sciendo

UDK: 336.71(5-13)
DOI: 10.2478/jcbtp-2024-0016

Journal of Central Banking Theory and Practice, 2024, 2, pp. 129-152
Received: 05 May 2023; accepted: 28 June 2023

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Liquid Asset Holdings and Banking Profitability: Evidence from South Asia

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Abstract: Ensuring liquidity is critical for the functioning of banks. This study investigates the functional form of bank profitability and liquid asset holdings. We test for an inverted Kuznets curve-shaped quadratic polynomial relationship using generalized least square regression on an unbalanced quarterly dataset of Islamic and conventional banks of South Asia from 2016 to 2021. The study finds that profitability and liquid asset holdings have a concave nonlinear relationship suggesting a profit-maximizing level of liquidity. However, Islamic banks are less nonlinear than conventional banks, suggesting that their profitability is less responsive to changes in liquid asset holdings and needs more liquid assets to maximize profitability. Additionally, we find that the optimal level of liquidity to maximize profitability fell during Covid-19 as the relationship became more nonlinear. The study provides evidence of unique liquid management requirements for different types of banks based on how bank profitability response differs across different types of banks. The development of a one-fit-all liquidity management framework as in the case of the Basel III liquidity risk framework may not be appropriate. From a policy standpoint, the Basel III liquidity risk framework needs to be tailored especially in the context of Islamic banks.

Keywords: Liquidity Management, Bank profitability, South Asian banks, Islamic banking, Basel III.

JEL Classification: E58, G21, G28.

1. Introduction

Liquidity in crude terms means the ability to exchange an asset for cash. The easier an asset is convertible to cash the more liquid it is. For banks, liquidity means holding enough liquid assets to honor the liabilities when due; that is, the ratio of the bank's loans to the deposits. A high ratio means that the banks have fewer deposits and grant more loan, a low ratio on the other hand means banks have more deposits and advance fewer loans. A high ratio reduces a bank`s ability to make profits and even sustain its operation in the long run. A very low ratio in contrast means that the bank's assets are exposed to inflation risk – a decrease in purchasing power of an asset over time - by not investing. Typical bank balance sheets include liquid assets: cash, treasury bills, bonds, certificates of deposit, exchange-traded funds (ETFs), money market funds, etc. Therefore, maintaining adequate liquid assets is crucial for the bank's profitability and has been getting attention for many reasons.

Holding liquid assets for banks has been gaining importance in recent years for a variety of reasons. First, the global financial crisis has made banks redefine their capital structures; hence holding more liquid assets is now important to avoid cash shortages during uncertain periods. Moreover, during the financial crises, deposits are low and cash withdrawals are on the rise, making liquidity an important factor for the banks (Banna, Ahmad, & Koh, 2017; Chronopoulos, Liu, McMillan, & Wilson, 2015; Gideon, Petersen, Mukuddem-Petersen, & De Waal, 2012; Mdaghri & Oubdi, 2022; Petria, Capraru, & Ihnatov, 2015). Secondly, Covid-19 has introduced a new dimension to the financial sector across the world. Overall during the pandemic, the financial industry took a major hit and banks were no exception. Banks were under immense pressure to maintain their liquidity high to honour payments when due. To support the economy, banks also had to keep the interest rates low to expand lending and attract fewer deposits by having more liquid assets (Dewi, Lailiyah, Nataliawati, & Sayyid, 2021; Marozva, 2021). Understanding liquidity for banks and its impact on profitability is therefore extremely important not only for conventional banks but also for Islamic banks.

Recent growth in Shariah-compliant banking, also known as Islamic baking, has gained more importance from the liquidity perspective. Unlike conventional banks, Islamic banks require less liquid assets as giving interest-bearing cash loans to the customers is prohibited by Islamic law. Therefore, liquidity for Islamic banks has a different dimension than for conventional banks. Moreover, the liquidity-profitability relationship in the context of Islamic banks has an opportunity cost and it needs to be explored further. Holding liquid assets

entails opportunity cost for the banks that needs to be considered. Banks work to maximize their profits, and usually the liquid assets –cash, government securities, and cash equivalents- have relatively low return as compared to long-term deposits and investments (Bordeleau & Graham, 2020; Lartey, Antwi, & Boadi, 2013). Having more liquid assets thus means less profit for the banks and it is the opportunity cost for not investing in long terms deposits for profit maximization. On the other hand, more liquid assets mean stability of the overall financial system in a country especially during financial crises, health emergencies like Covid-19, and other unforeseen events. Keeping this context in mind, it is very important to explore the relationship between liquidity and profitability for both Islamic and conventional banks.

Does holding onto more liquid assets reduce the profitability of banks? This is a question often researched. Although finding the optimal level of liquidity is beyond the scope of this research, this study demystifies the liquidity-profitability relationship between Islamic and conventional banks. Moreover, this study also explores, how Covid-19 has an impact on the profitability of banks. The recent Covid-19 pandemic has been an unprecedented negative shock to the global economy. However, studies on the pandemic impact on bank performance are limited and mostly country-specific (Fajri, Muhammad, Umam, Putri, & Ramadhan, 2022; Xu, Haris, & Irfan, 2022). Banks face liquidity constraints during periods of low productivity growth (Berrospide & Edge, 2010; Gideon et al., 2012). During the global financial and Asian crises, the banks faced these liquidity issues. However, they were better prepared in terms of performance during the covid crisis (Mohammad, Muhammad, & Muhammad, 2021). The global shutdown of business is a unique case study and has consequences on the liquidity management practices of banks. To the best of our knowledge, this is the first study to explore the liquidity – profitability relationship between South Asian banks and thus it will contribute to the existing literature.

This study`s contribution to the existing body of knowledge in many ways. The Covid-19 impacted bank profitability has come under the microscope recently (Aiyar et al., 2021; Haider & Mohammad, 2022; Katusiime, 2021; Rahmi & Sumirat, 2021; Xu et al., 2022). This study contributes to the existing literature on bank profitability by empirically testing the liquidity - profitability relationship during Covid-19. Additionally, the study improves the understanding of how liquidity impacted profitability of Islamic banks in comparison to conventional banks. This study also has implications for the regulatory bodies in deciding optimal reserve requirements for banks during health emergencies like Covid-19. Finally, this study uses unbalanced panel data of conventional and Islamic banks from South Asia to see the nature of relationship between liquidity and profit-

ability, i.e. linear or non-linear. A linear relation would mean that a one percent change in bank liquidity will have a corresponding effect on its profitability. A non-linear relationship signifies that the liquidity of banks can trigger more/less change in their profitability.

The rest of the study is organized as follows: the next section covers the literature on the liquidity-profitability relationship. Section 3 illustrates the methodology of the study, while sections 4 and 5 describe the results and conclusion, respectively.

2. Literature Review

Banks faced difficulties despite adequate capital during the 2007 global crisis, to provide low-cost funding. It is for this reason that Basel III incorporated minimum standards for ensuring liquidity in internationally active banks. Asset maturity transformation is one of the main roles of banks. It implies a risk if the bank assets are illiquid given the depositors' claims. Although liquidity management of banks' practices is similar, a single bank's liquidity problem can spread quickly and affect other banks, giving rise to systematic risk. Bank liquidity management involves balancing reserves, earning assets, and the adjustment costs of conducting unexpected borrowing to meet withdrawal requirements. Therefore, liquidity is a critical factor in ensuring bank stability and profitability.

The relationship between liquidity and bank performance in finance literature remains an unresolved empirical issue (Marozva, 2021). Extensive literature on bank profitability dates back to Bourke (1989) and Short (1979). Jaworski and Czerwonka (2021) suggested that developing generalized profitability and liquidity relationships is impossible due to underlying differences between countries. Studies have used multiple liquidity proxies with contradictory evidence on their impact on bank profitability. Liquidity has been measured using loan-to-deposit ratios, current ratios, quick ratios, deposit-to-asset ratios, etc. (Paul, Bhowmik, & Famanna, 2021). Some of the studies find a positive association in literature (Christopher Graham, 2020; Doan & Bui, 2021; Doku, Kpekpena, & Boateng, 2019; Hermuningsih, Kirana, & Erawati, 2019; Lartey et al., 2013; Lemonjava, 2018; Mosharrafa & Islam, 2021; Yildirim & Philippatos, 2007). However, some empirical evidence suggests a negative relationship between liquidity and profitability (Abdelaziz, Rim, & Helmi, 2022; Ben Jedidia, 2020; Dahiyat, 2016; Pradhan & Shrestha, 2018; Rahman, Yousaf, & Tabassum, 2020).

Berger and Bouwman (2009) find evidence of a positive relationship between capital and liquidity creation for large banks and an inverse relationship in small banks. In their a seminal study, Bordeleau and Graham (2010) analyse this relationship where they test the functional form of bank profitability with its levels of liquid asset holdings. They find that liquidity improves bank profitability, after which excess holdings negatively impact profits as the costs start to outweigh the benefits. They suggest that liquidity is a nonlinear concave function of bank profitability, implying an optimal level that maximizes profits. This may be why empirical studies that model it as a linear determinant seem to produce contradictory results. If the relationship is nonlinear, this would justify contradictory results based on different levels of liquid asset holdings.

Some studies report a negative relationship between liquidity and profitability. For example, Ben Jedidia (2020) find a negative relationship between ROA and liquidity in GCC countries. Other studies also reported a negative relationship (Abdelaziz et al., 2022; Ben Jedidia, 2020; Dahiyat, 2016; Mashamba, 2022; Pradhan & Shrestha, 2018; Rahman et al., 2020). Finally, a few studies reported no relationship between the two: liquidity and profitability. For example, Olarewaju and Adeyemi (2015) study Nigerian deposit money banks and found no liquidity impact on return on equity. Mishra et al. (2019) analysed the relationship in Indian banks but found no relationship between profitability and bank liquidity.

2.1. Determinants of profitability

The literature discusses numerous hypotheses that are the foundation of empirical research on firm profitability and its determinants. Efficiency structure, structure conduct performance, expense preference, and Galbraith-Caves risk avoidance hypothesis are among the few. The efficient structure hypothesis (Demsetz, 1973) suggests market competition is an important factor that disciplines firms, and efficient firms capture the market, and their profitability increases. The structure conduct performance hypothesis suggests that concentration and competition are inversely related, and market structure is hypothesized to influence firm conduct and performance. The expense preference hypothesis suggests that firms maximize utility rather than profits and may, in some cases, increase staff expenditures and discretionary profits beyond profit-maximizing points. Galbraith–Caves risk avoidance suggests that firms with larger market shares tend to avoid risk-taking, and risk avoidance is inversely related to profits.

A wide range of studies exists on its determinants, ranging from individual to cross-country regional studies. A few of the important country-specific studies

carried out on bank profitability determinants in the US, Colombia, Tunisia, India, Spain, Pakistan, Korea, and Japan (Angbazo, 1997; Barajas, Steiner, & Salazar, 2000; Berger, 1995; Kuknor & Rastogi, 2021; Lee & Kim, 2013; Liu & Wilson, 2010; Naceur, 2003; Vivas, 1997; Yao, Haris, & Tariq, 2018). In addition, cross-country empirical studies have been extensively carried out in literature-based economic zones and regional proximities. Some of these are (Angori, Aristei, & Gallo, 2019; Berger & Bouwman, 2013; Bourke, 1989; Demirgüç-Kunt & Huizinga, 1999; M. S. Islam & Nishiyama, 2016; Marozva, 2021; Saif-Alyousfi, 2022).

Literature has also extensively studied the determinants of financial and non-financial firm profitability. Market place risk-related dynamics and individual and country-specific factors have been identified in the literature as the underlying ingredients that impact profitability. Different measures like return on assets, equity returns, and bank spreads have been used in literature to proxy profitability. These studies find that individual bank-specific factors are important in determining profitability. A few of the factors are total assets, noninterest expenses, capital structure, and liquidity (Haider & Mohammad, 2022; Mohammad & Adnan, 2022; Petria et al., 2015; Sahyouni & Wang, 2019a).Additionally, studies have identified industry-specific factors like level of competition and concentration as well as macroeconomic factors like regulations, GDP growth, political stability, and inflation to impact profitability (Dietrich & Wanzenried, 2011; Ghosh, 2015; Godspower-Akpomiemie & Ojah, 2021).

Amongst the determinants of bank profitability, liquidity levels have important implications for bank stabilities and their prudential supervision (Davydov, Vähämaa, & Yasar, 2021). Liquidity allows banks to finance loans and meet their commitments when they become due. Technological innovation, reduced reliance on deposits, and more on capital markets coupled with increased financial uncertainty have created additional liquidity management challenges for banks (Roy, Misra, Padhan, & Rahman, 2019). Studies have used multiple ways to measure liquidity, and the most commonly used are quick and current ratios (Samo & Murad, 2019). Studies on liquidity have focused on liquid asset holdings as well as the ability of banks to create liquidity and their impact on profitability. Literature also focuses on determinants of liquidity risk, and different streams of studies associated profitability, negatively, with liquidity risks (Abdelaziz et al., 2022; Alzoubi, 2017).

In the analysis of determinants of bank profitability, liquidity asset holdings have been found to impact profit significantly. However, there is contradictory empirical evidence in the literature on the direction of the relationship. Christopher Graham (2020) uses liquid assets/total assets and loans to total assets to proxy

liquidity. He finds that they are positively related to profitability in the Tunisian banking industry and negatively related to return on equity. Hermuningsih et al. (2019), analyzing Indonesian firms find a positive relationship between firm value and liquidity. However, Lartey et al. (2013), analyzing listed banks of Ghana, found a significant positive relationship. Lemonjava (2018) finds a positive relationship in Georgian banks and uses net interest margins to measure profitability. Even in nonfinancial firms, their value is positively associated with remaining liquidity, and this relationship is moderated by firm leverages (Al-Qadi & Khanji, 2018; Febrinta Br Bukit, Muda, & Abubakar, 2021; Hossain & Alam, 2019).

2.2. Liquidity and non-conventional banks

In the banking domain, besides regional segregations, literature has focused on different types of banks, especially conventional and Islamic banks. There is a debate in the literature on whether Islamic banks are more stable and profitable than conventional banks. In addition, literature discusses whether Islamic banks are more liquid and their ability to create liquidity. Islamic banks and conventional bank balance sheets are significantly different (Sahyouni & Wang, 2019). However, studies reported no differences in the liquidity and profitability relationship (Sahyouni & Wang, 2019). Malaysia has the largest share of Islamic banks globally, and in analyzing them, a positive relationship is also found between liquidity and profitability (Javaid & Alalawi, 2018).

Important factors influencing liquid asset holdings includes Capital (more Islamic banks than conventional banks) and bank margins. Higher profitability does not cause higher liquidity (Musa, Musova, Natorin, Lazaroiu, & Boďa, 2021). Dabiri et al., (2017) reported similar findings for Islamic banks in the UK, while Farooq and Ahmad (2017) suggested that Islamic banks face a problem of surplus or shortfall in liquidity under different conditions, highlighting the need to understand the functional relationship and eventually optimal levels.

2.3. Liquidity during financial crises

One strand of literature has also focused on how economic conditions impact bank performance. For example, the literature suggests that Islamic and conventional banks are susceptible to the financial crisis (Adelopo, Lloydking, & Tauringana, 2018; Alqahtani, Mayes, & Brown, 2016; Chronopoulos et al, 2015; Mongid, 2016, Mebounou, Karan & Dannon, 2015). However, Akter and Mahmud (2014) find that liquidity did not affect profitability during Bangladeshi banks'

2007-08 financial crisis. Literature has also focused on how financial crises affect bank profitability, and recently covid-19 and its impact on bank profitability and its determinant has also come under attention (Aiyar et al., 2021; Alqahtani, Mayes, & Brown, 2017; Berger & Bouwman, 2013; Mohammed, 2022; Sutrisno, Panuntun, & Adristi, 2020; Xu et al., 2022)

3. Methodology

The data for this study was taken from Refinitiv database for South Asian countries. The unbalanced quarterly panel data covered the period of six year i.e. 2016 to 2021 and the data was taken from the Refinitiv database. The dependent variable was banks profitability (denote by return on assets and return on equity). The independent variable was denoted by: equity ratio, Nonperforming Loans to Total Assets (NPL), Interest Income as Ratio of Total Loans (IITOL), liquidity, Bank size and growth of deposits. The interaction term is also added in the model as a dependent variable to capture the liquidity's marginal impact on commercial banks as to conventional banks. Bank profitability has been modelled extensively, this study used the model which was previously used by Athanasoglou et al., (2008) and Haider & Mohammad (2022). We extend it by including a quadratic term to capture the nonlinearity in the relationship. The model is further extended to test if the Covid-19 crisis moderates the profitability and liquidity relationship.

$$\pi_{ictk} = \alpha_0 + \beta_1 Equity\ ratio_{ict} + \beta_2\ NPL\ ratio_{ict} + \beta_3\ IITOL\ ratio_{ict} + \boldsymbol{\beta_4}\ \boldsymbol{Liquidity_{ict}} + \boldsymbol{\beta_5}\ (\boldsymbol{Liquidity_{ict}})\text{^}\boldsymbol{2} + \beta_6\ Bank\ Size_{\ ict} + + \beta_7\ Growth\ of\ deposits_{\ ict} + \beta_8\ effeciency\ ratio_{ict} + + \boldsymbol{\beta_9}\ \boldsymbol{Interaction\ Term_{ct}} + \varepsilon_{ict} \quad (1)$$

π_{ictk} denotes bank profitability and is measured using return on asset and equity depicted by the k subscript for a bank i at time t and country c. Return on Assets (ROA) and Return on Equity (ROE) are used separately to identify how banks manage assets and equity to generate profit (Naceur, 2003). We use Albulescu (2015) definitions to calculate them. The equity ratio is the Capital asset ratio proxying strength of capitalization. Higher Capital is predicted to be negatively associated with profitability. NPL ratio is the ratio of nonperforming loans to total assets. Literature suggests the use of nonperforming loans in the context of earning management. However, they also proxy the quality of credit of banks. Therefore, nonperforming loans are hypothesized to negatively affect profitability (Haider & Mohammad, 2022). IITOL ratio is the interest income as a ratio of total loans. Higher interest rates are positively related to profitability. This relationship may, however, be moderated by bank size.

Liquidity is proxied as the loans to deposit ratio. Liquidity is expected to have a positive sign on it, and the squared term is expected to have a negative sign in line with the hypothesis of a positive concave relationship (Bordeleau & Graham, 2020). Studies suggest that a bank's liquidity ratio is positively associated with its profitability (Albulescu, 2015). Liquidity management practices focus on ensuring adequate liquid asset holdings. Higher liquidity ratios reduce liquidity risk. However, the higher liquid assets come with an opportunity cost of lower earning assets. Bank size is the log of total assets. Therefore, bank size is hypothesized to be positively associated with profitability (Karim, Sami, & Hichem, 2010; Kuknor & Rastogi, 2021). Efficiency ratio measures the non-interest-based earnings of the bank as the ratio of noninterest income to total assets (Bouzgarrou, Jouida, & Louhichi, 2018).

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	1591	0.005	0.01	-0.05	0.037
E to A	1591	0.142	0.08	0.039	0.586
NPL Ratio	965	0.049	0.038	0	0.175
Il to L	1591	0.129	0.031	0.066	0.274
Liquidity	1591	0.865	0.259	0.282	2.71
Bank Size	1591	20.347	1.296	15.92	24.602
Covid	1591	0.195	0.396	0	1
Growth of Deposits	1591	0.029	0.099	-0.986	1.126
Efficiency Ratio	1591	0.602	0.111	0.089	0.903

The study uses a random effect technique to estimate the model (Haider & Mohammad, 2022). The models control for country-specific effects using country dummies. Conventional and Islamic banks have been included in the sample. In addition, the model includes bank-type dummies to capture any difference in the behaviour of the two banks. Five years Quarterly data from 2016 to 2021 has been taken from the Refinitiv database of South Asian countries. Table 1 reports the descriptive statistics. Countries included in the sample are Pakistan, India, Bangladesh, and Sri Lanka based on availability of secondary data. Table 2 shows the matrix of correlations and suggests that there is no multicollinearity in the data.

Table 2: Matrix of Correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) E to A	1								
(2) NPL Ratio	-0.198	1							
(3) II to L	-0.031	-0.26	1						
(4) Liquidity	0.681	-0.144	-0.319	1					
(5) Bank Size	0.012	0.245	-0.178	-0.223	1				
(6) Covid	0.022	-0.133	0.138	-0.045	0.074	1			
(7) Growth of Deposits	0.084	-0.07	0.009	0.084	0.025	0.074	1		
(8) Efficiency Ratio	-0.121	0.478	-0.201	-0.098	0.278	-0.206	-0.091	1	
(9) ROA	0.171	-0.716	0.268	0.102	-0.259	0.085	0.108	-0.58	1

4. Results of the Study

Table 3 reports the findings. Model 1 is the base model. In contrast, models 2 to 5 are extensions which include interaction terms that provide insight into the following questions: Is liquidity's marginal impact on commercial banks different from that on Islamic banks? Is the profit functional form of Islamic banks different from that of conventional banks? Did the liquidity profitability relationship change during the Covid-19 crisis? And, finally, did the functional form changed for all banks during the Covid-19 period?

The models control for country-specific effects using country dummies which is why the model does not include other macroeconomic variables. The model fit for all the models is more than 58%, which shows that the estimated model has high explanatory power. Moreover, the model fit for the case of South Asian banks is relatively high compared to other studies (Banna et al., 2017; Haider & Mohammad, 2022; Sahyouni & Wang, 2019; Vu & Nahm, 2013).

Table 3: Main Results, Return on Assets

Independent Variable	Model 1	Model 2	Model 3	Model 4	Model 5
ROE	Coef./(Std. Err)	Coef./(Std.Err)	Coef./(Std. Err)	Coef./(Std.Err)	Coef./(Std.Err)
Bank Specific Variables					
Capitalization	-0.0065	-0.0059	-0.0060	-0.0047	-0.0047
	(0.0152)	(0.0153)	(0.0153)	(0.0137)	(0.0132)
Credit Quality	-0.1858***	-0.1867***	-0.1866***	-0.1800***	-0.1746***
	(0.0278)	(0.0278)	(0.0279)	(0.0273)	(0.0275)
Interest Income Ratio	0.0526**	0.0542**	0.0542**	0.0533**	0.0533**
	(0.0203)	(0.0197)	(0.0197)	(0.0232)	(0.0229)
$Liquidity^2$	**-0.0138****	**-0.0129****	**-0.0129****	**-0.0115****	**-0.0114****
	(0.0052)	**(0.0052)**	**(0.0052)**	**(0.0045)**	**(0.0044)**
Liquidity	**0.0296****	**0.0264***	**0.0266***	**0.0253****	**0.0259****
	(0.0133)	**(0.0137)**	**(0.0137)**	**(0.0124)**	**(0.0122)**
Bank Size	-0.0018**	-0.0018**	-0.0018**	-0.0007	-0.0005
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0007)
Growth of Deposits	0.0025**	0.0024**	0.0024**	0.0026**	0.0027**
	(0.0008)	(0.0008)	(0.0008)	(0.0009)	(0.0009)
Efficiency Ratio	-0.0289***	-0.0291***	-0.0290***	-0.0298**	-0.0307**
	(0.0084)	(0.0083)	(0.0083)	(0.0096)	(0.0094)
Interaction Terms					
Islamic x Liquidity		**0.0194****			
		(0.0060)			
Islamic x $Liquidity^2$			**0.0139*****		
			(0.0039)		
Covid x Liquidity				**-0.0017**	
				(0.0013)	
Covid x $Liquidity^2$					**-0.0027****
					(0.0012)
Constant	0.0328	0.0222	0.0286	0.0161	0.0126
	(0.0248)	(0.0241)	(0.0243)	(0.0250)	(0.0236)
Country Dummies	YES	YES	YES	YES	YES
Overall Rsquare	.5828134	.58256	.5827255	.60452	.6139938
No. of Obs	965	965	965	965	965
No. of Groups	66	66	66	66	66

* p < .10, ** p < .05, *** p < .001

Bourke (1989) suggested that better-capitalized banks could attract cheaper resources and, therefore, have higher profits. However, we find that the capital adequacy ratio representing capitalization strength is negatively related to profitability, although the result is statistically insignificant. Furthermore, Osborne, Fuertes & Milne (2012) suggest that overcapitalized banks have lower profitability, suggesting a need to reduce capitalization. Credit quality is also found to be a significant factor in profitability determination in South Asian banks. This finding is consistent with previous studies, where higher loan losses would adversely affect profits (Akter & Roy, 2017). On the other hand, higher interests are found to impact profitability positively.

Bank size is predicted to positively impact profitability. However, in the case of South Asia, the return on assets of small banks is significantly higher. Mosharrafa and Islam (2021) find a similar result in analysing the profitability of Bangladeshi banks. Higher deposit growth is also found to be positively related to profits. This is consistent with previous studies (Sivalingam & Kengatharan, 2018). We also find that noninterest earnings to negatively impact the profitability of South Asian banks.

Consistent with the literature, liquidity is positively associated with profitability in the case of South Asian Banks (Doku et al., 2019; Mosharrafa & Islam, 2021; Yildirim & Philippatos, 2007). However, some studies report an inverse relationship between the two (Dahiyat, 2016; Pradhan & Shrestha, 2018; Rahman et al., 2020). This is the evidence that justifies the need for the study. First, however, the study aims to identify whether a positive, concave relationship exists between bank liquidity and profitability. We find that the quadratic term included in the model is significantly negative, suggesting a function with a global maximum similar in shape to an inverted Kuznets curve. Mebounou et al. (2015) also predict an optimal level of liquidity maximizes profitability, which is similar to our findings.

Models 2 and 3 test whether Islamic banks exhibit a similar functional form or not. Islamic banks by construction are more liquid than conventional banks (Bitar, Kabir Hassan, & Hippler, 2018). Model 2 extends the base model by including the interaction of Islamic banks with liquidity. Estimation results of model 2 show that the linear marginal effect of liquidity on profitability is larger than with conventional banks. This suggests that Islamic banks` profitability is more susceptible to liquidity changes than that of conventional banks. In model 3, the interaction term of Islamic banks and the square of liquid assets is positive. The findings suggest that the relationship between Islamic banks is also nonlinear, albeit of lower magnitude, i.e. less concave. The response of bank profits to liquid

asset holdings is lower for Islamic banks, and the profit maximizing level of liquid asset holding would be higher than with conventional banks. This is consistent with Bitar et al. (2018).

Models 4 and 5 include interaction terms of the liquidity measure and its square term with the Covid-19 period dummy to see if economic conditions moderate the relationship. The Covid-19 crisis does not moderate the liquidity profitability relationship. However, we find that economic conditions significantly impact nonlinearity. During the Covid-19 crisis, the nonlinearity increases, and the functional form becomes more concave. This suggests that the responsiveness of profitability to liquidity changes would be higher. This also suggests that assuming everything else equal during the Covid-19 crisis, the optimal level of liquidity to maximize profitability would also fall.

As a robustness test, models 6 to 10 estimated the impact of liquidity on return on equity. Unlike return on assets, the impact of capitalization strength of Asian banks on the return on equity is statistically significant and negative. The impact of credit quality proxied by the nonperforming loans ratio is also significantly negative consistent with the prvious findings. However, the magnitude of the impact on return on equity is a lot larger than the return on assets.

Interest rates and bank size is not found to impact bank equity returns. Higher deposit growth is also found to be positively related to profits. In the case of South Asian banks, noninterest earnings negatively impact the profitability of banks. Consistent with our original finding, liquidity is positively associated with profitability; however, it is not statistically significant in the case of return on equity. The squared term, however, is significant at the 5% level. This suggests that assuming everything else is constant, the relationship between liquidity and ROE may go through the origin. The findings about Islamic banks are also consistent with our original findings.

Table 4: Main Results, Return on Assets

Independent Variable	Model 6	Model 7	Model 8	Model 9	Model 10
ROE	Coef./(Std.Err)	Coef./(Std.Err)	Coef./(Std.Err)	Coef./(Std.Err)	Coef./(Std. Err)
Bank Specific Variables					
Capitalization	-0.1459*	-0.1405*	-0.1409*	-0.1332*	-0.1306*
	(0.0830)	(0.0829)	(0.0827)	(0.0793)	(0.0782)
Credit Quality	-1.7248***	-1.7330***	-1.7323***	-1.6858***	-1.6627***
	(0.3505)	(0.3513)	(0.3514)	(0.3411)	(0.3400)
Interest Income Ratio	0.2827	0.2969	0.2967	0.2731	0.2669
	(0.2079)	(0.2027)	(0.2031)	(0.2244)	(0.2183)
Liquidity^2	**-0.0702****	**-0.0641***	**-0.0643***	**-0.0639***	**-0.0637***
	(0.0356)	**(0.0360)**	**(0.0360)**	**(0.0342)**	**(0.0340)**
Liquidity	**0.1773**	**0.1562**	**0.1570**	**0.1625**	**0.1635**
	(0.1117)	**(0.1142)**	**(0.1139)**	**(0.1074)**	**(0.1065)**
Bank Size	-0.0022	-0.0024	-0.0023	0.0015	0.0021
	(0.0063)	(0.0062)	(0.0063)	(0.0063)	(0.0060)
Growth of Deposits	0.0213**	0.0210**	0.0210**	0.0221**	0.0223**
	(0.0077)	(0.0077)	(0.0077)	(0.0080)	(0.0082)
Efficiency Ratio	-0.1783**	-0.1804**	-0.1803**	-0.1744**	-0.1739**
	(0.0759)	(0.0754)	(0.0754)	(0.0842)	(0.0811)
Interaction Terms					
Islamic x Liquidity		**0.1516****			
		(0.0500)			
Islamic x Liquidity^2			**0.1090****		
			(0.0414)		
Covid x Liquidity				**-0.0066**	
				(0.0125)	
Covid x Liquidity^2					**-0.0093**
					(0.0132)
Constant	0.1032	0.0177	0.0674	0.0453	0.0347
	(0.1932)	(0.1860)	(0.1886)	(0.1927)	(0.1872)
Country Dummies	YES	YES	YES	YES	YES
Overall Rsquare	.5711843	.5715605	.5716613	.5776849	.5803036
No. of Obs	965	965	965	965	965
No. of Groups	66	66	66	66	66

* p < .10, ** p< .05, *** p < .001

As for models 9 and 10, whether the linear and quadratic terms interacted with the Covid-19 dummy, the findings are insignificant because Covid-19 might not have affected banks' return on equity (Haider & Mohammad, 2022). Although Covid-19 caused return on assets to decrease for Asian and European banks, modelling return of equity and Covid-19 revealed an insignificant negative relationship.

5. Conclusion

Profitability and its determinants have been extensively studied in the literature. However, liquid asset holdings and their impact on profitability have conflicting evidence in the literature. Understanding this liquid asset holding and profitability relation is very important. The first reason is that banks with higher liquid assets are more prone to risk taking behaviour (Bonfim & Soares, 2018). Secondly, average banking sector liquid asset holdings of banks also has consequences for transmission channels of unconventional monetary policy tools employed post-2007 crisis. Higher liquid asset holding adds to banking resilience to contractionary shocks. These banks can utilize these assets as a substitute to external financing (Altavilla, Canova, & Ciccarelli, 2020). Finally, although profitability and its determinants have been extensively studied in literature, the liquid asset holding and profitability have conflicting empirical evidence.

We contribute to the existing literature by empirically by showing that that profitability and liquidity have a nonlinear relationship that should be tested by modelling quadratic polynomials rather than linear ones. This helps us disentangle the case of conflicting empirical evidence. Since the relationship is quadratic and nonlinear, different levels of bank liquid asset holdings maintained below or above the optimal level may be a possible explanation for conflicting evidence in literature. The second contribution of the study is that it finds that economic crisis proxied using the Covid-19 period strengthens the relationship, and bank profitability responds to more liquidity than in normal times. Finally, the study contributes to the empirical literature by suggesting that Islamic banks` profitability is less responsive to liquidity asset holdings than in the case of conventional banks.

Basel III framework proposed reforms to monitor and measure liquidity risks to strengthen the banking sectors against financial and economic stress. Banks faced difficulties despite adequate capital during the 2007 global crisis to provide low-cost funding. It is for this reason that minimum standards were developed for ensuring liquidity in internationally active banks. Banks are required to keep

more than 100% of liquidity coverage ratio. The second standard requires the net stable funding ratios to ensure long term assets are funded with at least a minimum amount of stable liabilities in relation to their liquidity risk profiles. The study finds that the response of profitability to liquidity is different across different banks. Therefore, this study suggests that while devising liquidity management practices/regulations, developing a one-model-fits-all solution for both Islamic and conventional banks might lead to economic inefficiencies.

Although this study has used a large dataset for empirical testing of the liquidity – profitability relationship, it has been restricted to South Asia. Previous studies suggest that profitability determinants vary across countries, so a natural extension would be to study the relationship for European countries for confirmation of the relationship. Additionally, an investigation in to how the relationship holds under unconventional zero lower bound regimes is an area we leave for future research.

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