Future Business Journal

RESEARCH Open Access

GCC banks liquidity and financial performance: does the type of financial system matter?

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Abstract

This study examines whether the type of financial structure in the GCC influences the relationship between liquidity risk and banks' performance from 2007 to 2021. By employing fixed effects and fully modified ordinary least squares (FMOLS), we find that the impact of liquidity risk on bank profitability differs among bank-based and market-based systems. Specifically, the results show that the profitability of banks operating in bank-based countries is positively influenced by the liquidity risk compared to their counterparts. The study also demonstrates that the global financial crisis increases banks' profitability in the bank-based financial system. Furthermore, the results show that gross domestic product growth (GDPG) determines banks' financial profitability in the banks-based market. This study offers some important implications for policymakers to consider the type of financial system to stimulate bank stability.

Keywords Liquidity risk, Banks, Financial performance, Financial system, COVID-19, GCC

JEL classification G20, G21

Introduction

Using short-term liabilities to increase the investment in fixed assets may expose banks to funding liquidity risk, which is considered a significant threat to bank stability [57]. Hence, it is recommended that the policymakers of the banks must retain a liquidity buffer to decrease liquidity risk [65]. Regulatory and bank supervisory circles, such as an international regulatory framework for banks, proposed the liquidity coverage ratio to mitigate this concern. This ratio requires banks to hold highly liquid assets to cover the estimated cash outflow. However, the link among liquidity risk and bank stability has become increasingly important in the accounting and finance literature.

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The Gulf Cooperation Council (GCC) banking system has grown significantly over the last two decades and represents the backbone of the financial system, which banks dominate. Total assets in the Gulf banks reached $2.6 trillion, which is equivalent to about 180% of GDP in these countries at the end of 2020, compared to $1.6 trillion or 102% of GDP in 2013. The banking systems in Gulf countries play a significant role in the financial stability of these countries [29]. With the recent drop in the price of oil, banks in the region are exposed to higher levels of risk, which could extend into a broader range in the economy [33]. Furthermore, despite the generally good level of capitalization in GCC banks, it is challenging to diversify portfolios credit in these banks due to the prevailing economic structure in the GCC countries, which exposes them to risks calls for a greater degree of scrutiny [35].

Several studies assessed the relationship between liquidity risk, bank stability, and performance [20, 46, 66]. According to these studies, liquidity risk not only affects the bank's performance but also significantly impacts the

bank's reputation. In this context, liquidity may affect the bank depositors' confidence if the funds are not provided to bank depositors on time, which will influence the bank's stability. However, these studies' findings reveal mixed evidence on the relationship between liquidity and profitability in the banking industry.

Moreover, the recent bankruptcy of some global banks, especially Lehman Brothers in 2008, directed researchers toward focusing on the impact of the 2008–2009 financial crises on liquidity risk-bank stability [35]. Several studies revealed that financial crisis positively impacts bank profitability [e.g., 28, 21]. While others demonstrated the opposite effect [18, 27], the global health crisis associated with the COVID-19 pandemic has tremendously affected the performance of many institutions [69]. The spread of this pandemic led to a steep decline in economic development worldwide [42]. Several studies assessed the impact of COVID-19 on the financial markets [22, 42, 62].

Prior research has not considered the impact of financial structure on the relationship between liquidity risk and the financial performance of the banking sector in GCC countries. Chen et al. [18] and Bats and Houben [14] demonstrated the importance of financial structure in explaining the inclusive findings in the banking sector. Earlier studies report that Gulf countries are not under a single financial structure. In this context, Saudi Arabia, Oman, Qatar, and Kuwait are bank-based, while UAE and Bahrain are market-based. This study aims to address this shortcoming of the literature and to strengthen the modest body of evidence on the linkage among liquidity risk and the financial performance of the banking sector in the case of GGC banks while considering the type of financial system (bank-based vs. market-based). Furthermore, the goal of this study is to examine the impact of the financial crisis and COVID-19 on the bank's performance in bank-based and market-based financial system.

Our findings demonstrate that liquidity risk positively impacts bank performance in a bank-based financial system. However, we find no association between liquidity risk and performance in market-based financial systems. These findings could explain the inclusive findings on the linkage between liquidity risk and banks' performance. Moreover, we show that the financial crisis positively increases bank's performance in bank-based countries. Our results also provide no support for the effect of COVID-19 on performance in bank-based financial systems. This finding could be attributed to the role of central banks in GCC in supplying liquidity during the pandemic.

Our study contributes to the existing literature in several ways. First, we demonstrate that the relationship between liquidity risk and a bank's profitability is influenced by the financial structure. More specifically, we find that the effect of liquidity on a bank's performance is more obvious in bank-based financial system. Chen et al. [19] and Bats and Houben [14] argued that the type of financial system may explain some variations of the inclusive findings in banking literature. To the best of our knowledge, no empirical study focused on the linkage between liquidity risk and the financial performance of the banking sector in GCC countries by taking into account the type of financial system. Second, the current study contributes to the literature in terms of focusing on the importance of liquidity management of GCC banks and its role as a critical factor in the continuity and ability of banks to operate in a competitive environment.

Third, this study further explains inclusive findings on the impact of liquidity risk, financial crisis, and COVID-19 on the bank's performance. Specifically, we show that their effect on performance differs between bank-based and market-based countries. Finally, the study presents valuable recommendations to policymakers in these countries to sustain the bank's performance and stability. That is, the financial structure does matter. Most banks care about liquidity position because it has a powerful impact on banks' capital costs, operations, and activities. On the other hand, recent health or economic crises, such as the 2008 global crisis or the COVID-19 crisis, have increased awareness of the importance of liquidity risk. During these crises, the bank's policymakers have faced a significant challenge in sustaining liquidity across financial markets.

The structure of this paper is organized as follows: The next section presents the relevant literature and the development of hypotheses, followed by the data and methodology section. Subsequently, the following part discusses the findings and the robustness tests. Finally, the last section presents the conclusion, limitations and future works.

Literature review and hypotheses development

Theoretical framework

The bank's liquidity is essential for economic development and market stability. In this context, the bank's liquidity is necessary for economic development and market stability. In this context, the liquidity position is considered one of the internal factors that determine the performance of banks. As a result, banks have to maintain sufficient liquidity to meet customers' needs and reduce financial risks [19]. Liquidity has been defined by Kalimashi et al. [41] as a process of payment of current and long-term obligations of a bank at the optimal time. Jenkinson [39] indicated that liquidity risk means the bank can't meet all depositors' requests either totally or partially on time. Hence, a bank ability to meet its depositors' obligation is an essential factor determining

a bank's performance. The bank's liquidity is necessary for economic development and market stability. The adequate liquidity of a bank is positively affected by the profitability of the bank [24]. According to Hassan et al. [37], liquidity position is considered an internal factor that determines the performance of banks. As a result, banks have to maintain sufficient liquidity to meet customers' needs and reduce financial risks [19].

The adequate liquidity of a bank is positively affected by its profitability [24]. Hassan et al. [37] showed that banks' liquidity is influenced by liquidity risk management, which is considered a crucial factor for banks. Tiwari et al. [62] suggested that a high level of liquidity can positively decrease the cost of capital, which mitigates constraints on bank funds. Chen et al. [18] argued that good risk management is highly relevant to providing better returns to the shareholders. Laminfoday [43] suggested that liquidity risk can affect financial performance and the bank's reputation. Besides, insufficient liquidity in the bank causes erosion in the confidence of the depositors, negatively impacting the bank's performance.

The last economic and health crises increased the importance of liquidity risk to the bank's financial performance and stability. In this context, an important question that needs to be addressed is the impact of economic crises such as the 2008 global financial crisis and the COVID-19 pandemic on bank financial performance and stability. However, the influence of crisis liquidity risk on the bank's performance depends on the nature of the crisis and how this crisis can affect the bank's operations and activities. Chen et al. [18] indicated that country or global financial can significantly affect bank liquidity and performance. According to the authors, a financial crisis can affect the bank's performance if the banks do not adjust the composition of their assets and liabilities to decrease the negative influence of the financial crisis on the liquidity risk. In this context, the study suggests that the bank sector can avoid a financial crisis affecting the bank's performance by increasing its liquid assets or by decreasing the level of credit process to mitigate the negative influence of the financial crisis on banks' liquidity position. Tiwari et al. [62] demonstrated that COVID-19 increased uncertainty in the market, which in turn affected the bank liquidity. In response to uncertainty in the bank's activities during COVID-19, the banks may decrease the credits and financing process, and the investors may be less willing to invest their money in risky assets. Subsequently, this affects the bank's performance.

Liquidity and financial performance

Several empirical studies have assessed the linkage among liquidity risk and banks' performance in different regions and found mixed results. Earlier empirical studies showed that liquidity risk positively affects banks' profitability [13, 47]. Recently, Rudhani and Bala [58] examined the link between liquidity risk and bank performance in Kosovo. The study revealed a positive linkage between liquidity risk and banks' performance. They also documented that the level of performance in commercial banks in Kosovo could be raised by reinforcing their ability to overcome liquidity risk. Ahamed [4] assessed this relationship between 2005 and 2018 in Bangladesh and found bank profitability and liquidity risk are positively correlated.

On the other hand, Musiega et al. [48] and Chowduhry and Zaman [20] reported that liquidity and bank performance are harmful in the case of developing countries. Kalimashi et al. [41] examined the effect of liquidity risk management on the performance of commercial banks in the Western Balkans. They found a negative association between liquidity risk and bank performance. In the case of US, DeYoung and Jang [25] used data from 1992 to 2012 to investigate the influence of liquidity risk on a bank's performance and found an adverse link between bank size and liquidity target. Ariffin [12] assessed the link between liquidity risks and the financial performance of Islamic banks in Malaysia, spanning from 2006–2008, and showed a negative relationship between liquidity risk and the financial performance of Islamic banks in Malaysia. Furthermore, Yahaya et al. [66] examined the influence of liquidity risk on banks' performance in African countries and demonstrated a significant and negative association among liquidity risk and bank performance. Gweyi et al. [34] found that liquidity risk adversely affects bank's performance in Kenya.

More interestingly, Chen et al. [19] investigated the impact of liquidity risk on commercial banks' performance in developed markets over the period from 1994 to 2006. They argued that banking-based and market-based financial systems could explain inclusive findings on the relationship between liquidity risks and profitability. Their results showed that liquidity risk negatively impacts bank profitability in a market-based financial system. However, they found no impact of liquidity risk on profitability in banking-based financial systems. Bats and Houben [14] demonstrated that systemic risk differs between market-based and bank-based financial systems.

Most GCC economies rely heavily on banking finance, and banks have crucial roles in mobilizing savings and promoting investments [47]. Calice et al. [16] demonstrated that Saudi, Oman, Qatar, and Kuwait are bank-based, while UAE and Bahrain are market-based. AlGhazali et al. [6] reported that Oman is a bank-based country. Hence, the relationship between liquidity risk

and a bank's profitability may be affected by the type of financial system, which leads to our first hypothesis:

H1: The linkage between liquidity risk and bank profitability varies across bank-based and market-based countries.

Financial crisis's, COVID-19 and financial performance

Studies on the financial crisis's impact on bank profitability revealed inclusive results. For instance, Dietrich and Wanzenried [28] investigated the determinants of banks' profitability in Switzerland from 1999 to 2009. They found that the financial crisis positively impacted the performance of Switzerland banks. Similarly, Chronopoulos et al. [21] affirmed that banks' profitability has increased during the crisis period. However, Diamond and Rajan [12] indicated that the 2008 crisis reduced the level of credit rates and paid higher rates of interest on deposits. Chen et al. [18] conducted a study in the U.S. in the banking sector from 1969 to 2013 to assess the association between liquidity risk and bank performance in financial crises. Their results showed that during the subprime crisis of 2007–2009, a negative linkage existed among liquidity risk and a bank's probability. Another study by Erfani and Vasigh [30] showed no impact of the 2008 financial crisis on banks' profitability.

Recent studies have been conducted to examine the impact of COVID-19 on liquidity risk in the banking sector. For example, Ji et al. [40] analyzed the impact of the COVID-19 pandemic on risks in the global financial markets. Their findings revealed that global financial market risks have increased substantially in response to the pandemic. Lalinsky and Pál [42] showed that the COVID-19 pandemic affected firms' performance in some European countries. Corbet et al. [22] indicated that financial markets have been the subject of much confusion and uncertainty when attempting to quantify the scale of the effect of this pandemic on the market. Hasan et al. [36] demonstrated that banks respond to COVID-19 by increasing loan spreads, which burden borrowers more. The earlier study by Chen et al. [19] revealed that the determinants of banks' profitability could also be explained by the context of the financial system in which the bank operates. We argue that different financial systems would provide further explanation for the mixed findings regarding the impact of the financial crisis and COVID-19 on banks' profitability. Therefore, we state our second and third hypotheses as follows:

H2: The impact of the financial crisis on GCC banks' profitability varies across bank-based and market-based countries.

H3: The impact of COVID-19 on GCC bank's profitability varies across bank-based and market-based countries.

Additional bank-specific and macroeconomic determinants of bank performance

In addition to the above-mentioned factors that could influence banks' profitability in GCC, enormous empirical studies have included other factors that could impact bank profitability. In this study we identify bank-specific and macroeconomic variables that have been extensively used in the literature.

The bank size is more likely to affect bank efficiency due to economies of scale as suggested by contemporary financial intermediary theory [2, 18, 20, 40]. This would allow banks to leverage their operational expenses, reducing costs and leading to higher profitability. Moreover, Rahman et al. [56] demonstrated that larger banks can easily access the capital market to obtain the required fund in the case of a money shortage, reducing their liquidity risk. Alternatively, Petria et al. [55] argued that bureaucracy is more likely to exist in bigger firms, leading to operational inflexibility and failure to respond to market opportunities. Studies investigating the relationship between bank size and profitability revealed mixed conclusions. Many empirical studies show that bank size positively impacts profitability [2, 7, 51]. However, other works reveal a negative association between the size of the bank and profitability [32, 46]. Other studies found no relationship between the two variables [15, 67].

Banking sector development plays an important role in promoting the country economic development. In this context, Taddese Bekele and Abebaw Degu [60] suggested that more domestic credit form banks to the markets enhanced the country the investment. According to Fang et al. [31] banking sector development contributes not only to economic development but also to banking profitability. In a well-developed banking market, the demand for banking products, both interest and non-interest products, is more likely to grow which positively boosts banks profitability [61]. However, other studies showed that the banking sector's development is affected by the level of concentration. For instance, Fang et al. [31] demonstrated that the risk taken by banks depends on the level of competition in the industry. The banking sector development in Gulf economies has faced significant improvement over the last years. For example, domestic credit as share of the GDP in Qatar increased from 11% in 1975 to 138% in 2020, and from 9 to 90% in case of UAE.

The gross domestic product (GDP) growth rate represents a country's overall economic development, which is considered to impact bank profitability. For example,

Table 1 Variable definitions

Variables	Definitions	Source	Expected sign
Panel A: Dependent variables			
ROA	Net profit after tax/total assets	Refinitiv	
ROE	Net profit after tax/Total equity	Refinitiv	
Panel B: Liquidity risk measures			
TLTA	Total loans scaled by total assets	Refinitiv	+
LIQA	Liquid assets divided by total assets	Refinitiv	+
Deposit Ratio	*Total deposits* divided by *total asset*	Refinitiv	+
Panel C: Other factors			
Size	Natural logarithm of total assets	Refinitiv	±
DBS	Bank sector asset/GDP	Refinitiv	±
GDPG	Annual percentage growth rate of GDP	World Bank	+
Inflation	Consumer price index	IMF	+

during economic growth, banks provide financing for companies and consumers to respond to the higher demand and increase investments. In this context, the level of deposits, loans, and interest on loans are more likely to grow, implying higher bank profitability. Enormous studies demonstrate a positive impact of economic growth on banks' profitability [7, 46, 51]. Therefore, we anticipate a positive relationship between economic growth and profitability.

The relationship between inflation and a bank's profitability depends on the ability of bank to anticipate inflation [19]. For instance, if the inflation rate is correctly anticipated, banks can adjust their interest rates to increase their revenue faster than their cost, implying higher profitability. However, the inability of the bank's management to anticipate the inflation rate will slow the speed of adjusting the interest rate. Furthermore, an increase in interest rate is more likely to be associated with higher bank's revenue, but it might increase the probability of credit default. Many studies find that the inflation rate positively relates to bank profitability [8, 19, 38]. However, other studies reveal no association between inflation and banks' profitability [3, 32].

Data and methodology

The sample of this study consists of all publicly traded banks listed in GCC stock markets (62 banks).[1] The data are obtained from three different sources: Refinitiv Eikon (Datastream), World Bank, and IMF databases. The sample covers the period from 2005 to 2022. We use World Bank and IMF databases to gather the annual percentage growth rate of gross domestic product (GDPG) and the Consumer Price Index (Inflation), respectively. The remaining variables are constructed based on the financial data obtained from Refinitiv Eikon. Banks with missing data are eliminated from our sample. The final sample consists of 905 bank-year observations from 2007 to 2021. The time span of our data enables us to consider the impact of the financial crisis and COVID-19 on the relationship between liquidity and bank performance in the GCC.

This study uses the return on assets (ROA) and return on equity (ROE) to measure banks' performance. ROA is calculated as the net profit after tax over total assets, while ROE equals net profit after tax divided by total equity. These measures have been widely used in the relevant literature as proxies for firms' profitability [e.g., 32, 44, 51].

Liquidity risk is the variable of interest in this study. Empirical studies reveal mixed findings on the relationship between liquidity risk and bank's performance. For instance, Rudhani and Bala [58] and Ahamed [4] demonstrated a positive effect. However, other studies reveal that banks with higher liquidity risk increase bank's profitability [20, 41, 48]. Earlier studies have used different measures of liquidity risks [e.g., 50, 63, 41, 24]. We construct three measures of liquidity risks following recent literature [8, 23, 57]. Total loan to total assets (TLTA), liquid assets to total assets (LIQA), and Deposit Ratio. The definitions of these variables are provided in Table 1.

We add more explanatory variables representing bank-specific factors such as size [20, 40] and bank sector development [31]. Moreover, we control for gross domestic product growth rate [7, 51] and inflation [3, 19]

[1] There are seven stock markets in GCC. Those markets are Bahrain Bourse in Bahrain, Boursa Kuwait in Kuwait, Muscat Stock Exchange(MSX) in Oman, Qatar Stock Exchange (QSE) in Qatar, Saudi Exchange (Tadawul) in Saudi Arabia and Dubai Financial Market (DFM) and Abu Dhabi Stock Exchange (ADX) in UAE.

as macroeconomic determinants. All the variables in this study are winsorized at the 1% and 99% levels to eliminate the effect of outliers.

The panel regression models are specified as follows:

$$\begin{aligned}\text{Performance}_{i,t} =& \alpha + \beta_1 \text{TLTA}_{i,t} + \beta_2 \text{LIQA}_{i,t} \\ &+ \beta_3 \text{DepositRatio}_{i,t} + \beta_4 \text{Size}_{i,t} \\ &+ \beta_5 \text{BSD}_{i,t} + \beta_6 \text{GDPG}_{i,t} \\ &+ \beta_7 \text{Inflation}_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{1}$$

The impact of financial crisis and COVID-19 on liquidity risks and banks performance nexus are investigated using the following models:

$$\begin{aligned}\text{Performance}_{i,t} =& \alpha + \beta_1 \text{Crisis} + \beta_2 \text{TLTA}_{i,t} \\ &+ \beta_3 \text{LIQA}_{i,t} + \beta_4 \text{DepositRatio}_{i,t} \\ &+ \beta_5 \text{Size}_{i,t} + \beta_6 \text{BSD}_{i,t} \\ &+ \beta_7 \text{GDPG}_{i,t} + \beta_8 \text{Inflation}_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{2}$$

$$\begin{aligned}\text{Performance}_{i,t} =& \alpha + \beta_1 \text{Covid} + \beta_2 \text{TLTA}_{i,t} \\ &+ \beta_3 \text{LIQA}_{i,t} + \beta_4 \text{DepositRatio}_{i,t} \\ &+ \beta_5 \text{Size}_{i,t} + \beta_6 \text{BSD}_{i,t} \\ &+ \beta_7 \text{GDPG}_{i,t} + \beta_8 \text{Inflation}_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{3}$$

where $\text{Performance}_{i,t}$ is the bank's profitability measure (ROA or ROE). $\text{TLTA}_{i,t}$, $\text{LIQA}_{i,t}$ and $\text{DepositRatio}_{i,t}$ are liquidity risk measures. $\text{Size}_{i,t}$ and $\text{BSD}_{i,t}$ are bank-specific control variables. $\text{GDPG}_{i,t}$ and $\text{Inflation}_{i,t}$ are macroeconomic determinants. Crisis is financial crisis dummy and Covid is COVID-19 dummy.$\varepsilon_{i,t}$ is the error term and the subscripts i and t indicate the country and time period, respectively.

Table 1 presents the definition of our variables and their sources. The econometric model is developed using panel data regression. The model uses profitability as a dependent variable (ROA, ROE), while liquidity measures are the main independent variables (TLTA, LIQD, and Deposit Ratio). Further, our model controls for internal factors (Size and DSB) and external factors (GDPG and inflation) that affecting liquidity risk in commercial banks. The distribution of our sample is displayed in Table 2.

Table 2 Frequency distribution per country and financial systems

Country	Freq	Percent	Cum
Panel A. Frequency per country			
Bahrain	140	15.47	15.47
Kuwait	146	16.13	31.6
Oman	113	12.49	44.09
Qatar	104	11.49	55.58
Saudi Arabia	148	16.35	71.93
United Arab Emirates	254	28.07	100
Total	**905**	**100**	
Panel B. Frequency of bank-based countries			
Kuwait	146	28.57	28.57
Oman	113	22.11	50.68
Qatar	104	20.35	71.04
Saudi Arabia	148	28.96	100
Total	**511**	**100**	
Panel C. Frequency of market-based countries			
Bahrain	140	35.53	35.53
United Arab Emirates	254	64.47	100
Total	**394**	**100**	

Table 3 Statistical testing to decide the appropriate model

Panel A. Breusch–Pagan–Lagrangian multiplier test	
chibar2 (01)	255.51
Prob > Chibar2	0.000
Panel B. Hausman test	
chi2 (8)	27.31
Prob > chi2	0.0003
Panel C. Heteroscedasticity test	
chi2 (62)	8966.66
Prob > chi2	0.000

Empirical results and discussion

Selecting the appropriate model

Multiple tests are performed to select the appropriate model for our study. First, the Breusch–Pagan–Lagrangian multiplier test is employed to decide between random effects and pooled OLS regression. The result in Panel A of Table 3 reveals a significant difference throughout the years. Hence, OLS regression is inappropriate. Second, we carry out Hausman test to select between random effects and fixed effects regression as stated in Panel B of Table 3. The outcome shows that Prob > chi2 is 0.0003 which is under 5% threshold. This indicates that the fixed effects model is the appropriate model to use in this study.

In addition, an investigation is carried out to determine if the regression suffers from heteroscedasticity [64] by employing modified Wald test for groupwise heteroscedasticity. The outcome is tabulated in Panel C of Table 3, thus negating the presence of the heteroscedasticity issue. As a result, the fixed effects method is used with robust standard errors in all regressions.

Table 4 Descriptive statistic

Variable	N	Mean	Median	Min	Max	SD
Panel A. All Sample						
ROA	905	0.01	0.01	-0.04	0.05	0.01
ROE	905	0.09	0.1	-0.44	0.26	0.09
TLTA	905	0.62	0.63	0.06	0.84	0.13
LIQA	905	0.11	0.1	0.01	0.32	0.07
Deposit ratio	905	0.75	0.78	0.09	0.9	0.13
Size	905	23.32	23.29	20.39	26.03	1.17
BSD	905	1.64	1.18	0.5	4.14	1.05
GDPG	905	2.9	2.93	-8.86	17.99	4.43
Inflation	905	2.62	2.17	-2.54	13.76	3.28
Panel B. Bank-based countries						
ROA	511	0.01	0.01	-0.04	0.05	0.01
ROE	511	0.1	0.11	-0.44	0.26	0.07
TLTA	511	0.64	0.65	0.06	0.84	0.12
LIQA	511	0.11	0.09	0.01	0.32	0.07
Deposit ratio	511	0.77	0.8	0.2	0.9	0.11
Size	511	23.52	23.49	20.39	26.03	1.11
BSD	511	1.26	0.97	0.5	3.21	0.74
GDPG	511	3	2.51	-8.86	17.99	5.13
Inflation	511	2.95	2.68	-2.54	13.76	3.23
Panel C. Market-based countries						
ROA	394	0.01	0.01	-0.04	0.05	0.01
ROE	394	0.08	0.1	-0.44	0.26	0.12
TLTA	394	0.59	0.6	0.06	0.84	0.13
LIQA	394	0.11	0.1	0.01	0.32	0.07
Deposit ratio	394	0.72	0.75	0.09	0.8	0.15
Size	394	23.07	22.86	20.39	26.03	1.21
BSD	394	2.14	1.56	0.85	4.14	1.19
GDPG	394	2.77	3.19	-5.24	8.29	3.32
Inflation	394	2.2	1.62	-2.32	12.25	3.3

Descriptive statistics and correlation matrix

Table 4 displays the descriptive statistics of the variables used in this study. Panel A of Table 1 reports the descriptive statistics for the whole sample, while Panels B and C represent the bank-based and market-based statistics, respectively. Panel A shows that in GCC banks, the mean of ROA is 1% and ROE is 9%, which are not similar to those reported for the European Union [3].[2] The mean of banks liquidity measures is shown to vary from 11 to 75%. For instance, TLTA shows a mean of 62% with a standard deviation of 13%; LIQA with a mean of 11% with a standard deviation of 7%; and Deposit Ratio with a mean of 75% with a standard deviation of 13%. The descriptive statistics in Panels B and C show that bank operating in bank-based countries exhibit greater ROE, TLTA and Deposit Ratios, and are larger compared with those in market-based financial systems.

The correlation among the variables used in this study is reported in Table 5. It shows that profitability measures are positively (negatively) and significantly correlated at 10% level with TLTA, LIQA, size, GDPG and inflation (BSD). Furthermore, the Deposit Ratio positively and significantly correlates with only ROE. Based on the correlation matrix, multi-collinearity is not an issue.

Results and discussion

Table 6 shows the fixed effects with robust standard error regressions regarding the impact of liquidity risks on GCC banks' performance (ROA and ROE). We consider the full sample as stated in models 1 and 4, bank-based countries in models 2 and 5, and market-based

[2] Adelopo et al. [3] show that the ROA and ROE for European banks is -0.18 and 0.73, respectively.

Table 5 Correlation matrix

	ROA	ROE	TLTA	LIQA	Deposit ratio	Size	BSD	GDPG	Inflation
ROA	1								
ROE	0.8764*	1							
TLTA	0.1311*	0.1180*	1						
LIQA	0.1300*	0.1091*	− 0.2051*	1					
Deposit ratio	− 0.0059	0.1070*	0.1602*	0.0822*	1				
Size	0.1496*	0.2690*	− 0.0306	− 0.0664*	0.1779*	1			
BSD	− 0.2603*	− 0.2277*	− 0.3429*	− 0.1854*	− 0.1232*	− 0.0788*	1		
GDPG	0.3162*	0.2706*	− 0.0671*	0.2433*	− 0.0452	− 0.1310*	− 0.2337*	1	
Inflation	0.2143*	0.2110*	0.03	0.1431*	0.0526	− 0.1259*	− 0.2841*	0.3176*	1

All variables are defined in Table 1. * denotes significance at 10% level

Table 6 Liquidity risk and bank's profitability (Fixed Effects)

	ROA			ROE		
	Full sample	Bank-based	Market-based	Full sample	Bank-based	Market-based
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
TLTA	0.0245**	0.0243**	0.00825	0.161**	0.116***	0.156
	(2.11)	(2.37)	(0.30)	(2.64)	(2.74)	(1.00)
LIQA	0.0228*	0.0248**	0.0122	0.106	0.0866	0.0591
	(1.85)	(2.34)	(0.50)	(1.37)	(1.12)	(0.36)
Deposit ratio	− 0.0098	0.00222	− 0.00953	− 0.0196	0.0506	− 0.0291
	(− 1.16)	(0.16)	(− 0.81)	(− 0.30)	(0.79)	(− 0.32)
Size	0.0001	− 0.000812	− 0.000733	0.0249	0.00874	0.0442
	(0.05)	(− 0.35)	(− 0.15)	(1.56)	(0.47)	(1.25)
BSD	− 0.0035	− 0.00206	− 0.00546	− 0.0337*	− 0.0113	− 0.0630
	(− 1.42)	(− 1.25)	(− 0.92)	(− 1.69)	(− 0.83)	(− 1.40)
GDPG	0.0004***	0.000429***	0.000501*	0.00289***	0.00354***	0.00263
	(3.23)	(3.06)	(1.91)	(3.08)	(3.06)	(1.42)
Inflation	0.0003**	0.000121	0.000380**	0.00352***	0.00113	0.00539***
	(2.20)	(0.64)	(2.15)	(3.54)	(0.80)	(4.07)
Constant	0.0042	0.0145	0.0392	− 0.546	− 0.223	− 0.902
	(0.08)	(0.25)	(0.37)	(− 1.63)	(− 0.55)	(− 1.22)
Observations	905	511	394	905	511	394
R^2 within	0.152	0.210	0.137	0.130	0.153	0.146
R^2 overall	0.130	0.146	0.0942	0.159	0.268	0.102
R^2 between	0.158	0.0851	0.115	0.318	0.599	0.211
F Value	12.55	11.56	8.507	12.75	11.90	7.629
P Value	0.00	0.00	0.00	0.00	0.00	0.00
Group	62	35	27	62	35	27

This table represents the fixed effects regressions with robust standard error. The dependent variable is ROA and ROE in models 1 to 3 and 4 to 6, respectively. All variables are defined in Table 1. The numbers in parentheses are t-statistics computed using robust standard error. *,**,*** indicates significance levels at the 10%, 5%, and 1%, respectively.

countries in models 3 and 6. The estimated outputs of Eq. (1) are reported in models 1 to 6 of Table 6. The results show that the coefficients of TLTA are positive and statistically significant at the 5% level in Model 1. This indicates that total loan to total assets as a measure of liquidity risk significantly and positively impacts banks' profitability. This finding implies that bank's profitability increases with the level of liquidity risk taken, which is consistent with earlier studies [4, 58]. Moreover, splitting the sample into bank-based (Model

Table 7 The impact of financial crisis on bank's profitability (Fixed Effects)

	ROA			ROE		
	Full sample	**Bank-based**	**Market-based**	**Full sample**	**Bank-based**	**Market-based**
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Crisis	0.0100***	0.00954***	0.0122	0.0568***	0.0715***	0.0496
	(3.27)	(5.24)	(1.64)	(2.98)	(5.36)	(0.99)
TLTA	0.0231**	0.0223**	0.00788	0.154**	0.102**	0.154
	(2.03)	(2.13)	(0.32)	(2.52)	(2.33)	(1.06)
LIQA	0.0221*	0.0249**	0.00842	0.103	0.0875	0.0437
	(1.86)	(2.38)	(0.35)	(1.35)	(1.14)	(0.27)
Deposit ratio	− 0.00811	0.00256	− 0.00756	− 0.00989	0.0532	− 0.0211
	(− 0.92)	(0.19)	(− 0.61)	(− 0.15)	(0.86)	(− 0.23)
Size	0.00190	0.000620	0.00266	0.0350**	0.0195	0.0580
	(0.86)	(0.26)	(0.58)	(2.10)	(1.03)	(1.49)
BSD	− 0.00479*	− 0.00250	− 0.00926	− 0.0410**	− 0.0145	− 0.0784
	(− 1.98)	(− 1.46)	(− 1.53)	(− 2.04)	(− 1.05)	(− 1.57)
GDPG	0.0004***	0.00041***	0.00040	0.0027***	0.0034***	0.0022
	(3.09)	(3.04)	(1.68)	(2.97)	(3.03)	(1.25)
Inflation	− 0.000429*	− 0.000509**	− 0.000584	− 0.000488	− 0.00359***	0.00147
	(− 1.86)	(− 2.72)	(− 0.98)	(− 0.34)	(− 2.89)	(0.37)
Constant	− 0.0348	− 0.0169	− 0.0308	− 0.766**	− 0.459	− 1.186
	(− 0.69)	(− 0.28)	(− 0.33)	(− 2.19)	(− 1.10)	(− 1.50)
Observations	905	511	394	905	511	394
R^2 within	0.193	0.276	0.170	0.153	0.228	0.155
R^2 overall	0.177	0.288	0.103	0.177	0.367	0.101
R^2 between	0.245	0.344	0.175	0.351	0.695	0.223
F value	11.41	15.87	8.375	11.86	13.82	7.219
P value	0.00	0.00	0.00	0.00	0.00	0.00
Group	62	35	27	62	35	27

This table represents the fixed effects regressions with robust standard error. The dependent variable is ROA and ROE in models 1 to 3 and 4 to 6, respectively. All variables are defined in Table 1. The numbers in parentheses are t-statistics computed using robust standard error

*,**,*** indicates significance levels at the 10%, 5%, and 1%, respectively

2) and market-based (Model 3) countries reveals that the positive impact of TLTA on a bank's profitability holds in bank-based countries. We also obtain similar results using ROE as an alternative measure of profitability, as stated in models 4 to 6. These findings prove that the risk of lessening the cash to counter depositors' withdrawals yields more profit in banks operating in bank-based financial systems.

The estimated coefficient of LIQA has a positive impact on ROA in the case of the full sample (Model 1) and bank-based (Model 2). However, this relationship turns out to be insignificant when considering the ROE measure (models 4 to 6). These findings suggest that liquid assets to total assets (LIQA) are positively associated with ROA in a bank-based financial system. Furthermore, the influence of the deposit ratio on performance reveals no significant associations, as stated in models 1 to 6 in Table 6. Thus, it could be concluded that deposits have no effect on banks' profitability in the GCC context. These results imply that the impact of liquidity risk measured by TLTA is pronounced in banks operating in bank-based financial structures. The results are in line with the recent study of Bats and Houben [14], where they show that the type of financial structure has a different effect on systemic risk.

The estimated coefficients of size in models 1 to 6 are statistically insignificant. This indicates that in GCC banks, there is no significant relationship between the size of banks and their performance. Nonetheless, this result contradicts the recent studies of Adelopo [2] and Al-Al Matari [8] where they found a negative association between bank size and profitability.

Models 1 to 3 of Table 6 show that GDP Growth (GDPG) has positive and significant coefficients, suggesting that banks exhibit more profitability in countries with high GDP growth rates, which is aligns with the findings

Table 8 The impact of COVID-19 on bank's profitability (Fixed Effects)

	ROA			ROE		
	Full sample	**Bank-based**	**Market-based**	**Full sample**	**Bank-based**	**Market-based**
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
COVID-19	− 0.00251*	− 0.00110	− 0.00286	− 0.0344***	− 0.0118	− 0.0552*
	(− 1.72)	(− 0.69)	(− 0.88)	(− 2.81)	(− 1.25)	(− 1.82)
TLTA	0.0239**	0.0242**	0.00813	0.154**	0.116**	0.153
	(2.06)	(2.36)	(0.29)	(2.53)	(2.72)	(0.95)
LIQA	0.0236*	0.0255**	0.0122	0.118	0.0951	0.0602
	(1.91)	(2.50)	(0.50)	(1.50)	(1.25)	(0.37)
Deposit ratio	− 0.00958	0.00190	− 0.00929	− 0.0162	0.0472	− 0.0246
	(− 1.13)	(0.13)	(− 0.78)	(− 0.25)	(0.75)	(− 0.27)
Size	− 0.00000751	− 0.000777	− 0.000957	0.0232	0.00912	0.0399
	(− 0.00)	(− 0.33)	(− 0.19)	(1.44)	(0.50)	(1.09)
BSD	− 0.00300	− 0.00192	− 0.00470	− 0.0268	− 0.00971	− 0.0483
	(− 1.21)	(− 1.14)	(− 0.75)	(− 1.32)	(− 0.70)	(− 0.97)
GDPG	0.000376**	0.000407**	0.000405	0.00211**	0.00329**	0.000784
	(2.51)	(2.68)	(1.40)	(2.16)	(2.70)	(0.50)
Inflation	0.000279**	0.000129	0.000368**	0.00351***	0.00121	0.00515***
	(2.20)	(0.70)	(2.12)	(3.55)	(0.87)	(3.93)
Constant	0.00670	0.0138	0.0431	− 0.511	− 0.231	− 0.826
	(0.13)	(0.24)	(0.40)	(− 1.51)	(− 0.57)	(− 1.09)
Observations	905	511	394	905	511	394
R^2 within	0.154	0.211	0.139	0.138	0.155	0.156
R^2 overall	0.131	0.147	0.0973	0.175	0.271	0.120
R^2 between	0.149	0.0852	0.105	0.332	0.613	0.227
F value	12.98	11.37	8.932	12.02	10.63	6.772
P value	0.00	0.00	0.00	0.00	0.00	0.00
Group	62	35	27	62	35	27

This table represents the fixed effects regressions with robust standard error. The dependent variable is ROA and ROE in models 1 to 3 and 4 to 6, respectively. All variables are defined in Table 1. The numbers in parentheses are t-statistics computed using robust standard error

*,**,*** indicates significance levels at the 10%, 5%, and 1%, respectively

of earlier study of Adelopo et al. [3]. Furthermore, the inflation coefficients are positive and significant in all models except models 2 and 4. This denotes that higher interest rates (high inflation) increase the GCC banks' performance in market-based countries, which is consistent with the findings of Islam and Nishiyama [38]. Overall, the results in Table 6 indicate that the relationship between liquidity risk and bank profitability depends on the financial systems in which the bank operates. Specifically, the findings suggest that the impact of liquidity risk is more pronounced in bank-based countries.

We extend our analyses and report the estimation of Eq. (2) that considers the effect of the global financial crisis on bank performance in Table 7. The results in Table 7 show that the financial crisis bears a positive and statistically significant coefficient in models 1 and 4, indicating that the global financial crisis reduces bank profitability in the GCC. Moreover, the findings in models 2–3 and 5–6 of Table 7 reveal that the coefficient of the crisis is positive and highly significant in the bank-based subsample (models 2 and 4), which is in line with earlier studies [21, 28]. However, in models 3 and 6, the crisis coefficient is statistically insignificant, consistent with the study of Erfani and Vasigh [30]. These results provide evidence that banks operating in bank-based countries exhibited an increase in their performance during the financial crisis, while the crisis had no impact on banks' performance located in market-based countries. Therefore, it is evident that the type of financial system explains the variation in the mixed findings on the impact of the financial crisis on bank performance. The estimated coefficients of other variables remain similar to those reported in Table 6.

Table 8 reports the regression outputs of Eq. (3). The findings in models 1 and 4 reveal that the coefficient of COVID-19 is negative and statistically significant at 10%, indicating that the recent pandemic (COVID-19)

Table 9 Liquidity risk and bank's profitability (Fully Modified OLS)

	ROA			ROE		
	Full sample	**Bank-based**	**Market-based**	**Full sample**	**Bank-based**	**Market-based**
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TLTA	0.031***	0.031***	0.022	0.215***	0.156***	0.255**
	(4.6)	(5.15)	(1.26)	(4.29)	(3.42)	(2.08)
LIQA	0.021**	0.025***	− 0.002	0.083	0.078	− 0.080
	(2.07)	(2.64)	(− 0.11)	(1.11)	(1.09)	(− 0.57)
Deposit ratio	− 0.004	0.009	− 0.005	0.027	0.152**	− 0.007
	(− 0.69)	(1.04)	(− 0.54)	(0.64)	(2.32)	(− 0.12)
Size	0.001	0.000	0.004	0.030***	0.012	0.069***
	(0.94)	(0.17)	(1.06)	(2.61)	(1.13)	(2.84)
BSD	− 0.004***	− 0.001	− 0.008**	− 0.032***	− 0.002	− 0.078***
	(− 2.63)	(− 1.03)	(− 2.29)	(− 3.06)	(− 0.17)	(− 3.09)
GDPG	0.001***	0.001***	0.001	0.003***	0.004***	0.001
	(3.37)	(4.87)	(1.06)	(2.81)	(5.17)	(0.6)
Inflation	0.001	0.001	0.001	0.003**	0.001	0.003
	(1.11)	(0.54)	(0.23)	(2.45)	(0.99)	(1.16)
Observations	905	511	394	905	511	394
R^2	0.45	0.55	0.40	0.42	0.45	0.41
Adjusted R^2	0.40	0.51	0.34	0.37	0.40	0.35
Group	62	35	27	62	35	27

*,**,*** indicates significance levels at the 10%, 5%, and 1%, respectively

reduces the bank's profitability. However, models 2 and 5 reveal no impact of COVID-19 on the profitability in the bank-based subsample. The results also show a negative association between COVID-19 and profitability that is statistically significant for one measure of profitability (ROE). These findings suggest that in market-based countries, the bank's performance was affected by the COVID-19 pandemic. However, we find no evidence of its impact on the bank-based countries.

Robustness tests

In this section, we have performed additional tests to check the robustness of our findings in the previous section. Specifically, we employ Fully Modified OLS (FMOLS) proposed by Pedroni [53, 54] to investigate the relationship between liquidity risk and a bank's profitability. FMOLS uses a nonparametric approach and accounts for serial correlation among regressors as well as the error term, leading to overcoming endogeneity issues in panel data.[3] This method is extensively used in recent studies such as Abdul Wahab et al. [1], Anastasiou et al. [10] and Nguyen et al. [49].

The findings of FMOLS provide a further robustness check to our results. The estimated outputs in Table 9, 10 and 11 are quantitatively similar to those reported in Tables 6, 7 and 8. Furthermore, in Table 9, we find that bank sector development is negative and significant at 1% for the full sample for both profitability measures, indicating that a higher level of bank sector development (DBS) reduces the profitability in GCC banks. The results also show that the negative impact of DBS on the bank's performance holds in the market-based system, where the coefficients are statistically negative at 1% in models 3 and 6 of Table 9.

Table 10 shows that the impact of the financial crisis (Crisis) remains positive and significant for the full sample (models 1 and 4) and bank-based market (models 2 and 5) as reported in Table 7. This result provides further evidence of the negative impact of the financial crisis on profitability in banks operating in bank-based countries. The results in Table 11 reveal that the COVID-19 pandemic is negatively associated with ROE at 10% level, as shown in Model 4, indicating that the recent health pandemic reduces the ROE of GCC banks. Moreover, this effect is pronounced in market-based system, which is consistent with our findings in Table 8.

[3] For more details about FMOLS, please refer to Pedroni [53, 54].

Table 10 The impact of financial crisis on bank's profitability (Fully Modified OLS)

	ROA			ROE		
	Full sample	**Bank-based**	**Market-based**	**Full sample**	**Bank-based**	**Market-based**
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Crisis	0.007***	0.007***	0.009	0.032*	0.050***	0.030
	(2.78)	(2.84)	(1.01)	(1.66)	(2.78)	(0.89)
TLTA	0.031***	0.028***	0.020	0.236***	0.154***	0.249**
	(4.39)	(4.19)	(1.21)	(4.44)	(3.05)	(2.05)
LIQA	0.020**	0.019*	− 0.004	0.100	0.040	− 0.081
	(1.96)	(1.78)	(− 0.19)	(1.28)	(0.51)	(− 0.58)
Deposit ratio	− 0.006	0.009	− 0.006	0.020	0.238***	− 0.016
	(− 0.96)	(0.76)	(− 0.68)	(0.45)	(2.76)	(− 0.26)
Size	0.001	− 0.002	0.004	0.031**	0.007	0.065***
	(0.55)	(− 0.99)	(1.16)	(2.41)	(0.50)	(2.68)
BSD	− 0.004***	− 0.001	− 0.010***	− 0.036***	0.001	− 0.080***
	(− 2.97)	(− 0.81)	(− 2.78)	(− 3.23)	(0.12)	(− 3.14)
GDPG	0.001***	0.001***	0.000	0.003***	0.005***	0.002
	(3.06)	(4.44)	(1.23)	(2.60)	(4.94)	(0.79)
Inflation	0.001	− 0.001*	− 0.001	0.001	− 0.002	0.001
	(− 1.25)	(− 1.86)	(− 1.38)	(0.61)	(− 1.18)	(0.18)
Observations	905	511	394	905	511	394
R^2	0.44	0.53	0.40	0.41	0.41	0.41
Adjusted R^2	0.38	0.49	0.34	0.35	0.35	0.35
Group	62	35	27	62	35	27

*,**,*** indicates significance levels at the 10%, 5%, and 1%, respectively

Conclusion

This study examines to what extend financial structure influence the impact of liquidity risk on bank's performance in the GCC context. There are many studies that investigate the association between liquidity and bank's profitability [e.g., 2, 4, 8, 19, 46] and find inclusive results. Chen et al. [19] argued that the inclusive findings in the recent studies may be explained by the financial structure. Bats and Houben [14] demonstrated that the systemic risk in a market-based financial system is lower than that in a bank-based financial system. Moreover, studies of this relationship in the GCC are emerging and are little understood.

Our study fills the gap in the literature by examining the association between liquidity risk and a bank's profitability while considering the financial structure in GCC. Furthermore, we examine the financial crisis and COVID-19's effect on bank performance in these two systems. In this study, we use panel data from 62 publicly listed banks in GCC from 2007 to 2021. Linear and nonlinear models are estimated using fixed effects and Fully Modified OLS, respectively.

The findings reveal that the liquidity risk represented by total loans to total assets (TLTA) positively and significantly impacts a bank's performance in GCC banks. More importantly, the influence of less risky liquidity (LIQA) on bank's profitability is significantly positive in a bank-based financial system. Furthermore, we find evidence on the positive impact of deposit ratio on the profitability of GCC banks using nonlinear estimation in bank-based financial structure. Taking together, we find evidence on the importance of financial structure on explaining the mixed results of this relationship.

The study also demonstrates that the influence of financial crisis is positively correlated with banks' performance in bank-based financial systems, while it has no impact on the profitability of banks operating in the market-based financial system. Our study also provides evidence of the adverse effects of COVID-19 on GCC bank's performance in market-based countries using linear regression. However, we find no association using the nonlinear estimation. Hence, we provide weak evidence on the impact of financial structure on the effect of COVID-19 on bank's profitability. These findings can be attributed to the fact that the central banks in bank-based countries played a significant role in supplying liquidity and bank stability during the COVID-19 pandemic. With

Table 11 The impact of COVID-19 on bank's profitability (Fully Modified OLS)

	ROA			ROE		
	Full sample	**Bank-based**	**Market-based**	**Full sample**	**Bank-based**	**Market-based**
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
COVID-19	− 0.001	− 0.001	− 0.001	− 0.027*	− 0.014	− 0.037**
	(− 0.60)	(− 0.49)	(− 0.17)	(− 1.82)	(− 1.13)	(− 1.97)
TLTA	0.031***	0.031***	0.021	0.209***	0.155***	0.251**
	(4.58)	(5.15)	(1.23)	(4.17)	(3.41)	(2.05)
LIQA	0.021**	0.026***	− 0.002	0.092	0.089	− 0.076
	(2.11)	(2.68)	(− 0.09)	(1.24)	(1.23)	(− 0.54)
Deposit ratio	− 0.004	0.009	− 0.005	0.029	0.145**	− 0.005
	(− 0.67)	(0.97)	(− 0.53)	(0.71)	(2.21)	(− 0.08)
Size	0.002	0.001	0.004	0.030***	0.014***	0.067***
	(1.01)	(0.29)	(1.04)	(2.66)	(2.78)	(2.75)
BSD	− 0.004**	− 0.001	− 0.008**	− 0.029***	0.001	− 0.072***
	(− 2.44)	(− 0.96)	(− 2.14)	(− 2.63)	(1.27)	(− 2.71)
GDPG	0.001***	0.001***	0.001	0.002**	0.004	0.001
	(3.08)	(4.56)	(0.86)	(2.21)	(− 0.02)	(− 0.01)
Inflation	0.001	0.001	0.001	0.003**	0.001***	0.003
	(1.10)	(0.61)	(0.25)	(2.42)	(4.64)	(1.09)
Observations	905	511	394	905	511	394
R^2	0.45	0.55	0.40	0.42	0.45	0.42
Adjusted R^2	0.40	0.51	0.33	0.37	0.40	0.36
Group	62	35	27	62	35	27

*,**,*** indicates significance levels at the 10%, 5%, and 1%, respectively

these liquidity support policies, liquidity risk should not affect bank performance during the pandemic.

The findings of this study offer some policy implications to policymakers to sustain the banks' performance. The study suggests that liquidity risk and financial crisis influence banks' performance in bank-based countries. These findings suggest that policymakers in bank-based GCC economies should monitor the liquidity risk of banks with lower capital ratios or those that have taken higher credit risk more closely.

This study is limited to 62 public banks in GCC. Future scholars may extend this study to other markets to generalize the significance of the research findings. Furthermore, this study does not consider additional control variables such as geopolitical risks and cultural effects. Future studies could investigate this relationship by including more bank-specific and macroeconomic variables. Another interesting future direction would be determining the extent to which financial structure could affect the banking industry's capital structure and payout policy. Moreover, many studies on corporate finance incorporate the impact of managerial psychological factors, such as overconfidence, on corporate financial decisions (e.g., 45, 5]. It would be interesting to examine the influence of overconfident managers on the relationship between liquidity risk and bank's profitability in different financial systems.

Abbreviations

ROA	Return on Assets
ROE	Return on Equity
TLTA	Total loans to total assets
LIQA	Liquid assets to total assets
DBS	Bank sector development
GCC	Gulf Cooperation Council
GDPG	The annual growth of gross domestic product
COVID-19	COVID-19 pandemic
Crisis	Global financial crisis 2007–2008

Acknowledgements
Not applicable.

Author contributions
ZB and AA contributed to conceptualization and original write-up. AS and AA helped in literature review, methodology, proofreading, and editing. AA estimated the models and wrote the results. AS provided the discussion and contributed to the conclusion. The paper has been reviewed and accepted by all authors.

Funding
There was no financial support for this work that could have influenced its outcome.

Availability of data and materials
Data available upon request.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

Received: 2 January 2024 Accepted: 19 May 2024
Published online: 31 May 2024

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