

National Crises and Bank Profitability in Lebanon: Evidence from the Financial Crisis, COVID-19, and the Beirut Port Explosion

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Abstract

This study examines the impact of major national crises on Lebanese bank profitability, focusing on the Lebanese financial crisis, COVID-19, and the Beirut Port explosion. It also investigates whether capital adequacy moderates the relationship between crises and bank profitability. The study adopts a quantitative explanatory research design using balanced panel data from five Lebanese commercial banks over the period 2017–2023, generating 35 bank-year observations. Profitability is measured using the return on assets (ROA) and return on equity (ROE). The study employs pooled ordinary least squares, fixed effects, and random effects panel regression models, along with moderation analysis, to assess the conditional role of capital adequacy. The results show that the Lebanese financial crisis and COVID-19 significantly reduced both ROA and ROE, indicating that systemic financial instability and pandemic-related disruption weakened Lebanese banks' profitability. The Beirut Port explosion showed weaker and less consistent direct effects, although its negative impact became more evident in the moderation model. Capital adequacy had a positive direct effect on profitability but did not act as a consistent buffer. It did not significantly moderate the financial crisis–profitability relationship, negatively moderated the COVID-19 profitability relationship, and positively moderated the Beirut Port explosion profitability relationship. This study contributes to the banking and crisis literature by examining three overlapping national shocks in Lebanon within one empirical framework. It extends the evidence on bank profitability in fragile and crisis-affected economies by showing that the role of capital adequacy is crisis-specific rather than universally protective.

Received: 11 January, 2026

Accepted: 01 June, 2026

Published: 03 June, 2026

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Keywords: Bank Profitability, Lebanese Banking Sector; Financial Crisis; COVID-19, Beirut Port Explosion; Capital Adequacy, Panel Data, ROA, RO

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1. Introduction

The Lebanese banking sector is a critical setting for examining the profitability consequences of national crises. For decades, Lebanese banks have played a dominant role in financial intermediation, sovereign financing, and deposit mobilization. However, beginning in 2019, Lebanon entered a severe financial and banking crisis characterized by liquidity restrictions, currency collapse, sovereign default, erosion of depositor confidence, and a sharp contraction in credit activity. These conditions directly affect the traditional channels through which banks generate income. The situation was further complicated by the COVID-19 pandemic, which reduced business activity, weakened borrowers' repayment capacity and increased uncertainty. In August 2020, the Beirut Port explosion added a catastrophic physical and economic shock, damaging infrastructure, businesses, housing, trade activity and collateral values. Together, these events created a multi-crisis environment in which Lebanese banks faced simultaneous financial, health-related and disaster-related pressures.

Prior banking literature generally confirms that financial instability and crises reduce profitability. Alnabulsi et al. (2023) show that non-performing loans negatively affect net interest margins in the MENA region, while Horobeç et al. (2021) demonstrate that bank profitability is shaped by macroeconomic instability, asset quality and capitalization. Zaiane and Moussa (2021) further show that MENA banks' profitability is sensitive to crisis conditions, political turmoil, capitalization, liquidity, and risk. These studies support the argument that financial crises weaken banking performance through credit contraction, higher provisioning and liquidity pressures, and deteriorating borrower quality. The Lebanese financial crisis is especially severe because it combines deposit restrictions, sovereign distress, currency depreciation, and loss of confidence in the banking system. The COVID-19 literature similarly indicates that pandemic-related disruption affects bank profitability through reduced lending activity, weaker borrower solvency, higher credit risk, and operational constraints. Katusiime (2021), Rekha and Hossain (2022), Rohman and Nurkhin (2023), Amir and Choudhury (2023), and Chand et al. (2023) provide evidence that COVID-19 affects bank profitability and credit-risk dynamics across different banking systems. In a related regional context, Alslaibi (2024b) examined fintech and profitability in the Palestinian banking sector before and during COVID-19 and found that the effect of profitability drivers differed between the pre-pandemic and pandemic periods, with no statistical significance during COVID-19 in the

Palestinian banking sector. This supports the broader view that pandemic conditions alter the normal determinants of bank profitability in fragile economies. Regional evidence also highlights the importance of bank-specific determinants, such as capital adequacy, bank size, liquidity, operational efficiency, and country context. Alslaibi et al. (2025), in their study of bank financial performance in the Arab Levant region, examined banks from Jordan, Palestine, Lebanon, and Syria from 2017 to 2023 and found that inflation, bank type, country, bank size, and capital adequacy positively influenced profitability, while liquidity had a negative effect. Their study also showed that the pandemic and financial inclusion negatively affected the market valuation. This regional evidence is directly relevant because it positions Lebanese banks within the broader Arab Levant environment characterized by economic instability, post-COVID pressures, and fragile institutional conditions. The role of governance, institutional capacity, and internal bank characteristics is also important in explaining performance during uncertainty. Prior research on Palestinian banks shows that internal behavioral factors and governance structures influence profitability and that corporate governance can moderate the relationship between internal dynamics and bank performance (Alslaibi, 2025; Alslaibi et al., 2026b). Similarly, studies on accounting culture, governance, and financial reporting quality in Palestinian and Jordanian banks show that governance mechanisms can strengthen institutional outcomes in emerging banking systems. These studies suggest that performance in fragile economies cannot be explained solely by macroeconomic shocks; it also depends on banks' internal capacity, governance quality, and resilience.

Despite this growing body of literature, several gaps remain. First, most studies examine financial crises, COVID-19, or catastrophic shocks separately, while limited research has investigated how overlapping national crises jointly affect bank profitability. Second, empirical evidence on the Lebanese banking sector remains limited, particularly after the simultaneous occurrence of the 2019 financial crisis, COVID-19 pandemic, and the Beirut Port explosion. Third, although capital adequacy is widely treated as a resilience indicator, its moderating role in the relationship between national crises and bank profitability remains underexplored, especially in fragile banking systems facing sovereign, currency, liquidity, pandemic, and disaster shocks simultaneously. Fourth, existing regional studies often examine broader bank performance determinants across multiple countries but do not isolate Lebanon's multi-crisis banking environment or assess whether capital buffers operate differently across different types of crises.

To address these gaps, this study investigates the effect of three major national crises on Lebanese bank profitability and examines whether capital adequacy moderates these relationships. The study focuses on five Lebanese commercial banks over the period 2017–2023 and uses Return on Assets (ROA) and Return on Equity (ROE) as profitability indicators. First, the study provides focused empirical evidence on Lebanese banks during an exceptional period of overlapping national crises, extending prior Arab Levant banking research that has

examined broader financial performance determinants across Lebanon, Jordan, Palestine, and Syria (Alslaibi et al., 2025). Second, it distinguishes between the profitability effects of a systemic financial crisis, a pandemic shock, and a catastrophic disaster shock, thereby responding to calls for more context-sensitive banking research in fragile and emerging economies. Third, it extends the capital adequacy and bank resilience literature by examining whether capital buffers operate as a consistent protective mechanism or whether their effect differs across crisis types. Fourth, by incorporating evidence from regional banking, governance, and performance studies, the paper positions Lebanese bank profitability within a broader Arab emerging-market context where institutional quality, internal governance, and financial resilience jointly shape performance outcomes (Alslaibi, 2025; Alslaibi et al., 2026a; Samara et al., 2025). Accordingly, this study addresses the following research questions: How did the Lebanese financial crisis, COVID-19, and the Beirut Port explosion affect Lebanese bank profitability? Does capital adequacy moderate the relationship between national crises and bank profitability? Does the moderating role of capital adequacy differ across financial, pandemic, and disaster-related shocks?

The remainder of the paper is structured as follows. Section 2 presents the literature review, theoretical framework, and hypothesis development. Section 3 describes the research design, data sources, variable measurement, model specification, and panel estimation techniques. Section 4 presents the empirical results, including descriptive statistics, correlation analysis, panel regression models, and moderation analysis. Section 5 discusses the findings in relation to prior literature and theoretical expectations. Section 6 concludes the paper by summarizing the main findings, outlining practical and theoretical implications, and identifying limitations and directions for future research.

2. Literature review

2.1 Theoretical Framework

This study is grounded in three complementary theories: Financial Intermediation Theory, Credit Risk Theory, and Capital Buffer Theory. These theories are appropriate because this study examines how national crises affect bank profitability and how capital adequacy may moderate this relationship. The selected theories explain three connected mechanisms: how banks generate profitability through intermediation, how crises damage profitability through borrower default risk, and how capital buffers may protect banks during periods of systemic stress.

Financial Intermediation Theory provides the main theoretical foundation. The theory is commonly associated with the work of Diamond and Dybvig (1983), who explained the role of banks in liquidity transformation and showed how banks may become vulnerable to liquidity pressure and depositor confidence shocks. More broadly, financial intermediation theory views banks as institutions that mobilize deposits, transform maturities, provide liquidity, monitor borrowers, and allocate

credit. Molnár (2018), in reviewing financial intermediation theory, explains that banks perform three central functions: providing funding liquidity, transforming assets, and reducing information problems between investors and borrowers. Freimanis and Šenfelde (2019) also discuss financial intermediation theory as one of the dominant theories explaining bank operations. In Lebanon, the financial crisis disrupted deposit mobilization, confidence, liquidity, and lending activity. COVID-19 reduced credit demand and borrower activity, while the Beirut Port explosion damaged businesses, trade flows, and collateral values. These events constrained banks' ability to perform their intermediation role and therefore provide a theoretical basis for expecting lower profitability during national crises.

Credit Risk Theory provides the second theoretical basis. The modern structural approach to credit risk is usually traced to Merton (1974), who linked default risk to the value of a firm's assets relative to its debt obligations. In banking research, this theory is used to explain how borrower default risk affects bank performance. Thapa and Sejuwal (2023) describe credit risk theory as a default-based theory in which borrowers' inability to meet their obligations affects banks' financial position. Al Zaidanin and Al Zaidanin (2021) similarly apply credit risk theory in examining how credit-risk indicators, including non-performing loans and capital adequacy, influence commercial bank financial performance. National crises weaken borrowers' repayment capacity, increase default probability, and raise non-performing loans and loan-loss provisions. The Lebanese financial crisis reduced real income and business stability; COVID-19 disrupted firms and households; and the Beirut Port explosion damaged businesses and collateral. Thus, Credit Risk Theory explains the main transmission mechanism from crisis conditions to lower bank profitability.

Capital Buffer Theory provides the third theoretical foundation and supports the moderating role of capital adequacy. The theory is commonly associated with banking capital and regulatory literature, including Marcus (1984), and later work on bank capital buffers. It argues that banks maintain capital above minimum regulatory requirements to absorb unexpected losses, avoid supervisory intervention, and preserve solvency during adverse conditions. Jokipii and Milne (2011) define capital buffers as the amount of capital held above minimum requirements and examine how banks adjust capital and risk. Pratama et al. (2021) also explain that capital buffers act as reserve funds that help banks face losses and meet regulatory requirements. Gospodarchuk (2019), in the context of macroprudential policy, links Basel III capital buffers to loss absorption and banking-sector stability. During crises, banks with stronger capital buffers should be more capable of absorbing credit losses, maintaining solvency, preserving depositor confidence, and continuing limited intermediation. However, the theory does not imply that capital always increases profitability directly. Instead, it suggests that capital becomes especially important under stress because it may reduce the severity of crisis-induced profitability deterioration. In Lebanon's multi-crisis environment, capital adequacy is therefore expected to condition the relationship between national crises and bank profitability.

2.2 Hypothesis Development

2.2.1 Financial Crisis and Bank Profitability

Financial crises affect bank profitability through several mutually reinforcing channels. In banking systems exposed to macroeconomic instability, crisis conditions typically weaken liquidity, impair borrower repayment capacity, reduce depositor confidence, and increase credit risk. These pressures are especially relevant in the Lebanese context, where the 2019 financial crisis involved severe deposit restrictions, loss of public confidence, currency depreciation, sovereign default, and a sharp contraction in credit intermediation. From a theoretical perspective, bank profitability is expected to decline when liquidity stress limits banks' ability to transform deposits into earning assets, while deteriorating asset quality increases non-performing loans and loan-loss provisions. At the same time, sovereign distress and exchange-rate instability can weaken bank balance sheets, particularly when banks hold substantial exposures to government securities or operate in highly dollarized and confidence-sensitive financial systems.

Empirical studies generally support the view that financial crises and macro-financial instability reduce banking profitability. Alnabulsi et al. (2023) show that non-performing loans negatively affect net interest margins in the MENA region, indicating that deterioration in loan quality can directly compress banks' income-generating capacity. Similarly, Horobeç et al. (2021) find that bank profitability in Central and Eastern European countries is shaped by macroeconomic instability, asset quality, and capital-related factors, reinforcing the argument that adverse macro-financial conditions transmit to bank performance. Zaiane and Moussa (2021) and Alslaihi et al., (2026b), focusing on the MENA region during periods of financial crisis and political turmoil, further demonstrate that profitability is sensitive to risk, capitalization, liquidity, and the broader institutional environment. These findings are consistent with the broader banking literature, which links crises to weaker ROA, ROE, and net interest margins through credit contraction, higher provisioning, liquidity pressures, and increased borrower default risk.

However, the empirical literature is not entirely uniform. Some studies suggest that the relationship between crisis conditions and profitability may be **nonlinear, delayed, or contingent on bank-specific characteristics**. For example, Alnabulsi et al. (2023) identified linear and nonlinear patterns in the relationship between non-performing loans and net interest margins, implying that low or moderate levels of asset quality deterioration may not immediately produce large profitability losses. Harb et al. (2022) also show that risk management, liquidity risk, and credit risk interact in complex ways in MENA banks, suggesting that the impact of crisis-related risks may vary according to banks' internal risk management capacity. Moreover, larger, more diversified, or better-capitalized banks may partly offset crisis pressures through cost pass-through, income diversification, liquidity reserves and regulatory support. This evidence indicates that crises do not affect all banks equally and that the profitability impact may depend on **the balance sheet structure, business model, and policy environment**.

Despite these qualifications, Lebanon's 2019 financial crisis provides a strong basis for expecting a negative relationship between crisis exposure and bank profitability. Unlike ordinary cyclical downturns, the Lebanese crisis combined liquidity shortages, deposit freezes, sovereign default, currency collapse, and severe erosion of public trust in banks. These conditions directly weakened the core functions through which banks generate income: deposit mobilization, lending, payment intermediation, and asset transformation. In addition, the contraction in economic activity and deterioration in borrowers' real incomes likely increased credit risk and provisioning needs. The Lebanese banking system's exposure to sovereign and currency-related risks further intensified these pressures. Therefore, although previous studies highlight nonlinearities and conditional effects, the severity and multidimensional nature of Lebanon's financial crisis support the expectation that it reduced bank profitability.

H1: Lebanon's financial crisis is negatively associated with bank profitability.

2.2.2 COVID-19 and Bank Profitability

The COVID-19 pandemic represents a major external shock that affected bank profitability through both demand-and supply side channels. Lockdowns, mobility restrictions, and reduced economic activity weakened firms' cash flows and household incomes, thereby reducing borrowers' repayment capacities. For banks, this translates into higher credit risk, increased non-performing loans, greater loan-loss provisions, and reduced demand for new lending. In addition, operational disruptions and uncertainty affect credit assessment, branch activity, transaction volumes, and fee income. These effects are particularly important in emerging markets and crisis-affected economies, where banks often operate with limited buffers, weaker institutional support, and higher exposure to macroeconomic volatility than in developed economies.

A growing body of evidence confirms the adverse effect of COVID-19 on bank profitability. Katusiime (2021), examining Uganda, reports that COVID-19 negatively affected bank profitability, including ROA, ROE, and net interest margins, with particularly important long-run consequences. Rekha and Hossain (2022) similarly find that the pandemic reduced the profitability of commercial banks in Bangladesh, reflecting the combined effects of weaker lending activity, asset-quality deterioration, and crisis-related income pressures. In Indonesia, Rohman and Nurkhin (2023) show that profitability during the pandemic was influenced by credit-risk conditions, especially non-performing loans. Amir and Choudhury (2023) also document that non-performing loans affected bank lending behavior before and during COVID-19, supporting the argument that pandemic-related credit deterioration constrained banks' performance. Evidence from Fiji further suggests that COVID-19 affected banking systems through non-performing loan dynamics, with effects varying by bank type and economic structure (Chand et al., 2023).

Nevertheless, the literature also indicates that COVID-19 did not affect all banks in the same way. Some banks experienced muted, delayed, or statistically mixed

profitability effects because of regulatory forbearance, payment moratoria, liquidity injections, capitalization buffers, or shifts toward digital channels and non-interest income. Harb et al. (2022) show that the relationship between risk management and bank performance in the MENA region is conditioned by the interaction between liquidity and credit risk, suggesting that bank-specific resilience can shape profitability outcomes during crisis periods. Rohman and Nurkhin (2023) also indicate that different profitability indicators may respond differently depending on bank characteristics and the timing of the shock. Similarly, Chand et al. (2023) emphasize that the effect of COVID-19 on non-performing loans and bank performance can vary by bank type and exposure to globalization. These findings suggest that the pandemic-profitability relationship is not purely mechanical; it depends on capitalization, liquidity, policy support, business model, and the duration of the shock.

However, in Lebanon, COVID-19 occurred during an already severe banking, currency, and sovereign crisis. This makes the expected effect of the pandemic more damaging than that of banking systems that entered the pandemic from a relatively stable position. Lebanese banks were already facing liquidity stress, depositor distrust, credit contraction, and balance sheet uncertainty when the pandemic further reduced economic activity and weakened borrowers' repayment capacity. COVID-19 therefore likely amplified profitability pressures rather than merely introducing them. The shock reduced business activity, constrained trade and consumption, and intensified credit risk at a time when banks had limited flexibility to expand lending, restructure balance sheets, or restore confidence. Although prior evidence acknowledges heterogeneity in COVID-19 effects, the Lebanese context supports the expectation that the pandemic further weakened bank profitability.

H2: COVID-19 negatively affected Lebanese bank profitability.

2.2.3 Beirut Port Explosion and Bank Profitability

The Beirut Port explosion represents a catastrophic urban and economic shock with direct implications for the Lebanese banking sector. Such disasters can affect bank profitability through physical destruction, business interruption, collateral impairment, reduced trade flows and declining borrower repayment capacity. The explosion damaged infrastructure, businesses, housing, and commercial activity in Beirut and disrupted a critical logistics gateway for the Lebanese economy. From a banking perspective, these effects are expected to weaken asset quality, increase loan loss provisions, reduce credit demand, suppress transaction activity, and heighten uncertainty. The shock may also reduce depositor and investor confidence, further constraining liquidity and intermediation.

Evidence from the crisis, disaster, and banking resilience literature supports the view that catastrophic shocks can harm bank performance. The Beirut Rapid Damage and Needs Assessment (2020) and Lebanon Reform, Recovery, and Reconstruction Framework (2020) document the extensive economic and infrastructure damage caused by the explosion, providing a basis for linking the event

to borrower distress, collateral impairment, and reduced business activity. Bastan et al. (2023) emphasize the importance of resilient banking and business continuity policies, suggesting that major disruptions can threaten banking operations and performance unless institutions possess strong continuity and resilience mechanisms. In addition, studies on banking risk in the MENA region show that liquidity risk, credit risk, and risk management quality are central to bank performance under stress (Harb et al., 2022; Hakimi et al., 2020). These findings support the argument that a major disaster can weaken profitability by disrupting the real economy and transmitting losses to bank balance sheets.

However, direct bank-level evidence of the Beirut Port explosion remains limited. This requires careful interpretation of the results. Some studies suggest that the effect of catastrophic shocks may be reduced or delayed by resilience factors such as liquidity buffers, capital adequacy, insurance coverage, business continuity planning, reconstruction activity, and temporary support measures. For instance, Bastan et al. (2023) show that banking resilience depends on continuity policies and institutional preparedness. Harb et al. (2022) similarly indicate that the performance consequences of risk exposure depend on how liquidity and credit risk are managed. Therefore, while the explosion plausibly harmed banking profitability, the magnitude and timing of its effect may vary across banks depending on their exposure to affected sectors, collateral portfolios, liquidity positions, operational continuity, and ability to manage crisis-related risks.

However, the Lebanese context strengthens the case for a negative expected effect. The explosion did not occur in isolation; it took place in August 2020, after the onset of the 2019 financial crisis and during the COVID-19 pandemic. This overlap created a multi-crisis environment in which banks faced simultaneous liquidity stress, currency depreciation, borrower distress, declining confidence, and operational disruption issues. The damage to Beirut's economic infrastructure likely intensified the difficulties faced by firms and households, thereby increasing credit risk and reducing bank income from loans and transactions. Furthermore, the explosion damaged confidence in the broader institutional and economic environment, which is particularly consequential for a banking system that is already experiencing depositor distrust and financial fragility. Although resilience mechanisms may mitigate some effects, the combined financial, pandemic, and disaster contexts make a negative profitability impact theoretically plausible.

H3: The Beirut Port explosion negatively affected Lebanese bank profitability.

2.2.4 Moderating Role of Capital Adequacy

Capital adequacy is central to bank resilience because it represents banks' capacity to absorb losses while maintaining solvency and continuing intermediation. During crises, banks with stronger capital buffers are better positioned to withstand loan losses, preserve depositor confidence, comply with prudential requirements, and avoid distress-related expenses. Capital also indirectly affects profitability by shaping banks' ability to continue lending, manage risk-weighted assets, and maintain

market confidence during periods of uncertainty. In the context of national crises, capital adequacy can moderate the relationship between crisis exposure and profitability by reducing the severity of profitability deterioration for better-capitalized banks. Empirical evidence generally supports the view that capital adequacy enhances banking resilience. El-Chaarani and Abraham (2022), examining Lebanese banks during the 2019–2021 crisis period, show that governance and political connectedness affected financial performance, highlighting the importance of institutional and bank-level characteristics during crisis conditions. IMF assessments of Lebanon also emphasize the relevance of capital, liquidity, and prudential soundness in evaluating banking-sector stability (International Monetary Fund, 2010, 2017). Badr and Ahmadiéh (2018), focusing on Lebanese banks under Basel III, further indicate that capitalization is a key component of prudential resilience. In the broader MENA context, Zaiane and Moussa (2021) and Hakimi et al. (2020) show that capital adequacy, credit risk, liquidity risk, and profitability are closely linked, especially during crisis and political turmoil. These studies support the argument that capital buffers can protect banks from severe profitability erosion by absorbing losses and stabilizing balance sheets.

However, the relationship between capital adequacy and profitability is not always positive or straightforward. Some studies find insignificant, nonlinear, or even negative associations between capital adequacy and profitability. Higher capital requirements may constrain lending, reduce leverage-based returns, increase compliance costs, or encourage conservative asset allocation. Alnajjar and Othman (2021), for example, examine capital adequacy and Islamic bank performance in selected MENA countries and suggest that the capital-profitability relationship may vary by bank type and business model. Alfouhaili et al. (2020) also show that Basel III capital regulation interacts with credit risk in complex ways, indicating that stronger capital regulation does not automatically translate into higher profitability. These mixed findings suggest that capital adequacy may function less as a direct profitability driver and more as a conditional resilience mechanism whose effect depends on liquidity, asset quality, sovereign exposure, governance quality, and macroeconomic stability.

In Lebanon, the moderating role of capital adequacy is especially important but conditional. Banks with stronger capital positions may be better able to absorb losses arising from financial crises, COVID-19, and the Beirut Port explosion. They may also be more capable of maintaining depositor confidence and continuing limited intermediation under stress conditions. However, capital adequacy alone may not fully protect profitability when banks face severe liquidity restrictions, currency collapses, sovereign default exposure, and widespread loss of trust. This means that capital adequacy is expected to shape the strength of the crisis-profitability relationship, but its protective role is unlikely to be absolute. Stronger capital buffers may reduce the depth of profitability decline, whereas weak capitalization may amplify the adverse effects of national crises.

Accordingly, capital adequacy is theorized as a moderating variable because it conditions banks' ability to absorb crisis-related losses and to sustain performance

under stress. While prior evidence includes mixed findings regarding the direct profitability effect of capital adequacy, the crisis resilience literature supports the expectation that capital adequacy changes the magnitude of the relationship between national crises and bank profitability. In the Lebanese multi-crisis context, this moderating effect is particularly relevant because financial, pandemic, and disaster shocks simultaneously increase credit risk, liquidity pressure, and uncertainty.

H4: Capital adequacy moderates the relationship between national crises and bank profitability.

3 Methodology

3.1 Research Design

This study adopts a quantitative explanatory research design based on secondary bank-level financial data. The objective is to examine whether major national crises in Lebanon are associated with changes in Lebanese banks' profitability and to assess whether capital adequacy moderates this relationship. The selected crises are the Lebanese financial and banking crisis beginning in 2019, the COVID-19 pandemic, and the Beirut Port explosion of August 2020. This design is appropriate because the study tests theoretically derived hypotheses using measurable financial indicators and crisis-period dummy variables. The empirical approach is based on panel-data regression, as the dataset follows multiple Lebanese banks across several years. Panel data are suitable for banking profitability research because they allow the analysis to capture both cross-sectional differences across banks and time-series variation across crisis and non-crisis years. This is particularly important in the Lebanese context, where banks were exposed to common national shocks but may have differed in capitalization, liquidity, size, leverage, cost efficiency, and profitability resilience.

3.2 Data Sources and Sample

The data were collected manually from the official websites, annual reports, and published financial statements of Lebanese commercial banks. These sources are appropriate because annual reports and audited financial statements provide standardized, publicly available, and verifiable bank-level financial information. The use of published bank financial data is common in empirical banking studies examining profitability determinants and crisis effects. For example, Athanoglou et al. (2008) examine bank profitability using panel data, while Dietrich and Wanzenried (2011) analyze bank profitability before and during financial crisis periods using bank-level data. The dataset covers five Lebanese banks observed annually from 2017 to 2023, producing a balanced panel of 35 bank-year observations. The unit of analysis is the bank-year observation, where each bank is tracked across time. Banks and years with missing or unavailable observations will be treated according to data availability and consistency criteria. Where a specific financial item is unavailable, the related variable should either be excluded from the relevant model specification provided that the measurement remains consistent across banks and years.

3.3 Variable Measurement

The variables used in this study were measured using bank-level financial indicators and crisis-period dummy variables. Table 1 presents the variable names, symbols, and operational measurements used in the empirical models.

TABLE 1. Variable Measurement

Variable	Symbol	Measurement
Return on Assets	ROA	Net income divided by total assets. This variable measures the efficiency with which a bank uses its asset base to generate earnings.
Return on Equity	ROE	Net income divided by total equity. This variable measures the return generated for shareholders.
Lebanese Financial and Banking Crisis	financial_crisis	Dummy variable equal to 1 for 2019 onward and 0 otherwise. It captures the period affected by Lebanon's financial and banking crisis.
COVID-19 Pandemic	covid	Dummy variable equal to 1 for the COVID-19 affected period and 0 otherwise. In the empirical results, this variable captures the pandemic-period effect on bank profitability.
Beirut Port Explosion	beirut_explosion	Dummy variable equal to 1 for 2020 and 0 otherwise. It captures the immediate impact of the Beirut Port explosion.
Capital Adequacy	CA	Equity divided by total assets. This variable is used as a proxy for bank capital adequacy and represents the

		bank's capital buffer.
Bank Size	BS	Natural logarithm of total assets. This variable controls for differences in bank scale and asset base.
Liquidity Ratio	LiqR	Liquid assets divided by total assets, or the liquidity ratio reported/calculated from bank financial statements. It measures the bank's liquidity position.
Leverage Ratio	LR	Total liabilities divided by total assets. This variable captures the extent to which bank assets are financed through liabilities.
Operational Efficiency	OE	Operating expenses relative to operating income or the efficiency ratio calculated from bank financial statements. This variable captures operational cost efficiency.
Moderation: Financial Crisis × Capital Adequacy	M Financial crisis	Interaction term between financial_crisis and CA. It measures whether capital adequacy moderates the relationship between the Lebanese financial crisis and bank profitability.
Moderation: COVID-19 × Capital Adequacy	M Covid	Interaction term between covid and CA. It measures whether capital adequacy moderates the relationship between COVID-19 and bank profitability.
Moderation: Beirut Explosion × Capital	M beirut_explosion	Interaction term between beirut_explosion and CA. It measures whether capital

Adequacy		adequacy moderates the relationship between the Beirut Port explosion and bank profitability.
Return on Assets	ROA	Net income divided by total assets. This variable measures the efficiency with which a bank uses its asset base to generate earnings.
Return on Equity	ROE	Net income divided by total equity. This variable measures the return generated for shareholders.
Lebanese Financial and Banking Crisis	financial_crisis	Dummy variable equal to 1 for 2019 onward and 0 otherwise. It captures the period affected by Lebanon's financial and banking crisis.
COVID-19 Pandemic	covid	Dummy variable equal to 1 for the COVID-19 affected period and 0 otherwise. In the empirical results, this variable captures the pandemic-period effect on bank profitability.
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Capital Adequacy	CA	Equity divided by total assets. This variable is used as a proxy for bank capital adequacy and represents the bank's capital buffer.
Bank Size	BS	Natural logarithm of total assets. This variable controls for differences in

		bank scale and asset base.
Liquidity Ratio	LiqR	Liquid assets divided by total assets, or the liquidity ratio reported/calculated from bank financial statements. It measures the bank's liquidity position.
Leverage Ratio	LR	Total liabilities divided by total assets. This variable captures the extent to which bank assets are financed through liabilities.
Operational Efficiency	OE	Operating expenses relative to operating income or the efficiency ratio calculated from bank financial statements. This variable captures operational cost efficiency.
Moderation: Financial Crisis × Capital Adequacy	M Financial crisis	Interaction term between financial_crisis and CA. It measures whether capital adequacy moderates the relationship between the Lebanese financial crisis and bank profitability.

3.4 Model Specification

The study estimates panel regression models to test the direct effects of national crises on bank profitability and the capital adequacy moderating effect. The baseline model is specified as follows.

$$\text{Profitability}_{it} = \beta_0 + \beta_1 \text{FINCRIS}_{it} + \beta_2 \text{COVID}_{it} + \beta_3 \text{EXPLOSION}_{it} + \beta_4 \text{CA}_{it} + \beta_5 \text{Controls}_{it} + \mu_i + \epsilon_{it}$$

Where **Profitability_{it}** refers to ROA or ROE for bank *iii* in year *ttt*. **$\beta_1 \text{FINCRIS}_{it}$** is the financial and banking crisis dummy variable, **$\beta_2 \text{COVID}_{it}$** is the COVID-19 dummy variable, **$\beta_3 \text{EXPLOSION}_{it}$** is the Beirut Port Explosion dummy variable, and **$\beta_4 \text{CA}_{it}$** represents capital adequacy. **$\beta_5 \text{Controls}_{it}$** includes bank size, liquidity, leverage, and operational efficiency variables. The term

μ_i captures unobserved bank-specific effects, while ϵ_{it} is the idiosyncratic error term.

To test the moderating role of capital adequacy, this study estimates an interaction model:

$$\begin{aligned} \text{Profitability}_{it} = & \beta_0 + \beta_1 \text{FINCRISIS}_{it} + \beta_2 \text{COVID}_{it} + \beta_3 \text{EXPLOSION}_{it} + \beta_4 \text{CA}_{it} \\ & + \beta_5 (\text{FINCRISIS}_{it} \times \text{CA}_{it}) + \beta_6 (\text{COVID}_{it} \times \text{CA}_{it}) \\ & + \beta_7 (\text{EXPLOSION}_{it} \times \text{CA}_{it}) + \beta_8 \text{Controls}_{it} + \mu_i + \epsilon_{it} \end{aligned}$$

The interaction terms indicate whether capital adequacy changes the strength or direction of the relationship between each national crisis and profitability. A positive and statistically significant interaction coefficient suggests that stronger capital adequacy reduces the adverse profitability effect of the crisis. A negative coefficient suggests that capital adequacy does not buffer the crisis effect or that higher capitalization is associated with more conservative, lower-return banking activity during stress periods.

3.5 Panel Estimation Technique

The study estimates the pooled ordinary least squares, fixed effects, and random effects models. The pooled OLS provides an initial benchmark but does not control for unobserved bank-specific heterogeneity. The fixed effects estimation controls for time-invariant bank characteristics, such as business models, managerial culture, risk appetite, ownership structure, and long-standing strategic differences. Random effects estimation is more efficient when unobserved bank-specific effects are not correlated with explanatory variables. The Hausman test was used to choose between fixed and random effects. If the test indicates that unobserved bank-specific effects are correlated with the explanatory variables, fixed effects are preferred. If the test is insignificant, the random effects may be appropriate. However, because the sample contains only five banks and several crisis dummies vary primarily over time rather than across banks, the results should be interpreted cautiously and presented as associational rather than strictly causal. Diagnostic tests will be conducted before interpreting the final models. Multicollinearity was assessed using variance inflation factors.

3.6 Justification for Panel Analysis

Panel-data analysis is appropriate because the study observes multiple Lebanese banks across several years, including pre-crisis and crisis periods. This structure provides more information than a purely cross-sectional design, which would only compare banks at one point in time, or a purely time-series design, which would ignore differences across banks. Panel data allow the study to account for both bank-level heterogeneity and temporal changes in profitability. This is important in the Lebanese banking context because banks may differ in size, capitalization, liquidity, operating efficiency, risk exposure, and resilience to national shocks. These differences may affect profitability independently of national crises. Panel regression

helps control for such heterogeneity and improves estimation efficiency by using repeated observations for each bank. Standard econometric texts emphasize that panel data provide richer information, greater variability, and improved ability to control for unobserved heterogeneity compared with cross-sectional or time-series data alone (Baltagi, 2005; Hsiao, 2003; Wooldridge, 2010). Panel methods are also widely used in banking profitability research. Athanasoglou et al. (2008) use panel methods to examine bank-specific, industry-specific, and macroeconomic determinants of bank profitability. Dietrich and Wanzenried (2011) examine bank profitability before and during the financial crisis using bank-level panel data. Menicucci and Paolucci (2016) use an unbalanced panel of European banks to investigate profitability determinants. Horobeç et al. (2021) also apply GMM panel-data estimates to examine the determinants of bank profitability in Central and Eastern European countries. These studies support the suitability of panel analysis for the present manuscript because bank profitability is shaped by both internal bank characteristics and macroeconomic or crisis-related conditions.

4 Results

Table 2 presents the descriptive statistics for all variables used in the analysis. The findings indicate that the average return on assets (ROA) among Lebanese banks during the study period was negative (mean = -0.005), suggesting that the banking sector experienced weak asset profitability during the examined years. Similarly, return on equity (ROE) recorded a negative average value (mean = -0.037), indicating that shareholders' returns were adversely affected during the period characterized by severe economic and financial instability. The negative profitability indicators are consistent with the prolonged banking distress, sovereign debt crisis, currency depreciation, and liquidity shortages experienced in Lebanon after 2019. The crisis-related dummy variables demonstrate that a substantial portion of the observations falls within crisis periods. The financial crisis variable shows a mean of 0.714, indicating that most observations were recorded after the onset of the Lebanese financial crisis. Likewise, the COVID-19 dummy recorded a mean of 0.571, reflecting the significant representation of pandemic years in the sample. The Beirut Port explosion dummy has a lower mean (0.143), as the variable captures a shorter event-specific period centered around 2020. Regarding bank-specific characteristics, capital adequacy (CA) recorded an average value of 0.10, suggesting that Lebanese banks maintained approximately 10% equity relative to assets during the study period. Bank size exhibited relatively limited variation, indicating that the sampled banks were somewhat comparable in terms of total asset scale.

Liquidity displayed moderate dispersion across observations, reflecting differences in banks' ability to maintain liquid assets during crisis conditions. Leverage demonstrated high average values, which is expected in banking institutions given the reliance on deposits and liabilities as primary funding sources. Operational efficiency recorded the highest standard deviation among the continuous variables, indicating substantial heterogeneity in cost structures and operational performance across Lebanese banks during the crisis period. Overall, the descriptive statistics provide

preliminary evidence of financial distress and profitability deterioration within the Lebanese banking sector during the examined national crises.

TABLE 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
roa	35	-.005	.015	-.057	.015
roe	35	-.037	.139	-.431	.164
financial crisis	35	.714	.458	0	1
covid	35	.571	.502	0	1
beirut explosion	35	.143	.355	0	1
ca	35	.1	.021	.072	.173
bank size	35	10.229	.337	9.537	10.672
liquidity	35	.408	.17	.043	.739
leverage	35	.9	.021	.827	.928
efficiency	35	-1.82	7.759	-42.222	4.946

Table 3 reports the pairwise correlation coefficients among the study variables. The results show that ROA is negatively correlated with the Lebanese financial crisis (-0.631) and COVID-19 (-0.543), providing initial support for the argument that national crises adversely affected bank profitability. These correlations suggest that profitability declined during periods characterized by financial instability and pandemic-related disruptions. In contrast, the correlation between ROA and the Beirut Port explosion is relatively weak (-0.063), implying that the immediate profitability effect of the explosion may have been less pronounced or more heterogeneous across banks. Capital adequacy (CA) is negatively associated with ROA (-0.549), which may initially appear counterintuitive. However, this relationship may reflect the crisis-driven deterioration in profitability among banks that attempted to preserve capital buffers during periods of financial distress. In banking literature, higher capitalization during crisis periods may sometimes coincide with lower short-term profitability because banks adopt more conservative lending and risk-management strategies. The results further indicate a perfect negative correlation between capital adequacy and leverage (-1.000), which is expected because both variables capture closely related balance-sheet structures. This finding suggests

potential multicollinearity concerns if both variables are included simultaneously in the same regression specification. Therefore, caution should be exercised when interpreting models containing both indicators. Bank size demonstrates a positive correlation with ROA (0.320), implying that larger banks may possess greater resilience, diversification capacity, or operational advantages during crisis periods. Liquidity exhibits a weak relationship with profitability, suggesting that liquidity alone may not have been sufficient to offset the severe macroeconomic and banking-sector disruptions experienced in Lebanon. Overall, the correlation matrix provides preliminary evidence consistent with the study hypotheses while also indicating the importance of multivariate panel estimation to isolate the independent effects of national crises on bank profitability.

TABLE 3: Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) roa	1.000								
(2) financial_crisis	- 0.631	1.000							
(3) covid	- 0.543	0.730	1.000						
(4) beirut_explosion	- 0.063	0.258	0.354	1.000					
(5) ca	- 0.549	0.359	0.476	0.001	1.000				
(6) bank_size	0.320	- 0.169	- 0.182	- 0.034	- 0.332	1.000			
(7) liquidity	- 0.022	0.267	0.209	- 0.044	0.177	0.310	1.000		
(8) leverage	0.549	- 0.359	- 0.476	- 0.001	- 1.000	0.332	- 0.177	1.000	
(9) efficiency	- 0.175	- 0.063	- 0.161	0.201	- 0.149	- 0.170	- 0.392	0.149	1.000

Table 4 presents the panel regression results examining the impact of national crises on return on assets (ROA). The findings consistently indicate that both the Lebanese financial crisis and COVID-19 had significant negative effects on bank profitability across multiple estimation techniques. The pooled regression results show that the Lebanese financial crisis reduced ROA significantly at the 1% level. The coefficient

remains negative and statistically significant in the random-effects specification, suggesting robustness across estimation methods. These findings support Hypothesis 1 and indicate that the onset of the financial crisis substantially weakened banks' ability to generate profits from their asset base. The results are theoretically consistent with Financial Intermediation Theory and Credit Risk Theory, as the crisis disrupted liquidity transformation, lending activity, depositor confidence, and borrower repayment capacity. Similarly, the COVID-19 dummy variable exhibits a statistically significant negative effect on ROA in both pooled and random-effects models. The results support Hypothesis 2 and suggest that the pandemic intensified profitability pressures already affecting Lebanese banks. The pandemic likely reduced economic activity, increased credit risk, weakened borrower repayment capacity, and constrained banking operations during an already fragile financial environment. In contrast, the Beirut Port explosion variable does not demonstrate statistical significance across the reported models. Although the coefficient signs vary slightly, the findings suggest that the explosion did not produce a statistically distinguishable immediate effect on ROA after controlling for other factors. One possible explanation is that the banking sector was already severely weakened by the financial crisis and COVID-19 before the explosion occurred, making it difficult to isolate the incremental profitability effect of the disaster. Another explanation is that the impact may have varied across banks depending on geographic exposure, collateral structure, and operational resilience. Among the control variables, operational efficiency (OE) demonstrates a consistently negative and statistically significant coefficient in several models. This indicates that worsening operational inefficiency contributed to lower profitability during the crisis period. Bank size becomes positive and statistically significant in the fixed-effects specification, suggesting that larger banks may have benefited from diversification advantages, stronger market positioning, or superior crisis-management capacity. The Hausman test results indicate that random effects are appropriate for the financial crisis and COVID-19 models, whereas fixed effects are preferred for the Beirut explosion specification. Overall, the results provide strong evidence that major national crises, particularly the Lebanese financial collapse and COVID-19 pandemic, significantly deteriorated Lebanese banks' asset profitability.

TABLE 4. Panel and Regression Results for ROA

	(1)	(2)	(3)	(4)	(5)	(6)
	Pooled for financial crisis	Pooled for Covid	Pooled for explosio n	RE Financia l Crisis	RE Covid	FE explosio n
Lebanese financial/bankin g crisis dummy: 1 from 2019 onward	-0.0205***			-0.0173***		

	(0.00274)			(0.00379)		
BS	0.00819	0.00918	0.0159**	0.00152	0.00353	0.0966
	(0.00569)	(0.00578)	(0.00660)	(0.00508)	(0.00560)	(0.0525)
LiqR	0.00160	-0.00660	-0.0186	0.00795	-0.000783	-0.0151
	(0.0140)	(0.0133)	(0.0180)	(0.0119)	(0.0126)	(0.0199)
OE	-0.000347	-	-0.000378	-	-	-0.000461
		0.000502*		0.000446*	0.000560*	
	(0.000205)	(0.000253)	(0.000269)	(0.000258)	(0.000312)	(0.000319)
))))))
COVID-19 dummy: 1 for 2020-2021		-0.0161***			-0.0119**	
		(0.00390)			(0.00484)	
Beirut Port Explosion dummy: 1 in 2020			-0.000951			0.00210
			(0.00603)			(0.00568)
LR				0.295	0.277	0.260
				(0.215)	(0.228)	(0.240)
Constant	-0.0753	-0.0878	-0.160**	-0.278*	-0.284*	-1.223*
	(0.0571)	(0.0581)	(0.0669)	(0.153)	(0.166)	(0.460)
Hausman				RE	RE	FE
Observations	35	35	35	35	35	35

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5 reports the regression results using return on equity (ROE) as the dependent variable. The findings largely confirm the results obtained using ROA and provide additional evidence regarding the adverse effect of national crises on shareholder returns. The Lebanese financial crisis variable exhibits a strong

negative and statistically significant relationship with ROE across both pooled and random-effects models. The magnitude of the coefficients suggests that the crisis substantially eroded shareholder value and equity-based profitability. This finding supports Hypothesis 1 and reflects the severe deterioration in the Lebanese banking environment following the onset of the sovereign debt crisis, liquidity shortages, and currency collapse. COVID-19 also demonstrates a significant negative effect on ROE across the estimated models, supporting Hypothesis 2. The pandemic likely amplified existing financial-sector vulnerabilities by reducing economic activity, weakening credit quality, and increasing uncertainty within the banking system. The stronger magnitude observed in the ROE models compared with ROA suggests that shareholder returns were more severely affected than asset-based profitability measures during the crisis period. Consistent with the ROA estimations, the Beirut Port explosion variable remains statistically insignificant. Although the explosion represented a major national disaster, its isolated effect on bank profitability may have been overshadowed by the broader and more persistent financial and pandemic crises already affecting Lebanon during the same period. Bank size exhibits a positive and statistically significant relationship with ROE in the fixed-effects model, indicating that larger banks may have possessed stronger resilience mechanisms, diversified income structures, or greater ability to absorb crisis-related shocks. Operational efficiency also shows a negative relationship with profitability, further highlighting the importance of cost management during periods of economic distress. The findings suggest that Lebanese banks experienced substantial deterioration in both asset-based and equity-based profitability during the examined crisis periods. The consistency between the ROA and ROE estimations strengthens the robustness of the empirical evidence and confirms the destabilizing effect of prolonged national crises on banking-sector performance.

TABLE 5. Panel Regression Results for ROE

	(1)	(2)	(3)	(4)	(5)	(6)
	Pooled for financial crisis	Pooled for Covid	Pooled for explosion	RE Financial Crisis	RE Covid	FE explosion
Lebanese financial/banking crisis dummy: 1 from 2019 onward	-0.220***			-0.211***		
	(0.0292)			(0.0355)		

BS	0.0594 (0.0520)	0.0663 (0.0589)	0.142** (0.0645)	0.0417 (0.0407)	0.0663 (0.0453)	1.237* (0.479)
LiqR	0.110 (0.130)	0.0199 (0.112)	-0.104 (0.156)	0.127 (0.0865)	0.0199 (0.0957)	-0.108 (0.175)
OE	-0.00262 (0.00172)	- 0.00427* (0.00228)	-0.00278 (0.00223)	-0.00289 (0.00198)	-0.00427 (0.00278)	-0.00348 (0.00299)
COVID-19 dummy: 1 for 2020-2021		-0.145*** (0.0479)			-0.145*** (0.0472)	
CA		-0.572 (1.679)				
Beirut Port Explosion dummy: 1 in 2020			-0.0286 (0.0529)			0.00961 (0.0448)
LR				0.785 (1.735)	0.572 (1.869)	0.275 (2.034)
Constant	-0.538 (0.521)	-0.591 (0.677)	-1.445** (0.656)	-1.076 (1.258)	-1.162 (1.392)	-12.91** (4.133)
Hausman				RE	RE	FE
Observations	35	35	35	35	35	35

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6 presents the moderation results examining whether capital adequacy (CA) conditions the relationship between national crises and bank profitability. The analysis uses two profitability measures, namely return on equity (ROE) and return on assets (ROA). The interaction terms, reported as M Financial crisis, M Covid, and M Beirut explosion, capture the moderating effect of capital adequacy on the relationship between each crisis event and bank profitability. The results show that capital adequacy has a positive and statistically significant direct effect on both ROE and ROA. The coefficient of CA is positive and significant at the 1% level in the ROE model ($\beta = 3.339$, $p < 0.01$) and the ROA model ($\beta = 0.396$, $p < 0.01$). This indicates that, in general, better-capitalized Lebanese banks achieved stronger profitability outcomes during the sample period. The finding supports the view that capital buffers enhance banking resilience by improving banks' ability to absorb losses, preserve solvency, and maintain confidence during periods of systemic instability.

With respect to the direct crisis effects, the financial crisis variable is negative in both models, but statistically insignificant for ROE and ROA. This suggests that, after including capital adequacy and the interaction terms, the independent direct effect of the financial crisis is no longer statistically distinguishable. This does not necessarily mean that the Lebanese financial crisis had no effect on profitability. Rather, it suggests that part of its impact may be absorbed through the interaction structure of the model and through bank-specific financial characteristics, particularly capitalization, size, liquidity, and efficiency. The interaction term between capital adequacy and the financial crisis is also statistically insignificant in both models. The coefficient is positive but insignificant in the ROE model ($\beta = 1.738$, $p > 0.10$) and negative but insignificant in the ROA model ($\beta = -0.044$, $p > 0.10$). Therefore, the results do not provide sufficient evidence that capital adequacy significantly moderated the relationship between the Lebanese financial crisis and bank profitability.

This finding may reflect the severity of the Lebanese banking collapse, where even better-capitalized banks were exposed to systemic liquidity restrictions, sovereign default, exchange-rate collapse, and widespread depositor distrust. Under such extreme conditions, capital adequacy alone may not have been sufficient to offset the profitability consequences of the financial crisis. The COVID-19 variable reports a positive and statistically significant direct coefficient in both the ROE model ($\beta = 0.594$, $p < 0.05$) and the ROA model ($\beta = 0.070$, $p < 0.01$). However, this result should be interpreted jointly with the interaction term. The interaction between COVID-19 and capital adequacy is negative and statistically significant in both models, with coefficients of -6.730 for ROE and -0.777 for ROA, both significant at the 1% level. This indicates that capital adequacy negatively moderated the relationship between COVID-19 and bank profitability. In practical terms, the profitability effect of COVID-19 becomes weaker, or more adverse, as capital adequacy increases.

This result suggests that, during the COVID-19 period, banks with higher capital

adequacy may have adopted more conservative strategies, reduced risk-taking, limited credit expansion, or prioritized balance-sheet protection over profitability generation. Therefore, although capital adequacy has a positive direct association with profitability, its interaction with COVID-19 indicates that higher capitalization did not necessarily strengthen profitability during the pandemic. Instead, capital adequacy may have functioned as a defensive buffer that preserved stability at the expense of short-term profitability.

This interpretation is consistent with the argument that capital adequacy may act as a resilience mechanism rather than a direct profit-enhancing mechanism under crisis conditions. For the Beirut Port explosion, the direct effect is negative and statistically significant in the ROA model ($\beta = -0.057$, $p < 0.05$), while it is negative but statistically insignificant in the ROE model ($\beta = -0.369$, $p > 0.10$). This suggests that the explosion had a more immediate and detectable effect on asset-based profitability than on equity-based profitability.

The negative ROA effect is consistent with the expectation that the explosion damaged business activity, weakened borrower repayment capacity, impaired collateral values, and reduced banks' capacity to generate returns from their asset base. Importantly, the interaction between capital adequacy and the Beirut Port explosion is positive and statistically significant in both models. The coefficient is positive and marginally significant in the ROE model ($\beta = 4.152$, $p < 0.10$) and positive and significant at the 5% level in the ROA model ($\beta = 0.615$, $p < 0.05$). This indicates that capital adequacy positively moderated the relationship between the Beirut Port explosion and bank profitability. In other words, banks with stronger capital adequacy were better able to mitigate the negative profitability consequences associated with the explosion. This finding supports Capital Buffer Theory, which argues that stronger capital positions allow banks to absorb unexpected losses and maintain operational resilience during sudden catastrophic shocks. The control variables also provide meaningful insights. Bank size is positive and statistically significant in both models, indicating that larger banks achieved better profitability outcomes.

This may reflect economies of scale, stronger diversification capacity, broader client bases, and greater resilience during crisis periods. Liquidity is also positive and statistically significant in the ROE model and marginally significant in the ROA model, suggesting that liquidity strength contributed positively to bank profitability and resilience. Operational efficiency is negative, as expected, although its statistical significance is limited, indicating that operational inefficiencies may weaken profitability but do not consistently dominate the models once crisis and moderation effects are included.

The model statistics indicate acceptable explanatory power. The between R-squared values are 0.694 for ROE and 0.727 for ROA, while the within R-squared values are 0.662 and 0.702, respectively. These values suggest that the models explain a substantial proportion of both cross-bank and within-bank variation in profitability. The number of observations is 35, consistent with the balanced panel

structure of five Lebanese banks observed over seven years. the moderation results provide partial support for the moderating role of capital adequacy.

Capital adequacy does not significantly moderate the relationship between the financial crisis and profitability, suggesting that the systemic nature of Lebanon's financial collapse may have limited the protective role of capital buffers. In contrast, capital adequacy negatively moderates the COVID-19-profitability relationship, implying that better-capitalized banks may have prioritized prudence and balance-sheet protection during the pandemic rather than profitability expansion.

Most importantly, capital adequacy positively moderates the effect of the Beirut Port explosion, indicating that stronger capital buffers helped banks absorb the profitability consequences of a sudden disaster shock. These findings suggest that the protective role of capital adequacy is crisis-specific and depends on the nature, duration, and transmission channels of the shock.

TABLE 6. Moderation Results

roe	ROE		ROA	
	Coef.	P value	Coef.	P value
ca	3.339	0***	.396	0***
Financial Crisis	-.356	.191	-.013	.524
M Financial crisis	1.738	.531	-.044	.835
COVID-19	.594	.016**	.07	.001***
M Covid	-6.73	.003***	-.777	0***
beirut_explosion	-.369	.104	-.057	.024**
M beirut_explosion	4.152	.052*	.615	.012**
bank_size	.102	0***	.01	.004***
liquidity	.149	.001***	.012	.053*
efficiency	-.003	.156	0	.061*
Constant	-1.284	0***	-.131	.001***

Prob > chi2	-0.037	-0.005
R-squared between	0.694	0.727
Chi-square	31	12
R-squared within	0.662	0.702
SD dependent var	0.139	0.015
Number of obs	35	35

*** p<.01, ** p<.05, * p<.1

5 Discussion

This study examined how Lebanon's financial crisis, COVID-19, and the Beirut Port explosion affected bank profitability and whether capital adequacy moderated these relationships. The findings show that the Lebanese financial crisis and COVID-19 exerted significant adverse effects on both ROA and ROE in the baseline models, whereas the Beirut Port explosion produced weaker and less consistent direct effects. The moderation results further indicate that capital adequacy does not operate as a uniform protective mechanism; rather, its effect varies according to the type and transmission channel of each crisis. These findings are consistent with the theoretical foundation of the study, particularly Financial Intermediation Theory, Credit Risk Theory, and Capital Buffer Theory, which explain how crises disrupt liquidity transformation, increase borrower default risk, and test the resilience of bank capital buffers.

The negative and statistically significant effect of the Lebanese financial crisis on ROA and ROE confirms that systemic financial instability severely weakened Lebanese banks' profitability. This result is consistent with Financial Intermediation Theory, which suggests that banks depend on deposit mobilization, liquidity transformation, credit allocation, and depositor confidence to generate income (Diamond & Dybvig, 1983; Molnár, 2018; Freimanis & Šenfelde, 2019). In Lebanon, the crisis disrupted these core banking functions through liquidity restrictions, currency depreciation, sovereign default exposure, deposit freezes, and declining public confidence. The finding also aligns with Credit Risk Theory, as crisis conditions weaken borrowers' repayment capacity and increase default risk (Merton, 1974; Thapa & Sejuwal, 2023; Al Zaidanin & Al Zaidanin, 2021). Empirically, the result confirms Alnabulsi et al. (2023), who find that non-performing loans reduce net interest margins in MENA banks, and Zaiane and Moussa (2021), who show that banking profitability in the MENA region is sensitive to financial crisis and political instability. It is also consistent with Horobeř et al. (2021), who demonstrate that macroeconomic instability, asset quality, and capital-related factors shape bank profitability. Therefore, the present findings support the dominant view that financial

crises reduce bank profitability by compressing income-generating capacity, increasing credit risk, and weakening intermediation activity. The COVID-19 findings also confirm the expected adverse effect of pandemic-related disruption on banking profitability. The negative and significant coefficients for COVID-19 in the ROA and ROE models suggest that the pandemic intensified profitability pressures in the Lebanese banking sector. This result is consistent with Katusiime (2021), who reports that COVID-19 reduced bank profitability in Uganda, and Rekha and Hossain (2022), who document a negative effect of the pandemic on commercial banks in Bangladesh. It also supports Rohman and Nurkhin (2023), who show that profitability during COVID-19 was influenced by credit-risk conditions, and Amir and Choudhury (2023), who find that non-performing loans affected lending behavior before and during the pandemic. In the Lebanese context, COVID-19 occurred during an already severe financial and banking crisis, meaning that the pandemic did not act as an isolated shock but amplified pre-existing vulnerabilities. This finding confirms the argument that pandemic shocks weaken profitability through reduced economic activity, lower credit demand, weaker borrower solvency, and increased provisioning needs (Chand et al., 2023; Harb et al., 2022). The Beirut Port explosion produced more mixed results. In the baseline models, its direct effect on ROA and ROE was not statistically significant, although the moderation model showed a negative and significant effect on ROA. This partially supports the expected negative relationship but suggests that the explosion's banking-sector impact may have been indirect, delayed, or heterogeneous across banks. The result partly contrasts with the expectation derived from the Beirut Rapid Damage and Needs Assessment (2020) and the Lebanon Reform, Recovery, and Reconstruction Framework (2020), both of which document extensive physical, economic, and infrastructure damage following the explosion. However, the insignificant baseline findings are explainable because the explosion occurred during an already severe financial crisis and the COVID-19 pandemic, making its isolated effect difficult to identify statistically. The result is also consistent with Bastan et al. (2023), who argue that the effects of major disruptions depend on business-continuity capacity and institutional resilience, and with Harb et al. (2022) and Hakimi et al. (2020), who emphasize that liquidity risk, credit risk, and risk-management quality condition bank performance during stress periods.

The moderation results provide additional insight into the role of capital adequacy. Capital adequacy has a positive and significant direct effect on both ROA and ROE, suggesting that better-capitalized banks generally achieved stronger profitability outcomes. This finding is consistent with Capital Buffer Theory, which argues that capital buffers enhance banks' capacity to absorb losses, maintain solvency, and preserve stability during adverse conditions (Marcus, 1984; Jokipii & Milne, 2011; Pratama et al., 2021; Gospodarchuk, 2019). It also aligns with Badr and Ahmadi (2018), who emphasize the relevance of capitalization for Lebanese banks under Basel III, and with IMF assessments that highlight capital and prudential soundness as central to banking-sector stability in Lebanon (International Monetary Fund, 2010, 2017). However, the interaction results indicate that the moderating effect of capital adequacy is crisis-specific. The interaction between capital adequacy and the financial

crisis is statistically insignificant, suggesting that capital buffers did not significantly reduce the profitability impact of Lebanon's systemic financial crisis. This finding partially contradicts Capital Buffer Theory, but it is understandable given the exceptional severity of the Lebanese crisis. When banks face simultaneous liquidity restrictions, currency collapse, sovereign default exposure, and depositor distrust, capital adequacy alone may be insufficient to preserve profitability. This interpretation is consistent with studies showing that capital-profitability relationships are conditional and may vary across institutional and crisis environments (Alnajjar & Othman, 2021; Alfouhaili et al., 2020; Zaiane & Moussa, 2021, Alslaibi & Daraghme 2022). For COVID-19, the interaction between capital adequacy and the pandemic is negative and statistically significant for both ROA and ROE. This indicates that higher capital adequacy did not strengthen profitability during the pandemic; instead, better-capitalized banks may have adopted more conservative strategies, reduced risk-taking, increased provisions, or prioritized solvency over short-term returns. This finding contradicts a simple protective-buffer expectation but aligns with evidence that capital regulation and bank profitability can interact in complex and sometimes non-linear ways (Alfouhaili et al., 2020; Alnajjar & Othman, 2021). It is also consistent with Harb et al. (2022), who show that the relationship between risk management and performance depends on the interaction between liquidity and credit risk. By contrast, the interaction between capital adequacy and the Beirut Port explosion is positive and statistically significant for both profitability measures. This indicates that better-capitalized banks were more capable of mitigating the adverse profitability consequences of the explosion. This finding supports Capital Buffer Theory more directly, as sudden disaster shocks require banks to absorb unexpected losses and maintain operational continuity (Marcus, 1984; Jokipii & Milne, 2011; Gospodarchuk, 2019, Alslaibi, 2024a). It is also consistent with Bastan et al. (2023), who emphasize the importance of resilience and continuity policies in protecting banks from major disruptions. Therefore, while capital adequacy did not significantly buffer the prolonged systemic financial crisis and negatively moderated the COVID-19 relationship, it appears to have played a protective role during the sudden catastrophic shock of the Beirut Port explosion.

6 Conclusion

This study examines the effect of major national crises on Lebanese bank profitability, focusing on the Lebanese financial crisis, COVID-19, and the Beirut Port explosion. We also assess whether capital adequacy moderates the relationship between these crises and bank profitability. Using panel data from five Lebanese banks over the period 2017–2023, the findings show that the Lebanese financial crisis and COVID-19 had significant negative effects on both return on assets (ROA) and return on equity (ROE). These results indicate that systemic financial instability and pandemic-related disruption substantially weakened Lebanese banks' ability to generate profits from assets and shareholders' equity. The Beirut Port explosion showed weaker and less consistent direct effects, although the moderation results suggest that its adverse effects

became more evident when capital adequacy was considered. Moderation analysis further shows that capital adequacy does not operate as a uniform protective mechanism. It did not significantly moderate the relationship between the financial crisis and profitability, negatively moderated the COVID-19–profitability relationship, and positively moderated the Beirut Port explosion–profitability relationship. These findings suggest that the role of capital adequacy depends on the nature, duration, and transmission mechanisms of each crisis.

From a practical perspective, the findings have important implications for bank managers, regulators, and policymakers in Lebanon and other crisis-prone economies. First, banks should strengthen crisis-preparedness frameworks by improving liquidity management, credit-risk monitoring, operational efficiency, and stress-testing practices. The negative effect of the financial crisis and COVID-19 indicates that profitability becomes highly vulnerable when banks face simultaneous liquidity pressure, borrower distress, and macroeconomic instability. Second, regulators should not treat capital adequacy as the only indicator of bank resilience. Although capital buffers are important, the findings show that capital adequacy alone may not protect banks under prolonged systemic crises involving sovereign default, currency collapse, and depositor distrust. Therefore, regulatory supervision should combine capital adequacy requirements with liquidity safeguards, asset-quality monitoring, governance reforms, and credible crisis-resolution mechanisms. Third, the positive moderating role of capital adequacy during the Beirut Port explosion suggests that stronger capital buffers can help banks absorb sudden disaster-related shocks. This highlights the importance of maintaining adequate capital reserves, particularly in economies exposed to political instability, natural disasters, infrastructure shocks, and repeated macroeconomic disruptions.

Theoretically, the findings provide mixed but meaningful support for the three theoretical perspectives used in the study. Financial Intermediation Theory is largely confirmed, as the negative effects of the financial crisis and COVID-19 show that profitability declines when banks' core intermediation functions are disrupted. In Lebanon, deposit mobilization, lending activity, liquidity transformation, and borrower monitoring were all weakened by crisis conditions, which supports the argument that banks' profitability depends on the effective functioning of financial intermediation. Credit Risk Theory is also confirmed, as the results indicate that crises reduce profitability by weakening borrowers' repayment capacity, increasing default risk, and pressuring bank asset quality. This is especially evident in the negative profitability effects associated with the financial crisis and COVID-19. Capital Buffer Theory is partially confirmed and partially challenged. It is confirmed in the case of the Beirut Port explosion, where capital adequacy positively moderated the crisis–profitability relationship, indicating that stronger capital positions helped banks absorb a sudden catastrophic shock. However, the theory is challenged in the case of the financial crisis and COVID-19. Capital adequacy did not significantly moderate the financial crisis effect, and it negatively moderated the COVID-19 effect. This

suggests that capital buffers may protect stability but do not always preserve profitability, particularly when banks respond to crisis conditions by becoming more conservative, reducing risk-taking, or prioritizing solvency over short-term returns.

Despite its contributions, this study has some limitations. First, the sample is limited to five Lebanese banks and 35 bank-year observations, which restricts the generalizability of the results and limits the statistical power of estimations. Second, the study relies on accounting-based profitability measures, namely ROA and ROE, which may not fully capture the broader dimensions of bank stability, market confidence, asset quality, or liquidity stress. Third, capital adequacy is proxied by the equity-to-assets ratio because detailed regulatory capital adequacy data are not consistently available across all banks and years. Fourth, the Beirut Port explosion was measured using a dummy variable, which may not fully capture the variation in banks' actual exposure to damaged borrowers, affected geographic areas, collateral losses, or trade-related disruptions. Finally, because this study examines overlapping crises in a small banking system, it is difficult to fully isolate the independent effect of each crisis.

Future research can extend this study in several ways. First, future studies may use a larger sample of Lebanese banks or include comparable crisis-affected banking systems in the MENA region to improve generalizability. Second, researchers may incorporate additional bank-risk indicators, such as non-performing loans, loan-loss provisions, deposit growth, liquidity coverage, capital adequacy ratios, and credit contraction measures. Third, future work may examine the Beirut Port explosion using more granular exposure-based variables, such as banks' geographic exposure to Beirut, sectoral loan concentration, collateral damage, or client exposure to affected industries. Fourth, future studies may apply alternative methodologies, including dynamic panel models, difference-in-differences designs, or crisis-event study approaches, where data availability permits. Finally, future research could investigate whether governance quality, ownership structure, political connectedness, digital banking capacity, or risk-management practices influence banks' ability to withstand national crises. Such extensions would provide a deeper understanding of how banks in fragile economies can build resilience under repeated and overlapping shocks.

Declarations

Funding

This research received no external funding. The article processing charge (APC) was waived by the publisher.

Conflict of Interest

The authors declare that they have no competing interests.

Ethics Approval:

Not applicable.

Consent to Participate:

Not applicable.

Consent for Publication:

Not applicable.

Data Availability

Data is available from the corresponding author upon reasonable request.

Authors' Contributions

The author FS contributed to Conceptualization; Methodology; while MS contributed to Data collection; Formal analysis; Writing – original draft; while FA contributed to Writing – review and editing

Clinical trial number

Not applicable.

Use of Artificial Intelligence

The authors declare that generative artificial intelligence (AI) tools were used only to assist with language editing and clarity of expression during the preparation of the manuscript. The authors reviewed and edited all AI-assisted outputs and take full responsibility for the content, interpretation, and conclusions of the manuscript. No AI tools were used to generate, manipulate, or analyse the research data, nor to produce the study's scientific results.

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