

Basel III and IFSB Requirements and Liquidity Resilience in Sudanese Islamic Banks: A Mixed-Methods Study

Abrar Nasereldean Mustafa Mohamed Nour¹ and Murtada Khidir Mohamed Abuzaid²

Faculty of Management Sciences, DBA Program (Finance), Sudan International University, Sudan

¹ Faculty of Management Sciences, DBA Program (Finance), Sudan International University, Sudan. Email: abrarmustafa348@gmail.com

² Faculty of Management Sciences, Sudan International University, Sudan. Email: murtadadr18@gmail.com

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Abstract

This study examines how Basel III and Islamic Financial Services Board (IFSB) liquidity requirements contribute to liquidity and financial resilience in Sudanese Islamic banks operating under structural fragility and armed conflict. The study addresses a contextual gap concerning the effectiveness of international prudential standards within a fully Shari'ah-compliant banking system characterized by limited Shari'ah-compliant high-quality liquid assets, constrained liquidity instruments, external financial isolation, and severe macro-environmental shocks. An explanatory sequential mixed-methods design combines longitudinal panel-data analysis of four Sudanese Islamic banks over 2010–2024, Partial Least Squares Structural Equation Modeling (PLS-SEM), and semi-structured interviews with five senior banking executives. Fixed Effects and System GMM estimations examine financial soundness and address dynamic and endogeneity concerns, while PLS-SEM provides complementary exploratory evidence on institutional relationships. The results indicate that stronger liquidity buffers and equity strength are positively associated with financial soundness, whereas non-performing loans and conflict intensity are negatively associated with financial soundness. The post-conflict interaction with liquidity is also negative, indicating weaker protective effectiveness of liquidity buffers under conflict conditions. PLS-SEM results show positive associations between regulatory compliance and financial soundness and negative associations involving credit risk, conflict, and external financial isolation. The findings support a Triple Crisis Framework in which regulatory effectiveness is conditional on structural Shari'ah liquidity constraints and conflict-induced fragility.

Keywords: Basel III; Islamic banking; liquidity resilience; financial soundness; Sudan; armed conflict; Shari'ah liquidity constraints

JEL Classification: G21; G28; G32; E58

1. Introduction

Liquidity resilience is a central component of banking stability because the ability of banks to meet short-term obligations and withstand funding stress is closely connected to their capacity to absorb financial and macroeconomic shocks. International prudential reforms have therefore placed increasing emphasis on liquidity and capital requirements designed to strengthen banks' capacity to withstand periods of financial stress. Basel III represents a major component of this regulatory architecture, particularly through liquidity and capital standards intended to improve banks' short-term liquidity positions and longer-term funding stability. For Islamic banks, however, the implementation of international prudential requirements involves additional institutional and Shari'ah-related considerations because conventional liquidity-management assumptions do not always correspond to the instruments and market structures available within Islamic financial systems.

The challenge becomes particularly important in fragile and conflict-affected economies. In such environments, banking institutions may simultaneously face liquidity shortages, deterioration in asset quality, disruption of payment systems, deposit withdrawals, restrictions on correspondent banking relationships, and deterioration in macroeconomic conditions. The effectiveness of regulatory liquidity buffers may consequently depend not only on the formal level of compliance but also on whether banks have access to appropriate liquid assets, functioning financial markets, stable funding channels, and effective institutional mechanisms for responding to stress.

Sudan provides an important setting in which to examine these issues. Sudanese Islamic banks operate within a predominantly Shari'ah-compliant banking environment while facing substantial structural constraints in liquidity management. These include limited availability of Shari'ah-compliant High-Quality Liquid Assets (HQLA), underdeveloped secondary Sukuk

markets, and limitations in access to Shari’ah-compliant lender-of-last-resort mechanisms. These structural conditions have been further intensified by the armed conflict that began in April 2023, which disrupted banking operations, payment systems, asset quality, and liquidity conditions. The combination of these factors creates a regulatory environment in which internationally designed prudential standards may encounter institutional and market constraints that are less pronounced in conventional banking systems. This study identifies this condition as a “Shari’ah Gap” and conceptualizes it as part of a broader Triple Crisis Framework.

The resulting research problem is therefore not simply whether Sudanese Islamic banks comply with Basel III and IFSB requirements. A more important question is whether such compliance remains effective when the institutional environment does not provide all of the market instruments and mechanisms implicitly required for liquidity resilience. The study consequently moves beyond a compliance-based perspective and examines the interaction between regulatory requirements, structural Shari’ah constraints, credit risk, conflict intensity, and external financial isolation. The proposed Triple Crisis Framework conceptualizes banking vulnerability as arising from the interaction of three principal dimensions: regulatory mismatch, structural Shari’ah liquidity constraints, and conflict-induced fragility, with credit-risk deterioration and external financial isolation reinforcing these vulnerabilities.

This study addresses this problem through a mixed-methods approach. The quantitative component uses longitudinal financial data covering four Sudanese Islamic banks during 2010–2024. Fixed Effects and Dynamic System Generalized Method of Moments (System GMM) estimations are employed to examine the relationship between liquidity conditions, credit risk, capital strength, conflict, and financial soundness. The System GMM specification is used to address potential endogeneity and dynamic persistence in banking outcomes. Complementing the panel analysis, PLS-SEM is employed using survey responses from banking professionals to examine institutional and organizational relationships. Because the survey sample consists of only 20 respondents, these findings are treated as exploratory and complementary rather than as definitive causal evidence. Finally, semi-structured interviews with five senior banking executives provide qualitative evidence concerning the practical implementation of regulatory requirements and the operational mechanisms through which conflict and structural constraints affect liquidity management.

The study addresses the following central research question:

How and under what conditions do Basel III and IFSB requirements contribute to liquidity and financial resilience in Sudanese Islamic banks operating under structural constraints and macro-environmental shocks?

This central question is addressed through several related objectives. First, the study examines the relationship between regulatory liquidity and capital conditions and financial soundness. Second, it investigates the role of structural Shari’ah liquidity constraints in limiting effective liquidity management. Third, it evaluates the effects of credit risk and conflict intensity on financial resilience. Fourth, it examines whether conflict weakens the effectiveness of liquidity buffers. Finally, it uses executive perspectives to explain the institutional and operational mechanisms underlying the quantitative findings. These objectives are consistent with the study’s original research design.

The empirical findings provide several contributions. First, the study provides evidence that stronger liquidity buffers are associated with improved financial soundness. The Fixed Effects results show a positive and statistically significant relationship between the Modified Liquidity Coverage Ratio and financial soundness, while the System GMM results provide complementary evidence of a positive short-run relationship. Second, credit risk emerges as a major source of financial instability, with non-performing loans showing a strong negative association with financial soundness across the quantitative approaches. Third, conflict intensity has a significant negative effect on financial soundness. Fourth, the negative interaction between post-conflict conditions and the Modified LCR suggests that the protective effectiveness of liquidity buffers declines during conflict periods.

The study also contributes theoretically by showing that prudential regulation cannot be evaluated independently of the institutional and macro-financial environment in which it operates. The qualitative evidence supports this interpretation: banking executives identified shortages of Shari’ah-compliant liquidity instruments, disruption of payment systems, collateral destruction, correspondent banking restrictions, and conflict-related operational difficulties as important constraints on effective liquidity management. These observations provide contextual explanations for the statistical relationships identified in the panel and PLS-SEM analyses.

The central argument of the study is therefore that regulatory compliance is necessary but not sufficient for financial resilience in fragile Islamic banking systems. The effectiveness of Basel III and IFSB requirements depends on the availability of appropriate Shari'ah-compliant liquidity instruments, effective credit-risk management, functioning financial infrastructure, and the ability of banks and regulators to adapt to severe macro-environmental shocks. This perspective extends the analysis of prudential regulation beyond formal compliance toward a context-sensitive understanding of regulatory resilience.

The remainder of the article is organized as follows. Section 2 reviews the literature on Basel III, IFSB requirements, Islamic bank liquidity management, financial resilience, and banking vulnerability under macro-environmental shocks. Section 3 develops the Triple Crisis Framework and the study hypotheses. Section 4 presents the research methodology and explains the panel-data, PLS-SEM, and qualitative components. Section 5 reports the empirical findings. Section 6 integrates the quantitative and qualitative evidence. Section 7 discusses the theoretical and policy implications, while Section 8 presents the study's limitations and Section 9 concludes.

2. Literature Review and Theoretical Framework

2.1 Basel III and Bank Liquidity Resilience

Liquidity risk represents one of the central dimensions of banking fragility because a bank may remain solvent on a balance-sheet basis while simultaneously becoming unable to meet its contractual or unexpected payment obligations. The post-global-financial-crisis regulatory architecture therefore placed greater emphasis on liquidity resilience alongside traditional capital adequacy requirements. Basel III introduced quantitative liquidity standards intended to strengthen banks' capacity to withstand short-term funding stress and to reduce excessive reliance on unstable funding structures. In particular, the Liquidity Coverage Ratio (LCR) focuses on short-term liquidity resilience, whereas the Net Stable Funding Ratio (NSFR) addresses the structural stability of bank funding.

The LCR is designed around the relationship between a bank's stock of high-quality liquid assets and its expected net cash outflows over a specified stress horizon. Its underlying regulatory logic is that banks should maintain a sufficient liquidity buffer that can be drawn upon during periods of funding pressure. The NSFR complements this short-term perspective by requiring banks to maintain a stable funding profile relative to the composition of their assets and off-balance-sheet exposures. (Basel Committee on Banking Supervision [BCBS], 2013).

The distinction between these two ratios is particularly important for the present study. A bank may maintain a relatively strong short-term liquidity position while remaining vulnerable because its longer-term funding structure is unstable. Conversely, a stable funding structure may not protect an institution from an immediate deposit run or payment-system disruption. Liquidity resilience therefore depends not only on the quantity of liquid assets but also on the composition, stability, and accessibility of funding. (BCBS, 2013, 2014).

This study's empirical design reflects this distinction by examining liquidity and capital indicators alongside broader measures of financial soundness. The study therefore does not treat regulatory compliance as an abstract institutional characteristic alone; rather, it examines observable prudential indicators, including LCR, NSFR and capital adequacy, within a broader financial-resilience framework.

2.2 Islamic Banking and the Problem of Liquidity Instrument Availability

The application of international liquidity standards to Islamic banks introduces an additional institutional dimension. Islamic financial institutions operate according to Shari'ah principles that constrain the use of interest-bearing instruments and shape the structure of permissible liquidity-management tools. Consequently, the effectiveness of a regulatory liquidity buffer depends not only on the regulatory requirement itself but also on whether appropriate Shari'ah-compliant instruments are available in sufficient volume, quality, and liquidity.

The IFSB's liquidity-risk guidance explicitly recognizes that liquidity regulation for Islamic financial institutions must take account of their specific institutional and contractual characteristics. IFSB guidance covers institutions offering Islamic financial services and emphasizes proportionality in implementation according to the size, sophistication, and complexity of the Islamic banking sector. (IFSB, 2012; IFSB, 2015).

This study identifies this institutional constraint through the concept of the "Shari'ah Gap." This refers to the structural gap between the liquidity assets and facilities required to satisfy modern prudential standards and the limited availability of sufficiently liquid Shari'ah-compliant alternatives. This study specifically identifies limited tradable Sukuk, underdeveloped secondary markets, restricted access to suitable HQLA and the absence or weakness of Shari'ah-compliant lender-of-last-resort mechanisms as important components of this constraint.

This distinction is theoretically important. A regulatory requirement may be formally appropriate while remaining operationally difficult to satisfy if the financial infrastructure necessary to implement it is weak. The issue is therefore not

necessarily a contradiction between Basel principles and Islamic finance. Rather, it concerns the institutional conditions under which a common prudential standard can be implemented effectively within a different financial architecture.

IFSB materials likewise recognize the importance of liquidity-management adaptation in Islamic banking. The IFSB's guidance on quantitative liquidity measures addresses the application of LCR and NSFR in Islamic financial institutions, while its broader work has addressed Shari'ah-compliant lender-of-last-resort facilities.

2.3 The Shari'ah Liquidity Gap as a Structural Constraint

The concept of the Shari'ah Gap provides the first major extension of conventional liquidity-resilience theory in this study. Conventional liquidity models generally assume the existence of deep financial markets, readily tradable high-quality liquid assets, functioning interbank markets, and credible lender-of-last-resort arrangements. This study argues that these assumptions become problematic in a fully Islamic banking environment where the range of permissible liquidity instruments is narrower and where secondary markets may be shallow.

The constraint can operate through several channels.

First, limited availability of tradable Shari'ah-compliant HQLA may make it difficult for banks to maintain liquidity buffers that are simultaneously regulatory-compliant and genuinely liquid during stress.

Second, reliance on short-term Sukuk or other relatively concentrated instruments may create maturity and market-liquidity pressures when institutions require immediate access to cash.

Third, the absence of an effective Shari'ah-compliant lender-of-last-resort mechanism can reduce the range of emergency funding options available to Islamic banks.

Fourth, shallow secondary markets can weaken the ability of banks to convert apparently liquid assets into cash without substantial price or transaction-cost effects.

Accordingly, the Shari'ah Gap is conceptualized in this study not as a failure of Islamic finance itself, but as a structural institutional constraint that can reduce the practical effectiveness of liquidity regulation. This interpretation is consistent with this study's central argument that regulatory effectiveness is conditional upon the financial environment in which the regulation is implemented.

2.4 Credit Risk and the Liquidity–Solvency Connection

Liquidity risk cannot be considered independently from credit risk. Deterioration in asset quality can reduce earnings and capital, increase provisioning requirements, weaken collateral values, and ultimately place additional pressure on liquidity. In a fragile banking system, these effects can become mutually reinforcing.

This study operationalizes this transmission channel through non-performing loans (NPLs). Its theoretical model proposes that credit-risk deterioration can transmit regulatory and balance-sheet pressures into broader liquidity and solvency stress. Specifically, this study identifies credit risk as a mediating mechanism through which capital adequacy pressures may affect systemic liquidity risk.

This mechanism is particularly relevant in Sudan because conflict can simultaneously impair borrowers' repayment capacity, destroy collateral, interrupt economic activity, and weaken banks' ability to recover distressed assets. The qualitative evidence in this study further indicates that executives associated conflict with collateral destruction, rising defaults, and operational disruption.

The implication is that liquidity resilience should not be interpreted solely as the ability to hold liquid assets. A bank's resilience also depends on the quality of its earning assets and its capacity to absorb credit deterioration without triggering funding stress.

2.5 Armed Conflict and Macro-Environmental Fragility

The third dimension of the framework concerns the macro-environment in which prudential regulation operates. Armed conflict can affect banking systems through multiple channels, including physical destruction of infrastructure, disruption of payment systems, branch closures, deposit withdrawals, deterioration in asset quality, staff displacement, reduced economic activity, and interruptions in domestic and international financial transactions.

This study treats the April 2023 conflict in Sudan as an exogenous stress event and examines whether the effectiveness of liquidity buffers changes under conflict conditions.

This approach allows the study to move beyond the conventional question of whether liquidity buffers are beneficial and instead ask a more context-sensitive question: under what conditions do liquidity buffers remain effective?

The empirical findings suggest that liquidity buffers retain a positive relationship with financial soundness under normal conditions, while their effectiveness is weakened after the onset of conflict. The fixed-effects estimates reported in this study show a positive association between the modified LCR and financial soundness, while the post-conflict interaction term is

negative and statistically significant. The System GMM results similarly show a positive effect of changes in the modified LCR and a negative conflict effect, with the post-conflict interaction providing additional evidence of weakened liquidity-buffer effectiveness.

The conceptual implication is that regulatory resilience is state-dependent. A prudential buffer that is protective under normal market conditions may provide less protection when the infrastructure required to mobilize that buffer is itself disrupted.

2.6 External Financial Isolation

This study introduces external financial isolation as an additional dimension that is often absent from conventional banking-liquidity models. International correspondent-banking relationships are important for cross-border payments, trade settlement, foreign-currency transactions and access to international financial networks. Restrictions or de-risking behavior affecting these relationships can therefore create liquidity consequences even when a bank remains internally compliant with prudential standards.

The study conceptualizes this phenomenon as “external financial isolation” and correspondent-banking de-risking. Its research questions explicitly ask whether such external constraints independently increase funding-liquidity risk regardless of internal Basel III compliance.

This argument broadens the concept of liquidity resilience from an institution-level balance-sheet construct to a network-dependent construct. A bank's effective liquidity capacity may depend not only on assets recorded on its balance sheet but also on its ability to access payment networks, correspondent institutions and external funding channels.

This study's PLS-SEM findings support this broader interpretation: external financial isolation has a negative estimated relationship with financial soundness, while the qualitative interviews describe correspondent-banking restrictions as an important operational constraint.

2.7 From Regulatory Compliance to Conditional Resilience

The literature reviewed in this study therefore suggests that the relationship between prudential regulation and financial resilience is more conditional than a simple compliance-resilience relationship implies.

The first condition is regulatory compatibility: international standards must be capable of being implemented within the institutional architecture of Islamic banking.

The second is market infrastructure: banks require sufficient access to appropriate Sharī'ah-compliant liquid instruments and functioning secondary markets.

The third is asset quality: regulatory liquidity buffers can be undermined by deteriorating credit portfolios.

The fourth is macro-financial stability: conflict and economic instability can weaken the operational effectiveness of otherwise adequate prudential buffers.

The fifth is external financial connectivity: correspondent-banking relationships and access to international financial networks can affect a bank's practical liquidity capacity.

These conditions motivate the central proposition of this article:

The effectiveness of Basel III and IFSB liquidity requirements is conditional on the institutional, structural and macro-environmental context in which Islamic banks operate.

This proposition provides the bridge between conventional regulatory theory and the Triple Crisis Framework developed in this study.

3. Triple Crisis Framework and Hypothesis Development

3.1 The Triple Crisis Framework

This study's central theoretical contribution is the Triple Crisis Framework, which conceptualizes banking vulnerability as the interaction of three dimensions:

1. Regulatory mismatch — the gap between internationally developed prudential requirements and the institutional conditions under which they are implemented;
2. Structural Sharī'ah liquidity constraints — limitations arising from the availability and marketability of permissible liquidity instruments; and
3. Conflict-induced fragility — the deterioration of banking-system operating conditions resulting from armed conflict and macroeconomic instability.

The framework further recognizes two reinforcing mechanisms: credit-risk deterioration and external financial isolation.

The framework therefore differs from a conventional regulatory-compliance model. Rather than assuming that stronger compliance automatically produces stronger resilience, it proposes that the effect of regulation is conditioned by structural and environmental factors.

Conceptually, the framework can be expressed as:

Basel III / IFSB requirements → Liquidity and capital buffers → Financial resilience

with the relationship conditioned by:

Shari'ah liquidity constraints + armed conflict + external financial isolation

and amplified through:

credit-risk deterioration.

This framework is consistent with this study's conclusion that conventional Basel III compliance measures alone are insufficient to explain resilience in fragile Islamic banking systems.

3.2 Hypothesis 1: Regulatory Requirements and Financial Resilience

Basel III's LCR and NSFR are explicitly intended to strengthen liquidity resilience. The LCR provides a short-term liquidity buffer, while the NSFR promotes a more stable funding structure.

This study's empirical evidence is consistent with this theoretical expectation. Its fixed-effects estimates report a positive and statistically significant relationship between the modified LCR and financial soundness ($\beta = 1.876$, $p = .026$). The System GMM model similarly reports a positive coefficient for changes in the modified LCR ($\beta = .924$, $p = .017$).

Accordingly:

H1: Stronger Basel III/IFSB-related liquidity and capital compliance is positively associated with financial soundness and resilience in Sudanese Islamic banks.

Importantly, this hypothesis should not be interpreted as claiming that this study directly observes a single composite Basel III/IFSB “compliance index.” The empirical analysis uses specific prudential indicators. The article should therefore retain this indicator-based interpretation unless the underlying dataset confirms that a composite compliance measure was actually constructed.

3.3 Hypothesis 2: Credit Risk and Financial Soundness

Credit deterioration can weaken capital, reduce income, increase provisioning requirements and ultimately intensify liquidity pressures. This study's empirical results provide strong support for this channel. The fixed-effects model reports a negative relationship between NPLs and financial soundness ($\beta = -3.894$, $p = .001$), while the System GMM model reports a negative relationship between changes in NPLs and financial soundness ($\beta = -1.672$, $p = .002$).

Thus:

H2: Higher credit risk is negatively associated with financial soundness in Sudanese Islamic banks.

This hypothesis positions credit risk as an important transmission mechanism within the broader Triple Crisis Framework.

3.4 Hypothesis 3: Conflict and Financial Soundness

Armed conflict can disrupt economic activity, weaken borrowers' repayment capacity, impair collateral, interrupt payment systems and constrain normal banking operations. This study's quantitative findings show a statistically significant negative relationship between conflict and financial soundness. The System GMM estimate is $\beta = -.487$ ($p = .035$), while the fixed-effects model reports a negative coefficient for the conflict trend.

Accordingly:

H3: Greater conflict intensity is negatively associated with financial soundness in Sudanese Islamic banks.

The qualitative findings provide contextual support for this relationship through reports of branch closures, payment-system disruptions, staff displacement and collateral destruction.

3.5 Hypothesis 4: Conflict as a Boundary Condition of Liquidity Regulation

The central theoretical extension of the article is that conflict does not merely have an independent negative effect on financial soundness; it may also reduce the effectiveness of liquidity buffers.

This study reports a negative post-conflict $\times$ modified-LCR coefficient in the fixed-effects model ($\beta = -1.234$, $p = .029$). The System GMM interaction estimate is also negative ($\beta = -.981$), although its reported significance level is weaker ($p = .059$). This difference should be transparently reported rather than selectively presented.

Accordingly:

H4: Conflict intensity weakens the positive relationship between liquidity buffers and financial soundness.

This hypothesis captures the “conditional resilience” proposition at the heart of the Triple Crisis Framework.

3.6 Hypothesis 5: Structural Shari'ah Constraints and Financial Resilience

This study conceptualizes the Shari'ah Gap as a structural constraint associated with limited availability of tradable Shari'ah-compliant HQLA, shallow secondary markets and limited emergency liquidity mechanisms.

The PLS-SEM results provide exploratory evidence of a negative relationship between the Shari'ah Gap and financial soundness ($\beta = -.187$, $p = .056$), while the Shari'ah Gap is positively associated with credit risk ($\beta = .456$, $p < .001$).

Given the small PLS-SEM sample, these results should be characterized cautiously. The article should not present them as definitive causal evidence.

The corresponding hypothesis is:

H5: Greater structural Shari'ah liquidity constraints are negatively associated with financial resilience.

3.7 Hypothesis 6: External Financial Isolation and Financial Resilience

This study identifies external financial isolation as a further source of vulnerability and reports a negative PLS-SEM relationship with financial soundness ($\beta = -.378$, $p < .001$). Qualitative evidence also indicates that correspondent-banking restrictions affected international transactions and institutional continuity.

Accordingly:

H6: Greater external financial isolation is negatively associated with financial resilience.

This hypothesis extends the analysis beyond the internal balance sheet by recognizing that liquidity resilience may depend partly on access to external financial networks.

3.8 Integrated Theoretical Proposition

Taken together, the six hypotheses imply that financial resilience in Sudanese Islamic banks is not determined by regulatory compliance alone.

The proposed causal logic is:

Regulatory foundation

Basel III / IFSB requirements

↓

Liquidity and capital buffers

LCR / NSFR / capital adequacy

↓

Financial soundness and resilience

but the strength of this pathway is conditioned by:

Structural constraint: Shari'ah liquidity gap

Macro shock: armed conflict

External constraint: financial isolation

Transmission mechanism: credit-risk deterioration

The resulting theoretical proposition is therefore:

Prudential regulation strengthens the foundations of banking resilience, but its effectiveness is conditional upon the availability of compatible Islamic liquidity infrastructure, the quality of bank assets, the stability of the operating environment, and access to domestic and international financial networks.

This proposition constitutes the central theoretical contribution of the study and provides the conceptual foundation for the empirical models that follow.

3.9 Research Gap and Contribution

This study identifies several interconnected gaps in the existing literature. First, conventional liquidity-regulation research has generally been developed in financial systems where liquid conventional instruments and deep secondary markets are available. Second, Islamic banking research has recognized liquidity-management constraints but has less frequently integrated these constraints into a broader regulatory-resilience model. Third, conflict-related banking research has examined financial deterioration during instability but has rarely examined whether conflict changes the effectiveness of prudential liquidity requirements. Fourth, external financial isolation and correspondent-banking de-risking have received insufficient

attention within conventional liquidity-risk models. Finally, relatively little empirical work combines bank-level panel evidence with practitioner perspectives in a conflict-affected Islamic banking environment.

The present study addresses these gaps by integrating these dimensions into one context-sensitive framework and by combining panel econometrics, PLS-SEM and executive interviews. The contribution is therefore not simply to test whether Basel III-related indicators are associated with financial soundness, but to explain why and under what conditions their effectiveness changes.

This conditional perspective is particularly important for fragile Islamic financial systems, where the institutional infrastructure necessary to convert regulatory requirements into effective liquidity protection may itself be constrained.

4. Methodology

4.1 Research Design

This study adopted an explanatory sequential mixed-methods design to examine the relationship between prudential regulation, liquidity risk management, and financial resilience in Sudanese Islamic banks operating under structural fragility and armed conflict.

The research combined three complementary sources of evidence. First, longitudinal secondary financial data were analyzed using panel-data econometric techniques, including Fixed Effects (FE) and Dynamic System Generalized Method of Moments (System GMM). Second, survey data from senior banking professionals were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine institutional and behavioural constructs that cannot be directly observed from financial statements. Third, semi-structured interviews with senior banking executives were analyzed thematically to provide contextual explanations for the quantitative relationships.

The explanatory sequential logic is particularly appropriate because the quantitative analysis identifies statistical relationships, while the qualitative component provides contextual explanations of how and why those relationships arise within a conflict-affected Islamic banking environment. The three strands of evidence were subsequently integrated through methodological triangulation and joint-display analysis.

The design therefore distinguishes between objective financial resilience, measured from bank-level financial data, and perceived institutional resilience, measured through the survey component. This distinction is important because the two forms of evidence address different levels of the research problem rather than representing interchangeable measures.

4.2 Study Population, Sample, and Period

The quantitative component focused on four purposively selected Islamic commercial banks operating in Sudan. The longitudinal financial dataset covers 2010–2024, which is the study period used consistently in the empirical analysis. The dataset therefore includes bank-year observations from 2010 through 2024.

The selection of the four banks was purposive and reflected their relevance to the Sudanese Islamic banking system and the availability of sufficiently consistent financial information. The conflict environment created substantial difficulties in obtaining institutional records; consequently, audited financial statements, Central Bank of Sudan publications, regulatory disclosures, and other archived sources were used where necessary to maintain continuity in the longitudinal dataset.

The survey component consisted of 20 senior banking professionals working in areas including liquidity management, treasury operations, risk management, and regulatory compliance. Because access to banking personnel was severely constrained during the conflict period, the survey sample was intentionally limited and was treated as an exploratory institutional dataset rather than as a basis for population-level causal inference.

The qualitative component comprised five senior banking executives selected purposively on the basis of their direct involvement in liquidity management, regulatory compliance, risk management, and strategic decision-making. Participants included a Chief Risk Officer, Treasury Manager, Compliance Manager, and two other senior banking executives, with reported professional experience ranging from 18 to 28 years.

4.3 Data Sources and Collection

The study relied on multiple data sources to reduce dependence on any single measurement approach.

The secondary financial dataset was constructed primarily from:

- audited annual financial statements of the selected Islamic banks;
- publications and supervisory materials issued by the Central Bank of Sudan;
- Basel-related regulatory disclosures and filings;
- available international financial databases; and

- relevant statistics and reports from the IFSB and International Monetary Fund.

The financial variables collected included liquidity indicators, capital adequacy measures, credit-risk measures, profitability indicators, funding structure variables, and financial-soundness indicators.

Because the conflict that began in April 2023 disrupted normal banking operations and restricted access to institutional records, archived regulatory disclosures and publicly available audited reports were used when direct institutional records were unavailable. This contingency approach was intended to preserve the longitudinal structure of the dataset and minimize missing observations.

Primary survey data were collected from banking professionals using a structured questionnaire designed around the institutional dimensions of the Triple Crisis Framework. The questionnaire addressed regulatory implementation, liquidity-management practices, Shari'ah-compliant liquidity constraints, and perceived financial resilience.

The qualitative data were obtained through semi-structured interviews. Interview questions were informed by both the Triple Crisis Framework and the preliminary quantitative findings. Five areas were emphasized: Basel III feasibility, Shari'ah-compliant liquidity constraints, conflict-induced operational disruption, external financial isolation, and future regulatory reform. Interviews were conducted through direct and virtual communication depending on participant availability and security conditions.

4.4 Variables and Measurement

The empirical strategy distinguishes between observable financial variables used in the panel models and latent institutional constructs used in the PLS-SEM analysis.

Table 1. Variables and Measurement

Variable	Role in empirical analysis	Operationalization / measurement
Modified LCR	Key explanatory variable (liquidity buffer)	Modified liquidity proxy defined as Liquid Assets / [Deposits + (0.10 × Total Loans)]. It is a stress-adjusted, data-constrained proxy for short-term liquidity resilience and is not an exact replication of the Basel III regulatory LCR.
Z-score	Dependent variable (financial soundness)	$Z = [ROA + (Equity / Total Assets)] / \sigma(ROA)$. Higher values indicate greater financial stability and lower insolvency risk.
LCR	Regulatory benchmark	Basel III liquidity coverage indicator; discussed as the international benchmark but not used as the principal estimated panel regressor.
NSFR	Regulatory benchmark	Basel III structural funding-stability indicator; discussed conceptually but not reported as a principal coefficient in the final FE/GMM tables.
Equity ratio	Explanatory variable (capital strength)	Equity relative to total assets, used as a measure of capital buffer and loss-absorption capacity.
NPL ratio	Explanatory variable (credit risk)	Non-performing financing/loans relative to total financing/loans, as reported in the study dataset.
Post-conflict dummy	Conflict indicator	Equals 1 for 2023–2024 and 0 for the pre-conflict period, as reported in the study.
Conflict trend	Conflict exposure	Ordinal conflict-trend measure: 0 = 2010–2022 (pre-conflict); 1 = 2023 (initial conflict period); 2 = 2024 (continuing conflict period).
Post-conflict × Modified LCR	Moderating effect	Interaction between the post-conflict condition and the modified liquidity-buffer measure.
Bank size	Control	Natural logarithm of total assets.
Inflation	Macro control	Inflation conditions during the study period.
Exchange rate	Macro control	Exchange-rate movements during the study period.
GDP growth	Macro control	Broader economic growth conditions during the study period.

Variable	Role in empirical analysis	Operationalization / measurement
Regulatory Compliance	PLS-SEM latent construct	Survey-based measure of perceived implementation of prudential regulatory requirements.
Shari'ah Gap	PLS-SEM latent construct	Survey-based measure of perceived shortage of tradable Shari'ah-compliant liquidity instruments.
Credit Risk	PLS-SEM latent construct	Survey-based construct capturing perceived credit-risk conditions.
Conflict Intensity	PLS-SEM latent construct	Survey-based construct capturing perceived conflict-related disruption.
External Financial Isolation	PLS-SEM latent construct	Survey-based construct capturing perceived restrictions or frictions in external financial connectivity.
Financial Soundness	PLS-SEM latent construct	Survey-based perceived financial resilience/soundness.

This study identifies the Modified LCR and Z-Score as the principal measures of the two dimensions of resilience: short-term liquidity resilience and broader financial soundness.

The Modified LCR was developed because the conventional Basel liquidity framework cannot simply be transferred mechanically to a fully Islamic banking system where conventional interest-bearing HQLA may not be readily available. This study therefore describes the modified measure as incorporating Shari'ah-compliant liquid assets and locally available liquidity instruments.

Basel III liquidity compliance is represented primarily by LCR and NSFR, while capital adequacy is represented by CAR/equity-ratio measures. Credit risk is measured using the NPL ratio. Conflict is captured through a post-conflict dummy, a conflict-trend measure, and the interaction between post-conflict conditions and the Modified LCR. Bank size and selected macroeconomic variables are included as controls. The Modified LCR is formally defined as: Modified LCR = Liquid Assets / [Deposits + (0.10 × Total Loans)]. This study uses this measure as a data-constrained, stress-adjusted liquidity proxy rather than as an exact replication of the Basel III regulatory LCR. The CONFLICT_TREND variable is coded ordinally as 0 for 2010–2022 (pre-conflict), 1 for 2023 (initial conflict period), and 2 for 2024 (continuing conflict period), thereby capturing the progression of conflict exposure across the study period.

4.5 Panel-Econometric Specification

The panel component was designed to account for the dynamic nature of banking resilience, unobserved bank-specific heterogeneity, and potential endogeneity between regulatory indicators and financial soundness.

The Fixed Effects model provides the baseline specification:

$$Z_{it} = \beta_0 + \beta_1 \text{LCR}_{it} + \beta_2 \text{NPL}_{it} + \beta_3 \text{Equity}_{it} + \beta_4 \text{Conflict}_t + \beta_5 (\text{PostConflict}_t \times \text{LCR}_{it}) + \varepsilon_{it}$$

where Z_{it} represents financial soundness for bank i in year t . LCR captures liquidity-buffer conditions, NPL represents credit risk, Equity captures capital strength, and the interaction term evaluates whether conflict changes the relationship between liquidity buffers and financial soundness.

This study selected Fixed Effects following the Hausman test, which produced $\chi^2 = 21.46$ with $p = .003$, supporting the FE specification over Random Effects. The residual cross-sectional dependence test was also statistically insignificant (Pesaran CD = 1.42, $p = .155$).

Panel stationarity was assessed using the Levin–Lin–Chu (LLC) and Im–Pesaran–Shin (IPS) tests. The reported variables were stationary at level, indicating $I(0)$ processes and eliminating the need for cointegration analysis in the reported specifications.

4.6 Dynamic System GMM Estimation

Because financial soundness may be persistent over time and regulatory variables may be endogenous to bank conditions, the study also employed Dynamic System GMM. The estimator follows the dynamic-panel approach associated with Arellano and Bover and Blundell and Bond.

The dynamic specification can be represented generally as (Arellano & Bover, 1995; Blundell & Bond, 1998):

$$Z_{it} = \alpha Z_{i,t-1} + \beta_1 \Delta \text{LCR}_{it} + \beta_2 \Delta \text{NPL}_{it} + \beta_3 \text{Conflict}_t + \beta_4 (\text{Conflict}_t \times \text{LCR}_{it}) + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

where $Z_{i,t-1}$ represents lagged financial soundness, X_{it} represents the relevant control variables, μ_i captures unobserved bank-specific effects, and λ_t captures time-specific effects.

System GMM was employed because the study's longitudinal banking data involve three potential empirical problems: persistence in financial soundness, unobserved heterogeneity, and potential endogeneity between bank-risk characteristics and regulatory indicators. This study additionally specifies that the number of instruments should be controlled to avoid instrument proliferation and that Hansen, Difference-in-Hansen, and Arellano–Bond serial-correlation tests should be used to assess estimator validity.

The reported results indicate a positive coefficient for lagged solvency and a positive relationship between changes in the modified LCR and financial soundness, while changes in NPLs and conflict exhibit negative relationships with financial soundness. The interaction between conflict and LCR is also negative, although its statistical significance is weaker in the System GMM specification than in the Fixed Effects model.

4.7 PLS-SEM Analysis

The second quantitative component examines institutional and behavioural dimensions that are not directly observable from bank financial statements.

The reported PLS-SEM structural model comprises six principal latent constructs:

- 1. Regulatory Compliance;**
- 2. Shari'ah Gap;**
- 3. Credit Risk;**
- 4. Conflict Intensity;**

5. External Financial Isolation; and

6. Financial Soundness.

These constructs correspond to the measurement and structural results reported in the final PLS-SEM specification. The six-construct specification is used here because it matches the reported reliability and structural-path results.

Because of the small sample, the PLS-SEM findings are positioned in the article as complementary institutional evidence, rather than as an alternative to the bank-level panel estimates.

4.8 Qualitative Analysis

Five semi-structured interviews were analyzed using Thematic Framework Analysis. Interview transcripts were reviewed systematically, followed by coding and identification of recurring patterns. The analysis followed the six-stage thematic process described in this study: familiarization, initial coding, identification of themes, review of themes, definition and naming of themes, and production of the analytical report.

The qualitative analysis focused on five principal domains:

- Basel III feasibility and regulatory adaptation;
- Shari'ah-compliant liquidity constraints;
- conflict-induced banking fragility;
- external financial isolation; and
- future regulatory reform priorities.

Where interviews were conducted in Arabic, responses were translated into English before thematic coding while seeking to preserve the meaning of the original narratives.

4.9 Mixed-Methods Integration

Integration occurred after the separate quantitative and qualitative analyses through methodological triangulation and joint-display analysis.

The purpose of integration was not simply to determine whether the different methods produced identical results. Rather, the study classified the relationships between findings as:

- convergence, where different sources supported the same conclusion;
- complementarity, where one method added information not captured by another; and
- explanation, where qualitative evidence helped explain the mechanism underlying a statistical relationship.

This approach is particularly relevant in a conflict-affected environment because financial ratios may identify deterioration without revealing the operational mechanisms through which that deterioration occurred.

For example, the negative interaction between conflict and liquidity conditions is interpreted alongside executive reports concerning branch closures, payment-system disruption, collateral destruction, staff displacement, and correspondent-banking restrictions.

4.10 Robustness and Diagnostic Procedures

Several diagnostic and robustness procedures were incorporated into the empirical strategy.

For the panel models, multicollinearity was examined using VIF; the reported VIF values remained below 4.2. Stationarity was examined using LLC and IPS tests, while cross-sectional dependence was assessed using the Pesaran CD test. The Hausman test was used to select between Fixed Effects and Random Effects.

For System GMM, model validity was evaluated using Hansen and Difference-in-Hansen tests, together with Arellano–Bond AR(1) and AR(2) serial-correlation diagnostics. Instrument proliferation was explicitly considered in the methodology.

Additional robustness exercises reported in this study included alternative liquidity measures, alternative lag structures, pre-conflict versus conflict-period comparisons, Altman Z" validation, stress testing under alternative conflict scenarios, HQLA eligibility assessment, and analysis of the external financial-isolation mechanism.

4.11 Methodological Positioning

The methodological contribution of the study lies in combining three analytically distinct forms of evidence.

The panel analysis provides objective bank-level evidence concerning financial soundness and liquidity resilience. The PLS-SEM analysis captures institutional perceptions and organizational practices that are difficult to observe through financial statements. The qualitative interviews provide contextual explanations of the mechanisms operating within the conflict-affected banking environment.

The resulting methodological structure is therefore:

Bank-level financial data → FE/System GMM → objective financial resilience

Managerial survey → PLS-SEM → perceived institutional resilience

Executive interviews → thematic analysis → contextual mechanisms

Integration → joint display → Triple Crisis Framework

This structure enables the article to answer not only whether regulatory liquidity conditions are associated with resilience, but also how structural Shari'ah constraints, credit deterioration, conflict, and external financial isolation shape the effectiveness of those regulatory mechanisms.

5. Results

5.1 Descriptive Statistics

The empirical analysis begins with descriptive statistics for the principal panel variables. Because the study examines Sudanese Islamic banks over a period characterized by substantial macroeconomic and conflict-related volatility, the distribution of the variables provides an initial indication of the degree of variation in liquidity, credit risk, capital strength, and financial soundness.

As reported in Table 2, the mean lagged Z-score was 5.87, with a standard deviation of 3.12 and a range from 0.94 to 11.70. The Modified Liquidity Coverage Ratio had a mean of 0.285 and a standard deviation of 0.194, ranging from 0.018 to 0.703. The mean NPL ratio was 0.061, while the maximum reached 0.183. The equity ratio averaged 0.102, ranging between 0.036 and 0.153.

The relatively wide dispersion of the Z-score and liquidity measure indicates substantial heterogeneity in financial resilience across bank-year observations. The Modified LCR also displays considerable variation, consistent with the study's proposition that liquidity conditions differed substantially across institutions and over time.

The descriptive evidence is particularly relevant in an Islamic banking environment because the availability of appropriate liquid instruments is an important determinant of the practical meaning of a liquidity ratio. IFSB guidance recognizes the need

for liquidity-management arrangements that take account of the specific characteristics of Islamic financial institutions, including the availability of Shari'ah-compliant collateral and liquidity-support mechanisms.

Table 2. Descriptive Statistics of Panel Variables

Variable	Mean	Std. Dev.	Min.	Max.	Observations
Lagged Solvency (Z-score)	5.870	3.120	0.940	11.700	52
Modified LCR	0.285	0.194	0.018	0.703	54
NPL Ratio	0.061	0.082	0.001	0.183	49
Post-Conflict Dummy	0.086	0.283	0	1	58
Conflict Trend	0.172	0.642	0	2	58
Equity Ratio	0.102	0.036	0.036	0.153	53

Source: Author's calculations based on this study dataset.

5.2 Correlation Analysis

The correlation matrix provides preliminary evidence concerning the direction and strength of the relationships among the principal variables.

The Modified LCR is positively correlated with lagged financial soundness ($r = .29$), while the NPL ratio exhibits a relatively stronger negative correlation with lagged Z-score ($r = -.47$). The post-conflict indicator is positively associated with the Modified LCR ($r = .34$), whereas its relationship with financial soundness is negative but relatively weak ($r = -.08$). The equity ratio has a positive association with financial soundness ($r = .21$).

The correlation results therefore provide preliminary support for the central theoretical proposition: stronger liquidity and capital positions tend to be associated with stronger financial soundness, whereas deteriorating asset quality is associated with weaker soundness.

Importantly, correlation coefficients do not establish causality. The subsequent Fixed Effects and System GMM estimations therefore provide the principal basis for evaluating the hypothesized relationships.

Multicollinearity does not appear to be a major concern. The reported VIF values remained below 4.2.

5.3 Panel Diagnostic Tests

Before estimating the panel models, several diagnostic procedures were conducted.

The Levin–Lin–Chu and Im–Pesaran–Shin tests indicate that all principal variables were stationary at level. The p-values for both tests were statistically significant for the Z-score, Modified LCR, NPL ratio, equity ratio, and conflict trend, indicating $I(0)$ processes. Consequently, cointegration analysis was not required for the reported specification.

The Pesaran cross-sectional dependence test produced a statistic of 1.42 with a p-value of .155. Thus, the null hypothesis of no significant cross-sectional dependence was not rejected. This study consequently retained the conventional Fixed Effects specification rather than applying Driscoll–Kraay corrections.

The Hausman test produced $\chi^2 = 21.46$, with 7 degrees of freedom and $p = .003$. This result supports the Fixed Effects model over the Random Effects alternative.

5.4 Fixed Effects Regression Results

Table 3 reports the Fixed Effects estimates.

Table 3. Fixed Effects Regression Results

Variable	Coefficient	Robust SE	t-statistic	p-value
Modified LCR	1.876**	0.812	2.31	.026
NPL Ratio	-3.894***	1.054	-3.69	.001
Equity Ratio	2.011**	0.923	2.18	.035
Conflict Trend	-0.423**	0.191	-2.21	.033
Post-Conflict × Modified LCR	-1.234**	0.543	-2.27	.029
Year effects	Jointly significant			<.001
R ²	.531			

Variable	Coefficient	Robust SE	t-statistic	p-value
F-statistic	7.83			<.001

Notes: ** $p < .05$; *** $p < .01$.

The Modified LCR is positively and significantly associated with financial soundness ($\beta = 1.876$, $p = .026$). This result indicates that stronger liquidity buffers are associated with improved financial resilience under the baseline conditions of the model.

The positive coefficient is consistent with the underlying regulatory rationale of the LCR, which is explicitly designed to promote short-term resilience in banks' liquidity-risk profiles. The Basel framework currently describes the LCR as a measure intended to promote short-term liquidity resilience.

The equity ratio is also positive and statistically significant ($\beta = 2.011$, $p = .035$), suggesting that stronger capital buffers contribute to financial soundness.

In contrast, the NPL ratio has the largest negative coefficient in the model ($\beta = -3.894$, $p = .001$). This finding indicates that deterioration in asset quality represents a particularly important source of financial fragility. The result is consistent with the Triple Crisis Framework's proposition that credit deterioration can transmit broader macroeconomic and institutional shocks into bank-level financial instability.

Conflict intensity is negatively associated with financial soundness ($\beta = -.423$, $p = .033$). Thus, increasing conflict exposure is associated with progressive deterioration in bank resilience.

Most importantly, the interaction between the post-conflict condition and Modified LCR is negative and statistically significant ($\beta = -1.234$, $p = .029$). This result indicates that the positive relationship between liquidity buffers and financial soundness becomes weaker under post-conflict conditions.

The interaction finding provides direct empirical support for the study's conditional-resilience proposition. It suggests that maintaining a liquidity buffer does not guarantee the same degree of protection when the operational and financial infrastructure required to mobilize that liquidity is disrupted.

The model explains approximately 53.1% of the variation in the dependent variable, and the overall F-statistic is statistically significant ($F = 7.83$, $p < .001$).

5.5 Dynamic System GMM Results

The Fixed Effects findings are complemented by a Dynamic System GMM specification designed to address persistence and potential endogeneity.

Table 4. Dynamic System GMM Results

Variable	Coefficient	z-statistic	p-value
Lagged Solvency Z_{t-1}	0.312***	4.12	<.001
Δ Modified LCR	0.924**	2.38	.017
Δ NPL Ratio	-1.672***	-3.05	.002
Conflict Trend	-0.487**	-2.11	.035
Post-Conflict $\times$ Modified LCR	-0.981*	-1.89	.059
AR(2) test			.231
Hansen J test			.342

Notes: * $p < .10$; ** $p < .05$; *** $p < .01$.

The lagged Z-score is positive and highly significant ($\beta = .312$, $p < .001$), confirming persistence in financial soundness. In other words, current financial resilience is partly related to the previous period's resilience.

The short-run change in Modified LCR has a positive and statistically significant coefficient ($\beta = .924$, $p = .017$). This reinforces the Fixed Effects finding that improvements in liquidity conditions are associated with stronger financial soundness.

Changes in the NPL ratio are negatively associated with financial soundness ($\beta = -1.672$, $p = .002$), confirming the importance of asset-quality deterioration as a short-run source of instability.

Conflict trend remains negative and statistically significant ($\beta = -.487$, $p = .035$). The interaction between post-conflict conditions and liquidity is also negative ($\beta = -.981$), although its significance is marginal at the 10% level ($p = .059$). This weaker interaction estimate should be reported transparently rather than interpreted as equally strong evidence as the Fixed Effects estimate.

The diagnostic results support the validity of the reported specification. The AR(2) test is statistically insignificant ($p=.231$), providing no evidence of second-order serial correlation, while the Hansen J test is also statistically insignificant ($p=.342$), supporting the validity of the over-identifying restrictions.

Taken together, the FE and System GMM results are directionally consistent. Both indicate that stronger liquidity conditions are associated with better financial soundness, credit deterioration is damaging, and conflict has a negative effect. The interaction estimates also point in the same negative direction, although the strength of statistical evidence differs across estimators.

5.6 PLS-SEM Measurement Model

The PLS-SEM analysis provides complementary evidence concerning institutional and managerial perceptions.

The reliability and convergent-validity results indicate acceptable measurement properties for the six reported constructs. Cronbach's alpha values range from .767 to .856, while Composite Reliability values range from .851 to .902. AVE values range from .572 to .755, exceeding the conventional .50 benchmark used in this study.

Table 5. PLS-SEM Reliability and Convergent Validity

Construct	Cronbach's α	Composite Reliability	AVE
Regulatory Compliance	.842	.886	.609
Shari'ah Gap	.818	.873	.580
Credit Risk	.791	.865	.617
Conflict Intensity	.856	.902	.755
External Financial Isolation	.803	.868	.572
Financial Soundness	.767	.851	.656

The reported HTMT ratios also support discriminant validity. For example, the HTMT ratios for Regulatory Compliance with Shari'ah Gap, Credit Risk, Conflict, and External Financial Isolation were .412, .523, .467, and .489 respectively, all below the reported threshold.

These results indicate that the latent constructs demonstrate acceptable internal consistency and empirical distinctiveness within the reported PLS-SEM specification.

5.7 PLS-SEM Structural Results

The structural model provides exploratory evidence concerning the institutional mechanisms represented in the Triple Crisis Framework.

Table 6. PLS-SEM Path Coefficients

Structural Path	β	p-value
Regulatory Compliance → Financial Soundness	0.324	.001
Shari'ah Gap → Financial Soundness	-0.187	.056
Credit Risk → Financial Soundness	-0.412	<.001
Conflict → Financial Soundness	-0.245	.009
External Financial Isolation → Financial Soundness	-0.378	<.001
Shari'ah Gap → Credit Risk	0.456	<.001
Conflict → Credit Risk	0.389	<.001
Conflict × Regulatory Compliance → Financial Soundness	0.178	.012

The strongest negative direct relationship with financial soundness is associated with credit risk ($\beta=-.412, p<.001$). This result is consistent with the panel estimates and reinforces the central role of asset quality in the resilience of Sudanese Islamic banks.

Regulatory Compliance has a positive relationship with Financial Soundness ($\beta = .324, p = .001$). This provides complementary institutional evidence that stronger regulatory implementation is associated with stronger perceived financial resilience.

The Shari'ah Gap has a negative relationship with Financial Soundness ($\beta = -.187, p = .056$). Although the coefficient is directionally consistent with the theoretical expectation, its p-value is slightly above the conventional 5% threshold. It should therefore be described as weak or marginal evidence, rather than as strong statistical confirmation.

More strongly, the Shari'ah Gap is positively associated with Credit Risk ($\beta = .456, p < .001$). This suggests that structural constraints in the availability of appropriate liquidity instruments may be linked indirectly to financial fragility through deterioration in credit conditions.

Conflict has a negative direct relationship with Financial Soundness ($\beta = -.245, p = .009$) and a positive relationship with Credit Risk ($\beta = .389, p < .001$). This provides evidence for the proposed transmission mechanism whereby conflict contributes to financial instability partly through asset-quality deterioration.

External Financial Isolation also exhibits a significant negative relationship with Financial Soundness ($\beta = -.378, p < .001$). The result suggests that financial resilience depends not only on internal balance-sheet conditions but also on access to external financial networks.

Finally, the Conflict $\times$ Regulatory Compliance interaction is positive and significant ($\beta = .178, p = .012$). This finding suggests that stronger regulatory structures may partially buffer the adverse effect of conflict. The result complements, rather than contradicts, the negative FE interaction between conflict and the Modified LCR because the two interactions represent different constructs and analytical specifications.

5.8 Explanatory and Predictive Power

The PLS-SEM model reports substantial explanatory power for the endogenous constructs. In the principal structural model, R^2 for Credit Risk is .467 and R^2 for Financial Soundness is .645, while the corresponding Q^2 values are .321 and .412.

These results indicate that the model accounts for a substantial proportion of the observed variation in the endogenous constructs and demonstrates positive predictive relevance.

However, these values should be interpreted in light of the survey sample size of 20. The PLS-SEM results are therefore best understood as exploratory institutional evidence that complements the much larger longitudinal structure of the financial panel, rather than as definitive population-level estimates.

5.9 Qualitative Findings

The qualitative analysis was conducted after the quantitative phase, with the purpose of explaining and contextualizing the statistical findings. Five senior banking executives participated, including senior professionals in risk management, treasury, compliance, and banking leadership. Their professional experience ranged from more than 18 to more than 28 years.

Five major themes emerged.

Theme 1: The Operational Reality of the Shari'ah Gap

Participants described the shortage of effective Shari'ah-compliant liquidity mechanisms as a structural challenge that becomes substantially more severe during conflict. The interviews particularly emphasized the difficulty of relying on conventional overnight liquidity facilities when interbank markets are disrupted.

This evidence provides contextual support for the study's conceptualization of the Shari'ah Gap as an institutional constraint rather than merely a compliance issue. IFSB-12 similarly emphasizes the importance of Shari'ah-compliant liquidity support and collateral arrangements for Islamic financial institutions.

Theme 2: De Jure versus De Facto Compliance

The interviews distinguished between formal regulatory compliance and operational resilience during crisis conditions. Executives reported that, during severe disruption, daily operational priorities shifted toward preserving assets, maintaining payment capacity, moving liquidity, and protecting critical banking infrastructure.

This finding helps explain why quantitative compliance indicators may remain positively associated with resilience while their practical effectiveness can diminish during extreme conflict.

Theme 3: Basel III Feasibility and Regulatory Adaptation

Participants generally recognized the value of Basel III but questioned the feasibility of applying its liquidity requirements without adaptation to Sudan's Islamic financial infrastructure.

The interviews repeatedly highlighted three constraints: limited Shari'ah-compliant liquidity instruments, weak secondary Sukuk markets, and the extraordinary operational disruption generated by conflict.

This theme directly complements the quantitative evidence showing that liquidity buffers are beneficial under baseline conditions but less effective during conflict.

Theme 4: The Shari'ah Gap and Liquidity Scarcity

All interviewees identified the limited availability of tradable Shari'ah-compliant liquidity instruments as a major constraint. Participants reported that the shortage of appropriate Sukuk and Level 1 HQLA encouraged banks to maintain larger cash balances as a precaution.

While this behaviour can improve immediate liquidity protection, participants also indicated that excessive cash holdings reduce opportunities for productive investment and may weaken profitability.

This qualitative evidence provides an important explanation for the PLS-SEM relationship between the Shari'ah Gap, credit risk, and financial soundness.

Theme 5: Conflict-Induced Banking Fragility

Participants consistently reported that the April 2023 conflict disrupted banking operations through branch closures, destruction of infrastructure, payment-system interruptions, customer withdrawals, and deterioration of economic conditions.

They also reported that destruction of collateral and business assets increased defaults and weakened asset quality.

This evidence strongly complements the econometric findings showing that conflict reduces financial soundness and increases credit risk.

6. Discussion and Integration of Findings

The integration of the three evidence streams produces a coherent picture of conditional financial resilience.

Table 7. Mixed-Methods Joint Display

Empirical finding	Panel evidence	PLS-SEM evidence	Qualitative evidence	Integrated interpretation
Liquidity buffers improve resilience	Modified LCR → FSN: $\beta=1.876$, $p=.026$	Regulatory Compliance → FSN: $\beta=.324$, $p=.001$	Executives emphasized importance of liquidity buffers	Convergence: regulatory liquidity capacity supports resilience
Conflict weakens liquidity effectiveness	Post-conflict × LCR: $\beta=-1.234$, $p=.029$	Conflict negatively affects FSN	Payment disruption, branch closures and withdrawals reported	Explanation: operational disruption reduces the practical value of liquidity buffers
Credit risk is a major source of fragility	NPL → FSN: $\beta=-3.894$, $p=.001$	CRR → FSN: $\beta=-.412$, $p<.001$	Collateral destruction and repayment disruption reported	Strong convergence: asset-quality deterioration is a major transmission mechanism
Shari'ah liquidity constraints matter	Not directly measured in FE/GMM	SHG → CRR: $\beta=.456$, $p<.001$; SHG → FSN: $\beta=-.187$, $p=.056$	Limited tradable Sukuk/HQLA repeatedly identified	Complementarity: qualitative evidence explains structural liquidity constraints
Conflict increases credit risk	Conflict trend → FSN: $\beta=-.423$, $p=.033$	CON → CRR: $\beta=.389$, $p<.001$	Defaults and collateral impairment reported	Convergence: conflict transmits through asset quality
External financial isolation reduces resilience	Not directly estimated in main panel model	EFI → FSN: $\beta=-.378$, $p<.001$	Correspondent and international-payment restrictions reported	Complementarity: external connectivity is an additional resilience condition
Regulation can partially buffer	FE liquidity interaction negative	CON × REG → FSN: $\beta=.178$,	Executives emphasized the importance of	Conditional resilience: stronger

Empirical finding	Panel evidence	PLS-SEM evidence	Qualitative evidence	Integrated interpretation
conflict		p=.012	institutional preparedness	institutional frameworks may mitigate, but not eliminate, conflict effects

Overall, the integrated evidence supports the central proposition of the study: regulatory liquidity requirements are beneficial, but their effectiveness is conditional on the institutional and macro-financial environment in which Islamic banks operate.

The panel models establish the objective financial relationships; the PLS-SEM results identify institutional pathways; and the interviews explain the mechanisms through which structural Shari'ah constraints, conflict, credit deterioration, and external financial isolation interact.

7. Theoretical Contributions, Policy Implications, Limitations and Future Research

7.1 Theoretical Contributions

This study makes several contributions to the literature on Islamic banking, liquidity risk management, and financial resilience under macro-environmental stress.

First, the findings support a conditional view of regulatory effectiveness. The positive association between the modified liquidity measure and financial soundness indicates that stronger liquidity buffers can contribute to bank resilience. However, the significant negative interaction between the post-conflict environment and the modified liquidity measure demonstrates that the protective effect of liquidity regulation is not invariant across operating environments. Regulatory requirements may therefore strengthen the foundations of resilience without guaranteeing resilience when banks face severe institutional and macro-financial disruptions. This extends conventional interpretations of prudential regulation by emphasizing the importance of the conditions under which regulatory requirements are implemented.

Second, the study develops the Triple Crisis Framework, which conceptualizes financial fragility in Sudanese Islamic banks as the interaction of three structural dimensions: regulatory mismatch, Shari'ah-related liquidity constraints, and conflict-induced fragility. These dimensions are further transmitted through deterioration in credit quality and external financial isolation. The framework therefore moves beyond a purely regulatory interpretation of liquidity risk and places regulatory requirements within the broader institutional environment in which Islamic banks operate.

Third, the findings position the Shari'ah liquidity gap as an institutional constraint rather than simply a compliance issue. The qualitative evidence indicates that the availability of Shari'ah-compliant liquid instruments, tradable Sukuk, and emergency liquidity mechanisms affects the practical capacity of Islamic banks to transform regulatory liquidity requirements into usable liquidity buffers. This distinction is important because formal compliance with a liquidity standard does not necessarily imply equivalent access to liquidity during periods of stress.

Fourth, the results identify credit risk as an important transmission mechanism of financial fragility. The negative and statistically significant relationship between non-performing loans and financial soundness in both the fixed-effects and dynamic panel models suggests that deterioration in asset quality can materially weaken resilience. The qualitative findings reinforce this mechanism by linking conflict-related disruption, collateral deterioration, borrower distress, and payment interruptions to worsening credit conditions. Liquidity risk management should therefore be considered together with asset-quality and credit-risk management rather than as an isolated prudential function.

Finally, the study contributes methodologically by combining longitudinal quantitative analysis, dynamic panel estimation, PLS-SEM, and qualitative evidence from senior banking professionals. This mixed-method approach allows the study to examine not only whether regulatory and macro-financial variables are associated with financial soundness, but also how institutional constraints influence the practical effectiveness of those regulatory mechanisms.

7.2 Policy and Practical Implications

The findings have several implications for regulators, Islamic banks, and other financial-sector stakeholders.

First, liquidity supervision should become more conflict-sensitive. Conventional prudential thresholds may provide an important baseline, but their interpretation and implementation should recognize conditions in which banking infrastructure, payment systems, collateral values, deposits, and access to external liquidity are simultaneously disrupted. Supervisory frameworks should therefore incorporate severe but plausible conflict scenarios into liquidity stress testing.

Second, the supply of Shari'ah-compliant high-quality liquid assets should be strengthened. The findings indicate that the effectiveness of liquidity regulation depends partly on the availability of instruments that Islamic banks can actually hold and monetize during stress. Developing a deeper and more liquid domestic Sukuk market, together with appropriate eligibility and valuation arrangements for Shari'ah-compliant instruments, could improve the practical effectiveness of liquidity buffers.

Third, emergency liquidity arrangements for Islamic banks require particular attention. The absence or limited availability of effective Shari'ah-compliant lender-of-last-resort mechanisms can reduce the ability of Islamic banks to respond to sudden liquidity pressures. A credible emergency liquidity framework compatible with Shari'ah principles would strengthen the transmission of prudential regulation from formal requirements to actual crisis-management capacity.

Fourth, liquidity and credit-risk management should be integrated more closely. The strong negative relationship between non-performing loans and financial soundness suggests that liquidity resilience can deteriorate rapidly when asset quality weakens. Banks should therefore incorporate expected credit deterioration, collateral impairment, delayed repayments, and sector-specific default risks into liquidity stress-testing and contingency funding plans.

Fifth, operational and payment-system resilience should form part of liquidity-risk management. The qualitative evidence indicates that conflict affects not only balance-sheet liquidity but also branch operations, payment infrastructure, cash movement, and the continuity of banking records and services. Business-continuity arrangements, alternative payment channels, decentralized operational capacity, and secure data and ledger continuity are therefore relevant components of financial resilience in conflict-affected banking systems.

Sixth, external financial connectivity should be incorporated into liquidity-risk assessment. Restrictions or frictions affecting correspondent relationships, cross-border payments, settlement processes, and external financial access can create liquidity pressures that are not adequately captured by conventional balance-sheet liquidity ratios. Banks and supervisors should consequently consider external financial isolation as part of stress scenarios and contingency liquidity planning.

7.3 Implications for Islamic Banking Regulation

The findings also suggest that the implementation of Basel-oriented liquidity standards in Islamic banking requires an appropriate balance between regulatory comparability and institutional specificity.

The objective should not be to abandon internationally recognized liquidity principles. Rather, regulatory implementation should ensure that equivalent prudential objectives can be achieved through instruments and mechanisms compatible with Islamic banking structures. In the Sudanese context, this implies greater attention to the availability, tradability, valuation, and stress performance of Shari'ah-compliant liquid instruments.

This distinction is particularly important during systemic stress. A liquidity ratio can indicate that a bank has accumulated qualifying liquid assets while providing limited information about whether those assets can actually be monetized quickly, without excessive loss, when market functioning is impaired. The practical resilience of Islamic banks therefore depends not only on the quantity of eligible liquidity but also on its quality, accessibility, and convertibility under stress.

Accordingly, regulatory authorities should consider combining conventional liquidity indicators with supplementary indicators covering instrument availability, market depth, concentration of liquid assets, access to emergency liquidity, payment-system functionality, and external financial connectivity.

7.4 Limitations of the Study

Several limitations should be considered when interpreting the findings.

First, the quantitative analysis is based on a relatively small panel of four Sudanese Islamic banks. The limited number of institutions restricts the statistical generalizability of the findings and reflects the structural limitations of conducting bank-level research in a conflict-affected financial system.

Second, the post-conflict period is relatively short. Because the major conflict-related disruption began in 2023, the available observations may not fully capture the longer-term effects of conflict on liquidity, asset quality, capital adequacy, and financial resilience. The estimated interaction effects should therefore be interpreted as evidence of an emerging relationship rather than a complete characterization of long-term conflict dynamics.

Third, the study relies partly on a modified liquidity ratio designed to reflect the institutional characteristics of Sudanese Islamic banks. Although this modification is theoretically and institutionally motivated, it means that the resulting measure is not necessarily identical to the standard conventional LCR. Comparisons with studies using an unmodified Basel LCR should therefore be made cautiously.

Fourth, the PLS-SEM component is based on a small sample of 20 senior banking professionals and is consequently exploratory and complementary rather than definitive causal evidence. Its primary value is triangulation and the assessment of relationships among the study constructs from professional perceptions.

Fifth, the qualitative component consists of interviews with five senior banking executives. These participants provide valuable institutional and practitioner perspectives, but their views cannot be assumed to represent all Sudanese banks, regulators, or market participants.

Sixth, although the use of fixed-effects and dynamic System GMM models strengthens the analysis by addressing unobserved heterogeneity and potential dynamic endogeneity, the observational nature of the data means that the findings should not be interpreted as establishing definitive causal effects. In particular, the results describe statistically supported relationships within the available sample and period.

Finally, data availability in the Sudanese banking environment may impose limitations on the measurement of certain dimensions of liquidity risk, conflict exposure, and external financial isolation. Some institutional characteristics are difficult to capture fully through standardized quantitative indicators and therefore require continued qualitative and regulatory investigation.

7.5 Directions for Future Research

Future research can extend this study in several directions.

First, subsequent studies should examine a larger number of Islamic banks and, where data permit, extend the analysis across multiple Islamic banking jurisdictions. Cross-country comparisons would help determine whether the conditional effectiveness identified in Sudan is specific to the Sudanese institutional environment or reflects broader characteristics of Islamic banking in fragile and conflict-affected economies.

Second, future research should use longer post-conflict periods to examine whether the negative effects of conflict on liquidity and financial soundness persist, intensify, or diminish as banking infrastructure and economic activity recover.

Third, researchers could compare Islamic and conventional banks operating within the same macroeconomic environment. Such comparisons would provide stronger evidence regarding whether Shari'ah-related liquidity constraints create distinctive channels of vulnerability during systemic shocks.

Fourth, future studies should examine alternative measures of liquidity resilience, including funding concentration, deposit withdrawals, liquid-asset composition, cash-flow mismatch, stable funding measures, and stress-based liquidity indicators. This would allow researchers to determine whether the relationships identified in the present study remain robust across alternative definitions of liquidity risk.

Fifth, future research could develop bank-level conflict stress-testing frameworks that jointly model liquidity, credit, capital, operational, and market risks. Such models could provide more direct estimates of how different conflict scenarios affect individual banks and the wider Islamic banking system.

Sixth, the Triple Crisis Framework should be tested empirically in other fragile or conflict-affected Islamic banking markets. Such testing would establish whether regulatory mismatch, Shari'ah liquidity constraints, conflict fragility, credit deterioration, and external financial isolation constitute a broader theoretical configuration or primarily describe the Sudanese case.

Finally, larger survey samples would allow future researchers to employ more statistically demanding structural-equation approaches and to examine mediation and moderation relationships with greater precision. This would provide an opportunity to test more rigorously the mechanisms through which regulatory compliance, Shari'ah constraints, credit risk, conflict, and external financial isolation interact to influence financial resilience.

7.6 Overall Contribution

Taken together, the study suggests that the effectiveness of Basel III- and IFSB-oriented liquidity regulation in Islamic banking should not be assessed solely by formal compliance with regulatory ratios. Regulatory resilience is conditional on the institutional capacity to operationalize regulatory requirements under stress.

In the Sudanese context, this capacity is shaped by the availability of Shari'ah-compliant liquidity instruments, the functioning of emergency liquidity arrangements, the quality of bank assets, the severity of conflict-related disruption, and access to external financial networks. The study therefore proposes a shift from viewing liquidity regulation primarily as a matter of regulatory thresholds toward understanding it as a broader institutional resilience system.

The central implication is not that Basel III- and IFSB-oriented requirements are ineffective. Rather, their protective effect is strongest when the surrounding financial infrastructure, Islamic liquidity instruments, credit-risk controls, crisis-management mechanisms, and external financial connections are sufficiently developed to support implementation. Where these supporting conditions are weak, formal regulatory compliance may provide only partial protection against severe macro-environmental shocks.

8. Conclusion

This study examined the effectiveness of Basel III- and IFSB-oriented liquidity and prudential requirements in strengthening financial resilience among Sudanese Islamic banks operating under conditions of structural fragility, armed conflict, and external financial constraints. Using an explanatory sequential mixed-methods design, the study combined longitudinal panel-data analysis, dynamic System GMM estimation, PLS-SEM, and qualitative evidence from senior banking executives. This integrated approach enabled the study to assess both the statistical relationships underlying financial resilience and the institutional mechanisms that shape the practical implementation of prudential requirements.

The empirical findings provide evidence that stronger liquidity and capital positions are generally associated with greater financial soundness. The fixed-effects estimates indicate a positive relationship between the modified liquidity measure and financial soundness, while equity strength is also positively associated with resilience. In contrast, non-performing loans and conflict-related conditions are negatively associated with financial soundness. The dynamic System GMM estimates broadly reinforce these findings, while also demonstrating persistence in bank solvency and supporting the importance of accounting for dynamic effects and potential endogeneity.

At the same time, the results demonstrate that the effectiveness of liquidity regulation is conditional on the environment in which regulatory requirements are implemented. The negative interaction between the post-conflict environment and the modified liquidity measure indicates that liquidity buffers provide less protection under severe conflict conditions than under more stable operating conditions. This finding is important because it suggests that regulatory ratios should not be interpreted independently of the institutional, operational, and macro-financial conditions surrounding the banking system.

The study further identifies credit risk as a major source of vulnerability. The consistently negative relationship between non-performing loans and financial soundness indicates that deterioration in asset quality can materially weaken banking resilience. Conflict can intensify this mechanism through borrower distress, disruption of economic activity, impairment of collateral, and interruptions in payment and collection processes. Liquidity resilience should therefore be understood as closely connected to the quality of bank assets and the effectiveness of credit-risk governance.

The qualitative findings provide an institutional explanation for these quantitative relationships. Senior banking executives described shortages of Shari'ah-compliant liquidity instruments, disruption of payment systems and banking operations, collateral impairment, and correspondent-banking restrictions as important constraints on the practical implementation of liquidity management. These findings complement the panel and PLS-SEM evidence by identifying mechanisms that are not fully observable through financial ratios alone.

Taken together, the findings provide support for the Triple Crisis Framework and for a conditional understanding of regulatory resilience in Sudanese Islamic banking. Basel III- and IFSB-oriented requirements provide an important prudential foundation, but their protective value depends on the availability of appropriate Shari'ah-compliant liquidity instruments, effective credit-risk controls, functioning financial and payment infrastructure, institutional preparedness, and the broader macro-financial environment. The study therefore suggests that regulatory resilience should be assessed not only through formal prudential indicators but also through the institutional capacity to implement those requirements under severe stress.

Research Ethics and Participant Confidentiality

This study involved primary data collected through a structured survey of 20 banking professionals and semi-structured interviews with five senior banking executives. The manuscript reports the survey and interview findings in aggregate and does not disclose personally identifying information about participants. The authors have not claimed a formal institutional ethics-approval number in this manuscript; accordingly, no specific ethics approval is represented here. The authors confirm that the data were collected and used for academic research purposes and that participant confidentiality was maintained in reporting the findings. Any institutional ethics-approval and informed-consent procedures applicable to the original data collection should be retained in the authors' research records and disclosed if required by the relevant institution or venue.

Author Contributions

Abrar Nasereldeen Mustafa Mohamed Nour led the study design, data collection, quantitative and qualitative analysis, interpretation of findings, and manuscript preparation. Murtada Khidir Mohamed Abuzaid contributed to the conceptual development, academic supervision, critical review of the methodology and interpretation, and critical revision of the manuscript. Both authors approved the final version.

Conflict of Interest

The authors declare no financial, professional, or institutional conflict of interest that could influence the interpretation or reporting of the study.

References

- Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1), 29–51.
- Basel Committee on Banking Supervision. (2013). Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools. Bank for International Settlements. <https://www.bis.org/publications/201301-standards-basel-iii-liquidity-coverage-ratio-and-liquidity-risk-monitoring-tools>
- Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115–143.
- IFSB. (2012). Guiding Principles on Liquidity Risk Management for Institutions Offering Islamic Financial Services (IFSB-12). Islamic Financial Services Board.
- IFSB. (2015). Guidance Note on Quantitative Measures for Liquidity Risk Management in Institutions Offering Islamic Financial Services (GN-6). Islamic Financial Services Board.