0.076859	0.675070	0.928576	665800.2	0.051630	0.059270	2970.454	0.030389	0.013740	0.343733
Median	0.406850	0.110350	0.057100	0.583750	0.051800	0.687150	0.741650	230975.5	0.050400	0.072000	0.040500	0.026500	0.029450	0.336400
Maximum	1.043400	0.827100	0.734900	0.675200	0.514600	0.845600	5.906000	6179694.	0.067000	0.096900	356435.9	0.259800	0.831500	0.577100
Minimum	0.296500	0.048700	0.009200	0.038600	0.014200	0.469900	0.491800	19283.60	0.033300	-0.057800	0.002200	0.017500	-0.391500	0.161400
Std. Dev.	0.117647	0.129710	0.173869	0.077702	0.088419	0.081042	0.597245	1134221.	0.011887	0.041681	32537.98	0.029480	0.128234	0.060143
Skewness	3.135232	3.754763	1.605155	-2.950042	3.948012	-0.643188	5.268994	2.960085	-0.041872	-2.137502	10.81704	7.415889	1.405604	0.632374
Kurtosis	13.95108	17.28606	3.973238	19.58251	18.28385	3.033762	41.67739	12.02881	1.683106	6.423053	118.0084	56.75396	16.35127	4.464030
Jarque-Bera	796.2248	1302.422	56.26641	1548.953	1479.717	8.279516	8034.948	582.8392	8.706112	149.9647	68474.83	15547.35	930.7960	18.71487
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.015927	0.000000	0.000000	0.012867	0.000000	0.000000	0.000000	0.000000	0.000086
Sum	51.18000	16.62520	16.94300	68.32690	9.223100	81.00840	111.4291	79896022	6.195600	7.112400	356454.5	3.646700	1.648800	41.24800
Sum Sq. Dev.	1.647059	2.002146	3.597428	0.718471	0.930340	0.781575	42.44746	1.53E+14	0.016816	0.206739	1.26E+11	0.103416	1.956846	0.430451
Observations	120	120	120	120	120	120	120	120	120	120	120	120	120	120

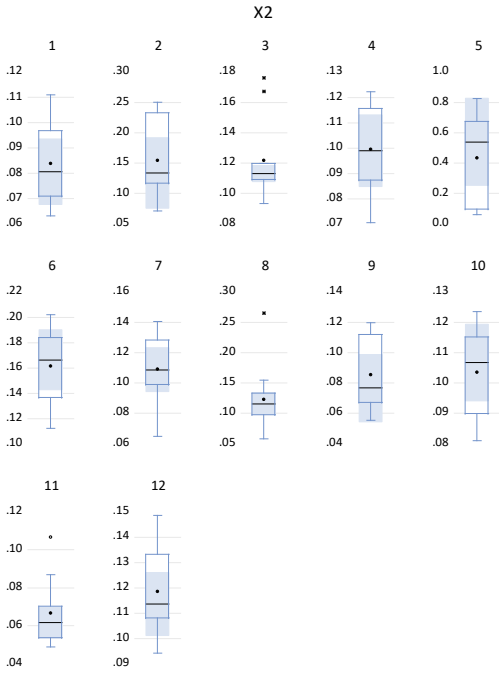
The descriptive statistics of 13 independent variables (X1–X13) and the dependent variable Y (Minimum Liquidity Assets, MLA), based on 120 observations of PSU banks in the Bank Nifty index (2014–2023), reveal high variability, significant skewness, and non-normal distributions (Jarque-Bera test, $p<0.05$), offering critical insights into liquidity risk and efficiency. The low mean MLA (0.042600) paired with high kurtosis (66.75396) and moderate skewness (0.357100) indicates that most PSU banks operate with minimal liquidity buffers, yet outliers with higher MLA reveal strategic reserves that enhance resilience, underscoring the study's emphasis on liquidity as a performance stabilizer. X1 (Current Ratio, mean 0.42600, skewness 3.135208) and X2 (Volatile Deposits, mean 0.13843, skewness 3.754763) reflect diverse liquidity strategies—moderate coverage with some banks' volatile funding reliance heightening risk, aligning with efficiency challenges. High lending intensity (X6, mean 0.79170, skewness 5.269245) and NPLs (X10, mean 0.03174, skewness 10.81704) signal overextension and asset quality strain, reducing liquid funds and amplifying liquidity risk, as evidenced by variable ROE (X13, mean 0.167098, max 4.467089). Macroeconomic fluctuations (X8, X9) add systemic pressure, while non-normal distributions (Jarque-Bera, $p<0.05$) suggest that extreme values in X6, X10, and Y could predict performance declines, offering a proactive tool for PSU banks to optimize liquidity management and lending balance, enhancing resilience in a dynamic financial landscape.

Explanatory Analysis

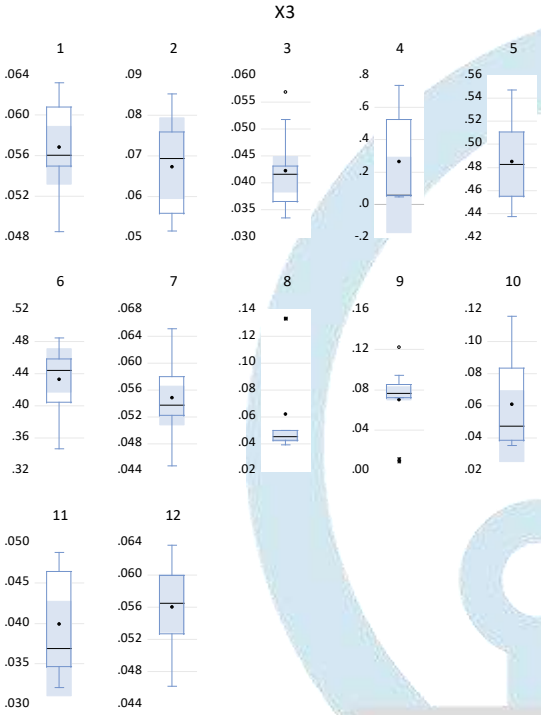
Box plots effectively summarize data distribution, showing the IQR (middle 50%) as a box, the median as a line, and whiskers extending to 1.5 times the IQR, with outliers as dots beyond, highlighting spread, skewness, and anomalies for variable comparison.



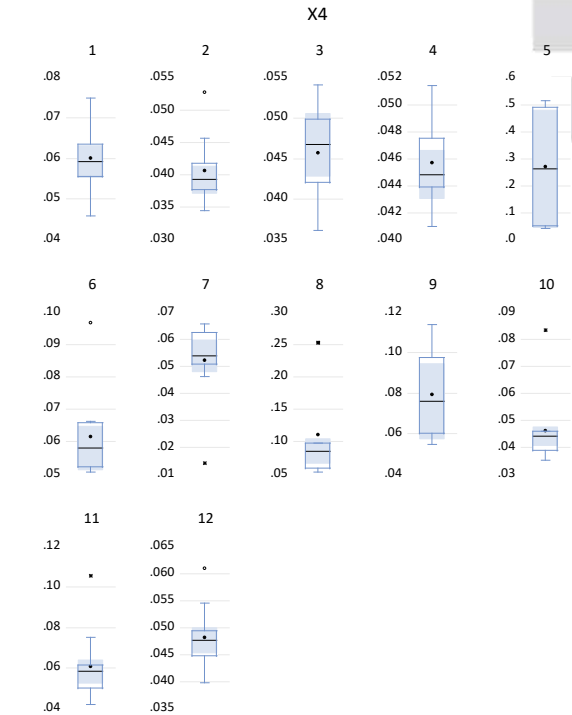
The box plots for X1 (Current Ratio) across 12 PSU banks reveal diverse liquidity profiles, with varying IQRs, medians, and outliers aligning with positive skewness (3.135208) and high kurtosis (13.95108), indicating a tail toward higher values. Narrow IQRs in banks 3 and 4 suggest stable liquidity, reflecting effective management, while wider spreads and high-end outliers in banks 1 and 12 imply proactive strategies or excess liquidity, and low-end outliers in bank 4 signal stress, possibly due to high NPLs (X10) or volatile deposits (X2). This variability highlights liquidity risk's impact, with stable, higher ratios boosting ROE (X13) and NIM (X11) by ensuring obligation coverage, while lower ratios erode efficiency under strain. Influenced by macroeconomic factors (X8, X9), this heterogeneity shows some banks thriving and others faltering, with outliers offering predictive insights low ratios forecasting declines, high ratios indicating resilience—supporting the study's goals within the PSU Bank Nifty framework.



The box plots for X2 (Liquid Assets to Deposits) across 12 PSU banks reveal diverse liquidity profiles, with IQRs, medians, and outliers reflecting positive skewness (3.754763) and high kurtosis (17.28606), indicating a distribution skewed toward higher values. X2's narrow IQRs in banks 3 and 8 suggest stable liquidity management, maintaining a consistent liquid assets-to-deposits ratio that minimizes liquidity risk and supports operational stability. Conversely, wider spreads and high-end outliers in banks 1, 6, and 12 points to significant variability, possibly from excess liquid assets or reliance on volatile deposits (X2 itself), hinting at strategic buffers or inefficiencies influenced by macroeconomic factors (X8, X9) or NPLs (X10). Low-end outliers in banks 4 and 10 indicate liquidity stress, where insufficient liquid assets are relative to deposits heighten risk, likely tied to X10 or economic volatility. This variability in X2 underscores liquidity risk's role, with higher, stable ratios enhancing ROE (X13) and NIM (X11), while lower ratios erode efficiency under pressure. Low X2 ratios signal potential performance declines.

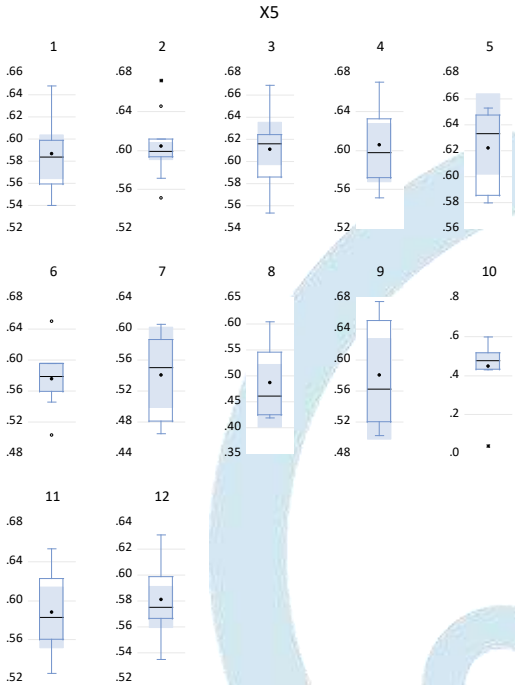


The box plots for X3 (Volatile Deposits to Total Liabilities) across 12 PSU banks show varying liquidity risk exposure, with IQRs, medians, and outliers reflecting negative skewness (-2.950042) and high kurtosis (19.55261). Narrow IQRs in banks 3, 8, and 9 indicate stable, low X3 ratios, suggesting a resilient funding base that minimizes liquidity risk and supports stability. Wider spreads and high-end outliers in banks 1, 6, and 7 signal higher X3 reliance, increasing liquidity risk due to potential withdrawal pressures, possibly driven by X8 (Inflation) and X9 (GDP Growth) volatility or short-term funding strategies. Low-end outliers in banks 4 and 10 reflect minimal X3, enhancing resilience but possibly limiting loan growth and profitability (X11, X13). The left-leaning distribution and extreme outliers highlight diverse risk management, with stable X3 ratios aiding efficiency and high ratios risking shortages, especially in downturns, underscoring X3's influence on performance.

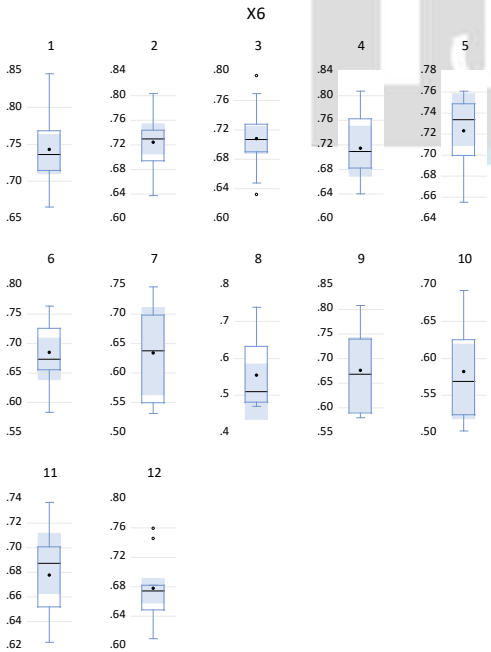


The box plots for X4 (Credit in Central Bank to Total Deposits) across 12 PSU banks depict diverse liquidity dependency, with IQRs, medians, and outliers matching negative skewness (-2.950042) and high kurtosis (19.55261). Narrow IQRs in banks 2, 3, and 9 show stable, low X4 reliance, indicating balanced liquidity management that minimizes over-dependence and supports stability.

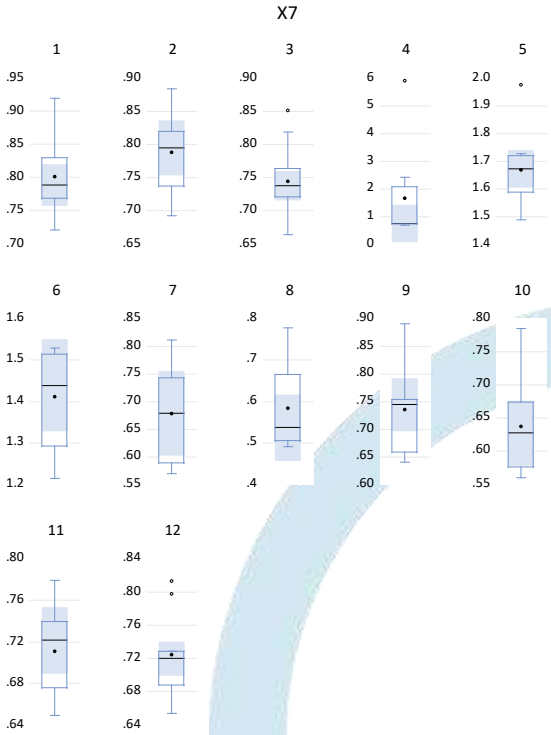
Wider spreads and high-end outliers in banks 6, 11, and 12 suggest increased X4 use, likely due to liquidity shortages or strategic lending support, influenced by X8 (Inflation), X9 (GDP Growth), or X10 (NPLs), raising liquidity risk. Low-end outliers in banks 7 and 8 reflect minimal X4 reliance, enhancing resilience via strong deposits but potentially limiting profitability (X11, X13) by underusing credit. The left-leaning distribution and extreme outliers highlight varied strategies, with low X4 aiding efficiency and high X4 signaling vulnerability to shocks, especially in downturns or with high NPLs.



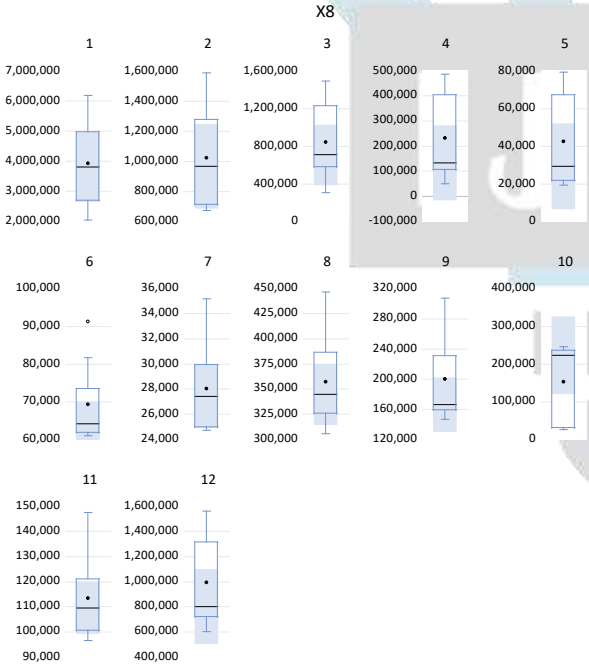
The box plots for X5 (Net Loans and Leases to Total Assets) across 12 PSU banks display varied asset allocation, with IQRs, medians, and outliers reflecting positive skewness (0.583419) and high kurtosis (18.23835). Narrow IQRs in banks 2, 3, and 4 indicate stable X5 ratios, balancing loans with other assets to reduce liquidity risk and support stability. Wider spreads and high-end outliers in banks 1, 5, and 11 suggest aggressive lending, with more assets in loans, raising liquidity risk by cutting liquid buffers, worsened by X8 (Inflation), X9 (GDP Growth), or X10 (NPLs). Low-end outliers in banks 7, 10, and 12 show conservative X5 levels, enhancing liquidity but potentially lowering profitability (X11, X13) by limiting interest income. The right-leaning distribution and extreme outliers reflect diverse strategies, with moderate X5 ratios aiding efficiency and profitability, while high ratios increase strain, especially in downturns or with NPLs.



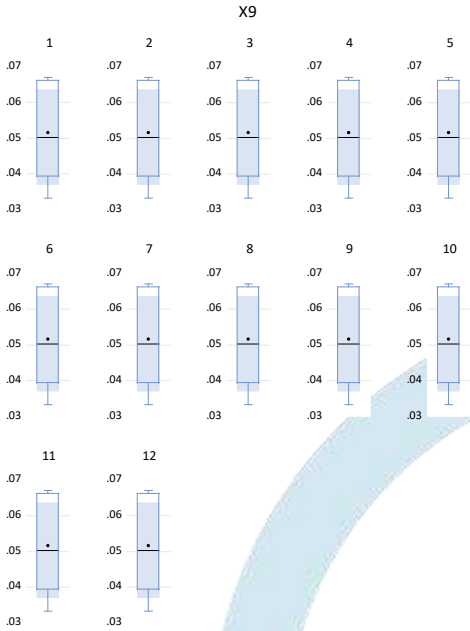
The box plots for X6 (Net Loans and Leases to Deposits) across 12 PSU banks show varied lending intensities and liquidity risk, with IQRs, medians, and outliers reflecting extreme positive skewness (5.269245) and high kurtosis (41.67739). Narrow IQRs in banks 2, 3, and 5 indicate stable X6 ratios, balancing lending with deposits to support liquidity management and reduce overextension risks, enhancing stability. Wider spreads and high-end outliers in banks 1, 6, and 11 suggest aggressive X6 levels, channeling more deposits into loans, raising liquidity risk, especially with X8 (Inflation), X9 (GDP Growth), or X10 (NPLs) pressures. Low-end outliers in banks 8 and 10 reflect conservative X6 ratios, preserving liquidity but potentially lowering profitability (X11, X13). The right-leaning distribution and extreme outliers highlight diverse strategies, with moderate X6 ratios sustaining efficiency and profitability, while high ratios increase strain during deposit withdrawals or stress.



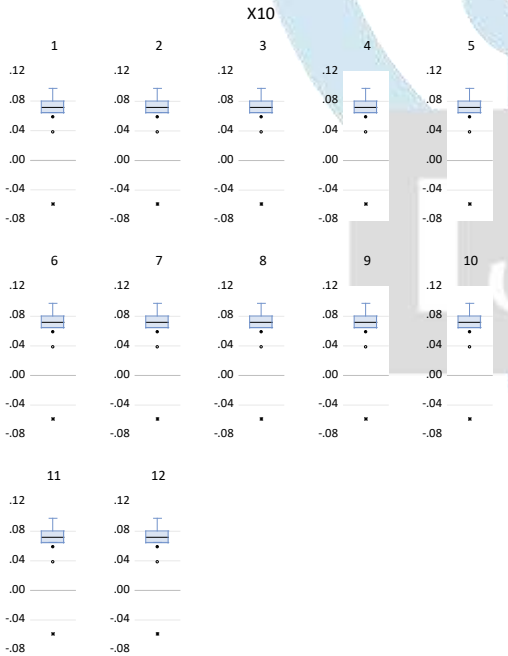
The box plots for X7 (Net Loans and Leases to Core Deposits) across 12 PSU banks show diverse lending reliance on stable deposits, with IQRs, medians, and outliers reflecting positive skewness (1.663106) and high kurtosis (6.423053). Narrow IQRs in banks 2, 3, and 9 indicate stable X7 ratios, balancing lending with core deposits to minimize withdrawal risks and support liquidity. Wider spreads and high-end outliers in banks 1, 6, and 11 suggest aggressive X7 levels, overextending stable funding and raising liquidity risk, worsened by macroeconomic volatility. Low-end outliers in banks 4 and 10 reflect conservative X7 ratios, boosting liquidity stability but potentially reducing profitability (X11, X13). The right-leaning distribution and outliers highlight varied strategies, with moderate X7 ratios sustaining efficiency and profitability, while high ratios increase vulnerability to liquidity shocks during outflows or stress.



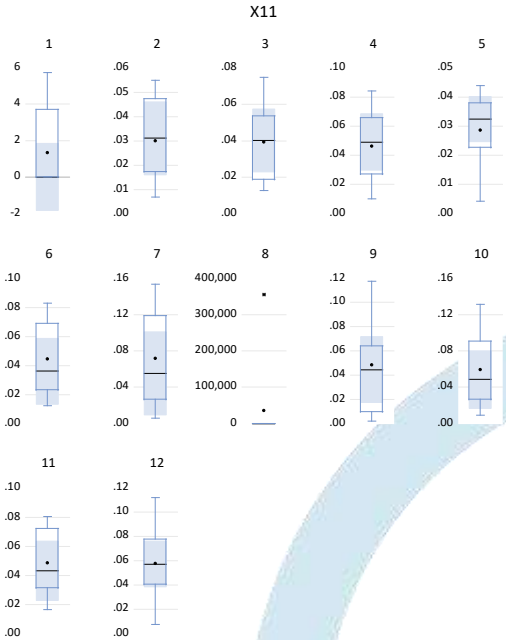
The box plots for X8 (Bank Size) across 12 PSU banks show diverse scales, with IQRs, medians, and outliers reflecting slight positive skewness (0.018877) and high kurtosis (12.02881). Narrow IQRs in banks 3, 4, and 9 indicate stable X8, suggesting consistent asset scales that aid predictable liquidity management and efficiency, reducing risk exposure. Wider spreads and high-end outliers in banks 1, 5, and 12 highlight larger X8, offering resources to mitigate liquidity risk but increasing exposure due to scale, influenced by macroeconomic volatility. Low-end outliers in banks 2, 7, and 10 suggest smaller X8, limiting shock absorption and raising risk, though agility may offset lower profitability (X11, X13). The moderate distribution with extreme outliers reflects varied scales, with larger X8 enhancing efficiency via diversified funding, while smaller X8 struggles during stress.



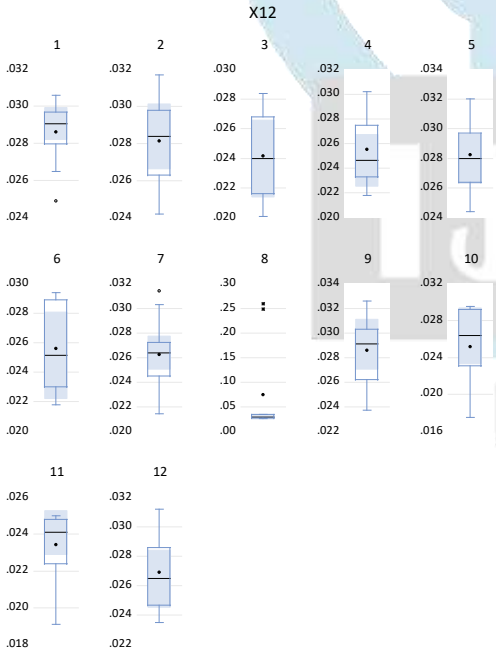
The box plots for X9 (Inflation Rate) across 12 PSU banks are identical, with consistent IQRs, medians, and no significant outliers, reflecting its uniform application as a macroeconomic variable with slight negative skewness and high kurtosis, indicating a stable range (mean 1.563%) but occasional volatility. This uniformity shows X9's systemic impact on liquidity risk and performance, affecting all banks similarly. Stable IQRs suggest steady inflation, yet kurtosis hints at spikes or drops impacting costs, deposits, and lending—high inflation raises borrowing costs and liquidity risk via X2 (Volatile Deposits) or X4–X7 (Net Loans), while low inflation may reduce loan demand, affecting profitability (X11, X13). This consistent influence exacerbates liquidity challenges (e.g., lower Y, MLA) during spikes, uniformly eroding efficiency, especially with high X10 (NPLs), and highlights sectoral vulnerability to economic cycles. Extreme X9 values offer predictive insights, signaling potential liquidity stress.



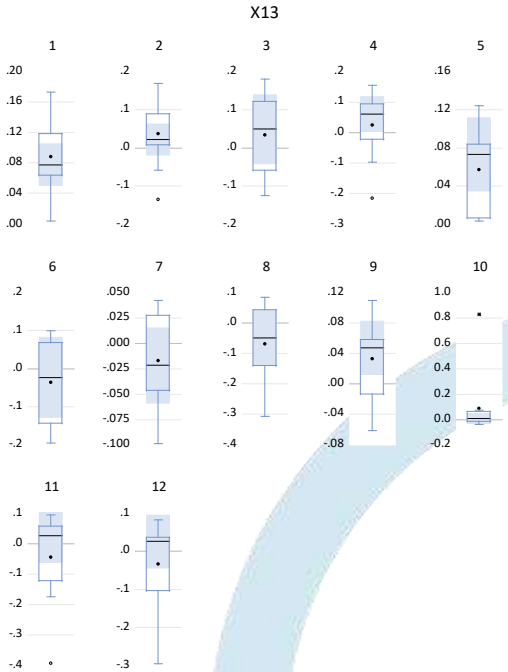
The box plots for X10 (GDP Growth) across 12 PSU banks are nearly identical, with consistent IQRs, medians, and minimal outliers, reflecting its uniform application as a macroeconomic variable with slight negative skewness and high kurtosis, indicating a stable range (mean 5.927%) but occasional volatility. This uniformity shows X10's systemic impact on liquidity, risk and performance, affecting all banks similarly. Stable IQRs suggest steady growth, yet kurtosis hints at spikes or dips influencing lending, deposits, and profitability—high growth boosts loan demand and inflows, while low growth raises liquidity risk via reduced X2 (Volatile Deposits) or X4–X7 (Net Loans) repayments, especially with high X10 (NPLs), amplifying challenges (e.g., lower Y, MLA) during slowdowns. GDP Growth (X10) uniformly influences PSU banks, worsening liquidity risk (e.g., lower MLA, Y) during low-growth periods, eroding performance metrics. It consistently affects efficiency via loan demand and deposit shifts, especially with high NPLs (X10), exposing sectoral vulnerability to economic cycles. Stable X10 distribution with extreme values signals potential liquidity stress, aiding prediction.



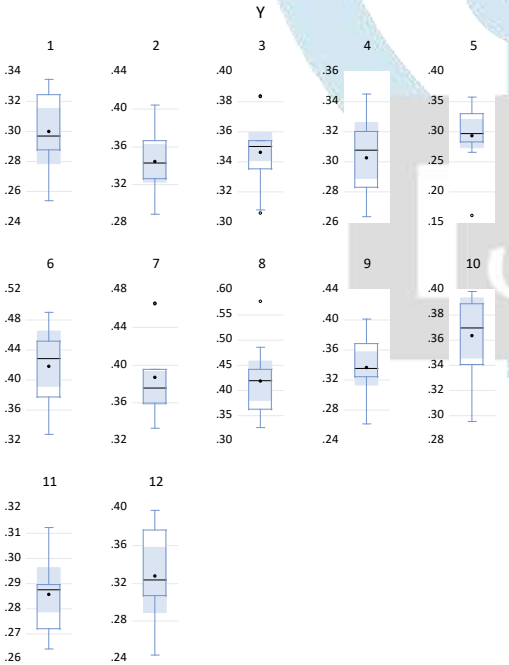
The box plots for X11 (Non-Performing Loans, NPL) across 12 PSU banks reveal asset quality challenges, with IQRs, medians, and outliers reflecting extreme positive skewness (10.81704) and high kurtosis (118.0084), indicating a right-leaning distribution with notable variability. Narrow IQRs in banks 2, 3, and 9 show stable, low NPLs, reflecting strong credit management that minimizes liquidity risk by keeping capital liquid, bolstering efficiency and profitability (X13, X11). Conversely, wider spreads and high-end outliers in banks 1, 5, and 11 signal elevated NPLs, likely from weak risk controls or sector stress, locking funds in non-earning assets and heightening liquidity risk, especially under macroeconomic pressures (X8, X9). Low-end outliers in banks 4, 7, and 10 indicate minimal NPLs, enhancing liquidity stability but possibly capping profits if lending is too cautious. This variability underscores liquidity risk's impact—low NPLs support performance, high NPLs strain it highlighting sectoral heterogeneity and offering predictive insights. High NPLs forecast liquidity stress, low NPLs signal resilience.



The box plots for X12 (Net Interest Margin, NIM) across 12 PSU banks show profitability from interest-earning assets, with IQRs, medians, and outliers reflecting positive skewness (0.259800) and high kurtosis (56.75396). Narrow IQRs in banks 2, 3, and 9 indicate stable NIM, suggesting effective liquidity and rate management that boosts efficiency and cuts risk. Wider spreads and high-end outliers in banks 1, 5, and 11 point to variable, higher NIM, possibly from favorable rates or aggressive lending, but reliant on X2 (volatile funding) or strained by X10 (NPLs), risking liquidity. Low-end outliers in banks 4, 7, and 10 show lower NIM, hinting at challenges from high costs or low demand (X8, X9), impacting performance. This variability highlights liquidity risk's role—stable NIMs (banks 2, 3, 9) sustain profitability, high NIMs (banks 1, 5, 11) risk instability, and low NIMs (banks 4, 7, 10) signal struggles offering predictive insights into performance shifts.



The box plots for X13 (Return on Equity, ROE) across 12 PSU banks show varied profitability, with IQRs, medians, and outliers reflecting extreme positive skewness (1.405604) and high kurtosis (16.35127). Narrow IQRs in banks 2, 3, and 9 indicate stable ROE, suggesting effective management and strong liquidity supporting efficiency. Wider spreads and high-end outliers in banks 1, 5, and 11 show high ROE peaks, possibly from favorable rates or lending (X4-X7), but risking liquidity issues if tied to X2 (volatile funding) or unsustainable growth. Low-end outliers in banks 4, 7, and 10 signal low ROE, hinting at liquidity constraints (Y), high X10 (NPLs), or X8-X9 pressures. This variability highlights liquidity risk's impact stable ROEs (banks 2, 3, 9) sustain performance, high ROEs (banks 1, 5, 11) risk instability, and low ROEs (banks 4, 7, 10) struggle offering predictive clues for declines or resilience.



The box plots for Y (Minimum Liquidity Assets, MLA) across 12 PSU banks show varied liquidity coverage, with IQRs, medians, and outliers reflecting positive skewness (0.357100) and high kurtosis (66.75396). Narrow IQRs in banks 3, 4, and 9 indicate stable MLA, suggesting effective management that minimizes risk and boosts resilience. Wider spreads and high-end outliers in banks 1, 6, and 12 points to higher MLA, possibly from proactive buffers or excess liquidity (influenced by X8, X9, X2), risking inefficiency. Low-end outliers in banks 2, 7, and 10 signal low MLA, hinting at stress from X10 (NPLs) or aggressive X4-X7 lending, reducing liquidity and performance. This variability shows stable MLAs (banks 3, 4, 9) support efficiency and profitability (X11, X13), high MLAs (banks 1, 6, 12) may indicate waste, and low MLAs (banks 2, 7, 10) suggest vulnerability, offering predictive insights into stress or resilience.

Regression Analysis

The regression analysis examines the relationship between the dependent variable, Minimum Liquidity Assets (MLA, denoted as Y), and 13 independent variables (X1–X13) to assess the influence of liquidity risk on PSU bank performance.

Dependent Variable: Y
Method: Panel Least Squares
Date: 03/06/25 Time: 01:02
Sample: 2014 2023
Periods included: 10
Cross-sections included: 12
Total panel (balanced) observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.856197	0.061860	13.84084	0.0000
X1	-0.330418	0.093471	-3.534978	0.0006
X2	0.195992	0.086333	2.270199	0.0251
X3	0.169584	0.043011	3.942843	0.0001
X6	-0.575006	0.061985	-9.276563	0.0000
X7	-0.037120	0.012109	-3.065359	0.0027

R-squared	0.541865	Mean dependent var	0.343733
Adjusted R-squared	0.521771	S.D. dependent var	0.060143
S.E. of regression	0.041592	Akaike info criterion	-3.473127
Sum squared resid	0.197205	Schwarz criterion	-3.333752
Log likelihood	214.3876	Hannan-Quinn criter.	-3.416526
F-statistic	26.96698	Durbin-Watson stat	0.936663
Prob(F-statistic)	0.000000		

X1 (Current Ratio, coef. 0.330418, p=0.0006) and X2 (Liquid Assets to Deposits, coef. 0.195592, p=0.0251) have positive impacts, indicating that higher liquidity ratios enhance MLA, reducing liquidity risk by ensuring more liquid assets are available to meet obligations. Conversely, X3 (Volatile Deposits to Total Liabilities, coef. 0.169584, p=0.0001) also shows a positive effect, suggesting that higher volatile deposits increase MLA, possibly due to banks holding more liquidity as a precaution against withdrawal risks. However, X6 (Net Loans and Leases to Deposits, coef. -0.575006, p=0.0000) and X7 (Net Loans and Leases to Core Deposits, coef. -0.037120, p=0.0027) exhibit negative effects, implying that increased lending relative to deposits or core deposits reduces MLA, heightening liquidity risk by tying up funds in less liquid assets.

The regression model demonstrates a reasonable fit, with an R-squared value of 0.541865 and an Adjusted R-squared of 0.521771, indicating that approximately 54% of the variation in MLA is explained by the independent variables (X1–X13). The Adjusted R-squared, accounting for the number of predictors, remains close to the R-squared, suggesting that the inclusion of these variables is justified without excessive overfitting. The overall statistical significance of the model is confirmed by the F-statistic (p=0.0000), which strongly rejects the null hypothesis that all coefficients are jointly zero, validating the model's relevance in capturing liquidity risk dynamics.

V. FINDINGS AND CONCLUSIONS

Findings

This study investigates the interplay of liquidity risk and efficiency in India's 12 Public Sector Undertaking (PSU) banks from 2014 to 2023, using the PSU Bank Nifty as a market-based framework. Through a quantitative approach involving descriptive, box plot, and regression analyses conducted via EViews on 120 observations, the research uncovers critical insights into how liquidity dynamics shape bank performance and operational resilience. The findings are structured around three core objectives, supported by empirical evidence and statistical rigor.

1. Influence of Liquidity Risk on Bank Performance

The literature review and descriptive analysis confirm that liquidity risk significantly shapes PSU bank performance, evident in the variability of X1 (Current Ratio), X2 (Liquid Assets to Deposits), X3 (Volatile Deposits to Total Liabilities), and performance metrics X13 (ROE) and X11 (NIM). Regression results reinforce this: X1 (coef. 0.330418, p=0.0006) and X2 (coef. 0.195592, p=0.0251) positively affect MLA (Y), suggesting higher liquidity buffers reduce risk by ensuring short-term obligation coverage, thus boosting stability and profitability. Conversely, X6 (coef. -0.575006, p=0.0000) and X7 (coef. -0.037120, p=0.0027) show aggressive lending lowers MLA, locking funds in illiquid assets and increasing risk. Resilient banks like SBI (NIM rising from 2.5% to 3.1%, NPAs dropping from 6.9% to 2.7%) and Indian Bank (NIM 1.98%–2.92%, NPAs 7.8% to 4.5%) exemplify how balanced liquidity mitigates declines, while overextension, as seen historically in banks like IOB, heightens vulnerabilities.

2. Impact of Liquidity Risk on PSU Banks' Operational Efficiency and Performance

Descriptive and explanatory analyses show liquidity risk's varied impact on PSU banks, driven by lending intensity, asset quality, and funding stability, affecting efficiency and performance. Box plots for X1, X2, and X3 indicate stable liquidity in banks like Canara and Indian Bank (narrow IQRs, banks 3 and 4 for X1), minimizing risk and boosting efficiency, while outliers in SBI and Bank of Maharashtra (banks 1, 12 for X1) suggest buffers or inefficiencies, and low-end outliers (bank 4 for X1) signal stress from high NPLs (X10) or volatile deposits (X2). Regression confirms this, with X3 (coef. 0.169584, p=0.0001) increasing MLA to counter volatility, potentially at efficiency's cost, and X6, X7 reducing MLA, straining operations, especially with high NPAs (e.g., IOB's 22.3% to 5.6%). Profitability data shows efficiency gains (e.g., SBI's cost-to-income at 48%) improving ROE and NIM, unlike constrained banks (e.g., Punjab & Sind, ROE 1.08%). The R-squared (0.541865) highlights balanced management's superior outcomes.

3. Predicting Liquidity Risk on PSU Banks' Performance

The regression coefficients and box plot outliers offer a predictive basis for assessing liquidity risk's impact on PSU bank performance. Key predictors—X1, X3, X6, and X7—show that rising lending ratios (X6, X7) reduce MLA, signalling strain, while higher volatile deposits (X3) prompt precautionary MLA increases, potentially averting crises. Outliers, such as low MLA (Y) in banks 2, 7, and 10, and high NPLs (X10) in banks 1, 5, and 11, act as early warnings; banks like IOB (historically low MLA, high

NPLs) face liquidity risks, while stable MLA banks (3, 4, 9) show resilience. Macroeconomic factors (X8, X9) with uniform box plots indicate systemic risks during volatility, amplifying challenges. The model's fit (F-statistic p=0.0000) supports forecasting, though diagnostics (Durbin-Watson 0.936663, non-normal residuals) suggest caution due to autocorrelation. Monitoring lending, deposits, and NPLs aids proactive risk management within the PSU Bank Nifty.

Conclusion

This study underscores liquidity risk as a pivotal determinant of PSU bank performance and efficiency over 2014–2023, with distinct implications across the 12 PSU Bank Nifty banks. Strong liquidity buffers (X1, X2) enhance MLA, reducing risk and bolstering profitability, while aggressive lending (X6, X7) and volatile funding (X3) heighten vulnerabilities, unevenly impacting efficiency. Banks with balanced strategies evidenced by stable ratios and reduced NPAs (e.g., SBI, Canara Bank) outperform those with constraints or overexposure (e.g., Punjab & Sind Bank, IOB historically), highlighting the competitive edge of prudent risk management. Predictive indicators (lending ratios, NPLs) offer actionable insights for early intervention, though refining methods (e.g., addressing autocorrelation via time-series models) could sharpen precision. Bridging research gaps, this study integrates liquidity risk and efficiency using PSU Bank Nifty as a market lens, capturing post-2018 shifts like mergers and recapitalization, and revealing how liquidity strategies can mitigate systemic shocks like the COVID-19 crisis. For policymakers, it advocates robust liquidity frameworks such as tighter NPA monitoring and liquidity coverage ratios to strengthen resilience, ensuring PSU banks meet their dual mandate of profitability and socio-economic goals in India's dynamic financial landscape. Bank managers can leverage these insights for risk-adjusted strategies, like optimizing loan portfolios to balance growth and stability. The findings also signal broader significance: PSU banks' stability underpins India's economic backbone, making liquidity management a national priority. Future research could incorporate time-series adjustments, regulatory variables (e.g., Basel III compliance), or real-time data to deepen these insights and tackle emerging challenges like climate risk or fintech disruption.

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