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Does Capital and Funding Liquidity Risk Affect Risk-Taking and Monetary Policy?

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ABSTRACT

This paper examines how bank capital and funding liquidity risk influence the interplay between monetary policy and risk-taking among banks in the South Asian Association for Regional Cooperation (SAARC) region. The Generalized Method of Moments (GMM) model was employed to analyse panel data from 2009-18. The empirical findings indicate that the interest rate negatively affects bank risk-taking. Diverging from previous literature, this study provides evidence that bank capital and funding liquidity risk moderate the relationship between monetary policy and bank risk-taking. This is evident from the significant coefficients of both interaction terms. Banks with low capital and high funding liquidity risk exhibit increased sensitivity to interest rate changes, leading to greater variations in risk-taking behaviours. Consequently, it is advisable for regulators and policymakers to closely monitor liquidity and minimum capital requirement ratios, particularly for banks with lower levels of deposits and capitalisation. Furthermore, this study contributes to the literature by providing evidence that risk-taking is influenced by both bank capital and funding liquidity risk.

Keywords: Monetary Policy, Interest Rate, Bank Capital, Funding Liquidity, Bank Risk-taking.

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1. INTRODUCTION

From 2002 to 2005, the expansionary monetary policy in the United States (US) maintained low interest rates over an extended period. This environment increased risk-taking among financial institutions in the US housing market prior to the crisis (Mishkin 2011, p. 62). There is a growing consensus among researchers that monetary policy influences both the pricing of risky assets and financial stability (Dreschler et al., 2016, p. 1933). However, the trade-off between financial stability and the transmission of monetary policy has received relatively little attention (Woodford 2012, p. 34).

The risk-taking channel of monetary policy delineates the potential relationship between interest rates and bank risk-taking. Dell’Ariccia et al. (2017, p. 613) were the first to provide empirical evidence on this channel, through their analysis of the US’ financial sector. Their research established that risk-taking is influenced by bank capital, which moderates the relationship between interest rates and risk-taking.

The effect of interest rate change on risk-taking is more pronounced for well capitalised banks. However, the current study is an effort to provide evidence on the importance of funding liquidity risk and bank capital as a function of risk-taking. The findings reveal that the effect of interest rate change on bank risk-taking is more pronounced for banks having low capital and funding liquidity risk. Low interest rates increase bank deposits (Adrian and Shin 2009, p. 600), which leads to lower funding liquidity risk and ultimately enhances risk-taking (Khan, Scheule and Wu 2017, p. 203). Therefore, the impact of changes in interest rates on risk-taking is moderated by funding liquidity risk and bank capital.

Banks are obligated to repay deposited money on demand according to their agreements. The inability of a bank to meet these obligations when demanded is defined as ‘funding liquidity risk’ (Drehmann and Nikolaou 2013, p. 2173).

Capitalisation and liquidity are important determinants of a bank’s risk-taking, as evidenced by regulations concerning minimum capital requirements and liquidity coverage ratios aimed at stabilising the banking sector (Begenau 2020). Much of the literature on the risk-taking channels of monetary policy focuses on developed nations such as the US and Europe, with significantly less attention given to developing or emerging economies (Brana, Campmas and Lapteacru 2019, p. 576). There remains a notable gap in empirical evidence specifically concerning South Asian banks.

The Risk Shifting and Portfolio Allocation model yield contrasting results regarding risk transformation following changes in monetary policy. Portfolio Allocation models suggest an inverse relationship between interest rates and risk-taking. Specifically, higher interest rates on safer assets lead to a greater investment proportion in these assets

compared to riskier ones, thereby reducing the overall portfolio risk (Fishburn and Porter 1976, p. 1064). Conversely, lower interest rates maintained over an extended period can increase risk-taking (Brana, Campmas and Lapteacru 2019, p. 576), as evidenced by banks loosening their lending standards (Neuenkirch and Nöckel 2018, p. 71).

H₁: There is a negative relationship between interest rate and risk-taking by banks.

The extent of this risk-taking shift is contingent upon a bank's capitalisation. Banks with the least capital are anticipated to be more vulnerable to changes in monetary policy, as they face a higher risk of agency problems (Acharya and Viswanathan 2011 p.99). Therefore, the impact of interest rate change on risk-taking is a function of capitalisation with the least capitalised banks showing greater variation in response to interest rate fluctuations (Lee, Liu and Stebunovs 2019, p. 105550). Dreschsler et al., (2016, p. 1933) found that weakly capitalised banks invest in more riskier assets; whereas Dell'Ariccia, Laeven and Marquez 2017, p. 613) showed that better capitalised banks are more sensitive changes in monetary policy. Thus, variations in interest rates impact a bank's risk-taking behavior according to its capital structure adjustments and alterations in lending rates (Ibid.). Based on the critical review of past studies, this study hypothesised that:

H₂: Bank capital moderates the relationship between interest rates and a bank's risk-taking behaviour.

The primary cause of bank failures is the principal-agent problem, also known as agency conflicts, which drive managers to lower lending standards and take on additional risk (Abbate and Thaler 2019, p. 2115). In periods of low interest rates, banks often misprice downside risk due to excess liquidity, leading to the formation of asset price bubbles (Acharya and Naqvi 2012, p. 349). Consequently, there is a connection between monetary policy, liquidity, and the risk-taking behaviour of the financial sector. Monetary policy influences the economy's final output by altering interest rates, which in turn impacts the economy's liquidity position and ultimately, the financial sector's risk-taking (Khan et al., 2017, p. 203). Additionally, interest rates have a negative effect on liquidity (Dreschsler et al., 2016, p. 1933).

Banks having high liquidity take more risk when they expect the interest rate to remain low for a longer period (Bonfim and Soares 2018). This is because the liquidity provides a buffer against any economic shock that may cause the interest rate to rise and may increase the sudden demand of payments from depositors (Hong, Huang and Wu 2014, p. 91). In the subprime mortgage market, financial firms extend loans to borrowers lacking the capacity to repay, thereby assuming increased risk when flush with liquidity. Furthermore, liquidity links balance sheet management, monetary policy, and asset pricing (Adrian and Shin 2009, p. 600). Thus, it is hypothesised that:

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H₃: Funding liquidity risk moderates the relationship between interest rate and risk-taking by a bank.

Agency theory, introduced by Meckling and Jensen (1976, p. 305), explains the conflict of interest among owners, managers, and debt holders. Khan et al. (2017, p. 203) argue that a principal cause of bank failures is the principal-agent problem, or agency conflicts, which prompt managers to reduce lending standards and assume greater risk. Excess liquidity often leads managers to engage in risky lending practices, such as lowering lending standards and collateral requirements, thereby increasing risk-taking in financial firms.

This study aims to offer a non-Western perspective by focusing on the South Asian Association for Regional Cooperation (SAARC), which includes members like Pakistan, India, Bangladesh, Sri Lanka, the Maldives, Nepal, Afghanistan, and Bhutan. It enriches the existing academic framework by presenting evidence of the risk-taking channel of monetary policy in the SAARC region.

Empirical evidence is provided to show that risk-taking is influenced by both funding liquidity risk and bank capital. Interest rate changes simultaneously affect the demand (lending) and supply (deposits). The study utilises annual data from 2009-18 of banks in the SAARC region, analysed using the Generalized Method of Moments (GMM). It is found that the relationship between interest rates and risk-taking is more pronounced in banks with low capital and funding liquidity risk, as they are more sensitive to interest rate changes, leading to greater variations in risk-taking.

Additionally, the study discovers that both liquidity ratio and minimum capital requirement play a role in restricting the financial sector's risk-taking. The findings reveal that interest rates negatively impact bank risk-taking and also confirm that risk-taking is dependent on capitalisation and funding liquidity risk.

2. DATA DESCRIPTION AND EMPIRICAL FRAMEWORK

2.1 Data Description and Sample Selection

The study analysed annual data from banks listed on the stock exchanges in the SAARC region, spanning from 2009 to 2018. This approach aligns with the methodology of Delis and Kouretas (2011, p. 840), who empirically demonstrated that annual data effectively explains bank risk-taking in response to policy changes induced by interest rate fluctuations. The total number of listed SAARC banks was 204 but the data of 174 banks was available on 'The Banker' database. The banks having incomplete data were removed from the sample. The final sample, therefore, consisted of a balanced panel data set of 99 banks from 2009-18 (Afghanistan 6, Bangladesh 21, Bhutan 0, India 43, Maldives 2, Nepal 8, Pakistan 8, and Sri Lanka 11) representing 41% of listed banks.

2.2 Research Methodology

The study employed a dynamic Generalized Method of Moments (GMM) model for coefficient estimation. The coefficient of the lagged dependent variable indicates the speed of convergence to equilibrium. In econometrics, endogeneity implies that variables are correlated with error terms and previous shocks, but not with future shocks and error terms (t+1) (Delis and Kouretas 2011, p.840).

2.3 Variable Description

The study investigated the moderating role of funding liquidity risk and bank capital in the risk-taking channel of monetary policy. The bank specific variables included Z-score, NPL ratio, deposits, capital, bank size, return on assets and loans. The country-specific variables included GDP, inflation, and unemployment. Details about the variables are given in Table 1:

Table 1: Variable Description

	Variable	Construction
Risk-taking	-Z-Score	$-1\{\text{return on assets} + (\text{equity/asset})\}/\text{standard deviation of ROA}$
	NPL Ratio	Non-performing loans to total loans
Monetary Policy	Risk-free rate	Risk free interest rate
Bank Capital	Bank capital	Tier 1 regulatory capital / total risk weighted assets
Funding Liquidity Risk	Deposit	Total deposits/ total assets
	Size	Natural logarithm of TA
	Loan	Total loans/ TA
	ROA	Net income/ TA
	GDP	GDP growth rate
	UNEM	Unemployment Rate
	INF	Inflation
Interaction Terms	RF* Deposits	RF* Deposits
	RF* Capital	RF* Capital

Source: Authors' own.

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To assess overall bank risk-taking, the study utilised the Z-score, and for evaluating asset risk, it employed the Non-Performing Loans (NPL) ratio. This ratio is an indicator of bank asset quality, with any decline in loan quality negatively impacting the market value of assets and earnings. A high NPL ratio, indicative of significant loan losses, is associated with increased risk (Delis and Kouretas 2011, p. 840). Brana, Campmas, and Lapteacru (2019, p. 576) and Khan et al., (2017, p. 203) also used this measure in their studies as it effectively captures creditors' rights and information sharing in cross-country analyses. It is calculated as under:

$$Z\text{-scores} = \frac{\text{Return on Asset} + (\text{Equity/Asset})}{\text{Standard Deviation of Return on Asset}} \quad (3)$$

The study computed the standard deviation of ROA using a three-year rolling window, as established in the literature. The Z-score, a measure of stability, indicates greater bank stability with higher values. Therefore, the Z-score was multiplied by -1 to transform it into a suitable proxy for risk, where a high -Z-score signifies increased risk. Additionally, the study used the ratio of Non-Performing Loans (NPL) to total loans as a measure of credit risk. This ratio assesses the quality of bank assets, with any decline in loan quality negatively affecting the market value of assets and earnings. Consequently, a higher NPL ratio is associated with elevated risk (Delis and Kouretas 2011, p. 840).

In the literature, monetary policy is often measured by the risk-free interest rate, as noted by Lucchetta (2007). The interest rate has a significant impact on both the quantity and quality of a bank's balance sheet (Dell'Ariccia and Marquez 2017, p. 613). Any negative shock transmitted through the interest rate affects the final output, making it a crucial indicator of financial stress (Gilchrist and Zakrajšek 2011, p. 195). Jiménez et al., (2014, p. 463) argue that interest rate influences the quality of credit extended to borrowers, as well as the investment opportunities of firms, their net worth, and collateral value.

The interest rate, a primary tool of monetary policy, regulates bank liquidity, credit extension, and ultimately the economy's output (Lucchetta 2007). It is noted that a reduction in interest rates prompts banks to favour deposits over equity, as deposits become comparatively cheaper. This shift can increase a bank's risk-taking due to a lower equity stake. Consequently, this study employs interest rate as a proxy for measuring monetary policy, as supported by the evidence above. Funding liquidity risk is measured by the liquidity of bank 'I' in year 't-1', indicating that a decrease in funding liquidity risk can lead to increased risk-taking by the bank in the following year.

The study measured funding liquidity risk using the ratio of total deposits to total assets, a proxy derived from the research of Khan et al., (2017, p. 203). To calculate bank capital, the study utilised the ratio of Tier 1 capital to total risk-weighted assets, a risk-adjusted measure, following the methodology of Dell'Ariccia et al., (2017, p. 613).

2.4 Econometric Model

The general baseline model used for this study is as under:

$$Risk_{i,t} = \alpha_i + \lambda(Risk_{i,t-1}) + \beta r_t + \gamma K_{it} + \theta D_{it-1} + \mu Y_{it} + \rho Z_{it} + \varepsilon_{it}$$

whereas α_i are bank specific fixed effects, $Risk_{i,t-1}$ is lagged dependent variable, r_t is the interest rate used as a proxy to calculate monetary policy, K_{it} is the capital to assets ratio (inverse of leverage), D_{it-1} is the deposit to asset ratio for measuring funding liquidity risk, Y_{it} is the set of bank specific control variables, Z_{it} are country specific control variables and ε_{it} is the error term. β is the coefficient of interest of the study. Interaction term is introduced between capital and risk-free interest rate $r_t * K_{it}$ and deposit and risk-free interest rate $r_t * D_{it-1}$. Dell’Ariccia et al. (2017, p. 613) used an interaction term between the interest rate and bank capital, arguing that the effect of interest rate changes is moderated by bank capital. In this study, however, a double interaction term is employed, based on the premise that both bank capital and funding liquidity risk moderate the relationship between interest rate and bank risk-taking.

2.5. Estimation Method

Delis and Kouretas (2011) utilised the GMM estimator to address endogeneity issues. They posited that the dynamic nature of risk, deviating from equilibrium, leads to intensified competition, relationship banking with risky borrowers, business cycle fluctuations, and regulatory changes. They observed that heightened competition increases risk-taking among banks, and relationship banking with risky borrowers influences risk-taking in the long run. Additionally, they noted that business cycles, affected by macroeconomic shocks, require time to mitigate their effects. Furthermore, banking regulations such as capital requirements and guarantees might exacerbate moral hazard issues, leading to increased risky investments. Therefore, given the dynamic nature of risk, the use of a static model would be inappropriate. Hence, the study utilised a dynamic model to empirically test the relationship, incorporating a lagged dependent variable. The coefficient of this lagged variable indicated the speed of convergence towards equilibrium. In econometrics, endogeneity implies correlation between variables and error terms, as well as previous shocks, while showing no correlation with future shocks and the error term at time (t+1) (Ibid., p. 840).

3. DATA ANALYSIS

This section begins with the descriptive statistics of the data, followed by the presentation of the GMM results:

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Table 2: Descriptive Statistics

	Mean	Maximum	Minimum	Std. Dev.
-Z-score	-16.744	6.662	-439.068	31.911
NPL Ratio	5.675	17.200	0.800	4.949
Risk-free Rate	6.938	14.840	0.222	2.991
Deposits / Total Assets	0.764	1.046	0.000	0.139
Tier 1 Capital / Total Risk Weighted Assets	0.135	7.312	0.005	0.263
Return on Assets	1.173	5.500	-3.800	0.999
Loans	0.608	0.982	0.055	0.126
Size	3.716	5.745	1.668	0.737
GDP	6.093	21.391	-7.229	1.959
Unemployment	3.034	6.120	0.535	1.144
Inflation	7.206	13.881	-6.811	3.010

Source: Authors' own.

Table 2 shows the descriptive analysis of all the variables of the study. The mean value of deposit shows that deposits are almost 76% of the total assets but dispersion is insignificant. Similarly, the meaning of Tier 1 capital/total risk weighted assets shows that Tier 1 capital is almost 14% of the risk weighted assets with very minimal deviations. The risk-free rate in the SAARC region exhibits a mean value of 6.938, accompanied by a significant dispersion of 299%, indicating considerable variation. The study's dependent variable, the -Z-score as a measure of risk, has a mean value of -16.744. Additionally, the banks, on average, remained profitable, as reflected in the mean return on assets, with a standard deviation of 0.99, which suggests considerable variability in profitability. Loans constitute a major portion of the banks' balance sheets, as demonstrated by the mean loan value, signifying that loans account for nearly 60% of total assets, with minimal dispersion.

3.1 Correlation Matrix

The findings of the test depicted that all the independent variables are not highly correlated with each other. The association or correlation between the two variables should not be greater than ± 0.80 , otherwise, there are chances of multicollinearity or the issue of serial correlation in the variables included:

Table 3: Correlation Matrix

	DEP	GDP	INF	LNTA	NPL	RF	ROA	TICap	TLTA	UR	InvZ-Score
DEP	1.000										
GDP	-0.076**	1.000									
INF	0.035	-0.188**	1.000								
LNTA	0.106**	0.276**	0.020	1.000							
NPL	-0.069	-0.084**	-0.132**	-0.073**	1.000						
RF	-0.113**	-0.161**	0.174**	0.266**	0.068*	1.000					
ROA	-0.226**	-0.150**	0.168**	-0.327**	-0.343**	-0.110**	1.000				
TICap	-0.301**	-0.016	-0.046	-0.146**	0.215**	0.033	0.035	1.000			
TLTA	0.206**	0.116**	-0.055	-0.114**	-0.210**	-0.275**	-0.043	-0.061	1.000		
UR	-0.152**	0.173**	-0.465**	-0.165**	0.068*	-0.187**	0.058	0.036	0.264**	1.000	
InvZ-Score	0.179**	-0.029	-0.182**	0.152**	0.119**	-0.049	-0.254**	-0.073*	0.003	0.105**	1.000

Note: RF stands for risk free rate, DEP stands for Deposits, TICap stands for Tier 1 capital ratio, NPL is the ratio of non-performing loans, LNTA Log of Total Assets, ROA stands for Return on Assets, TLTA stands for total loans to total asset, UR stands for unemployment rate, GDP for gross domestic product and INF for inflation, InvZ-Score stands for inverse of Z-score. ** and * present significance level at 5% and 10%, respectively.

Source: Authors' own.

3.2 GMM Results (-Z-score)

Table 4 reports GMM results to investigate impact of interest rate on bank risk-taking as a measure by (-Z-score & NPL Ratio) in column (I & IV) and the differential effect of

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funding liquidity risk in column (II & V) and finally differential effect of Tier 1 capital in column (III & VI):

Table 4: GMM Results

	-Z-score			NPL Ratio		
	(I)	(II)	(III)	(IV)	(V)	(VI)
Risk-free Rate	-2.516**	15.192**	-5.301**	-0.026	3.071***	0.156
	(1.276)	(6.882)	(2.220)	(0.063)	(0.856)	(0.15)
Deposits / Total Assets	17.879	175.129**	63.511**	-2.065	25.151**	-3.002
	(26.914)	(78.609)	(32.726)	(4.185)	(10.266)	(5.097)
Tier 1 Capital / Total Risk Weighted Assets	-2.693	1.901	-211.235**	1.922***	2.416***	12.41
	(3.881)	(4.096)	(103.152)	(0.277)	(0.366)	(7.851)
Return on Assets	5.164*	4.507	6.343**	-1.162***	-0.708*	-1.173***
	(2.879)	(3.015)	(2.953)	(0.394)	(0.413)	(0.413)
Loans	-59.725**	-60.249**	-51.831**	-2.83	0.684	-2.011
	(24.748)	(24.748)	(25.091)	(2.197)	(2.046)	(2.472)
Size	-11.652	-13.973	-2.395	1.408	3.648	2.384
	(15.723)	(16.760)	(17.095)	(2.651)	(2.493)	(3.323)
GDP	1.484*	0.829	0.142	-0.053	0.026	-0.034
	(0.867)	(0.697)	(0.557)	(0.103)	(0.109)	(0.103)
Inflation	0.483	-0.170	-0.379	-0.543***	-0.711**	-0.461**
	(0.541)	(0.410)	(0.448)	(0.192)	(0.288)	(0.228)
Unemployment	0.974	-2.067	1.877	-0.085	-0.043	-0.052
	(2.497)	(2.044)	(2.066)	(0.052)	(0.048)	(0.06)
Risk-free Rate* Deposits / Total Assets		-21.970**			-4.048***	
		(9.210)			(1.169)	
Risk-free Rate* Tier 1 Capital/ Total Risk Weighted Assets			29.848**			-1.583
			(14.925)			(1.191)
-Z-score(-1)	0.624***	0.500***	0.469***			
	(0.087)	(0.026)	(0.027)			
-Z-Score(-2)	-0.078**					
	(0.040)					
NPL Ratio(-1)				0.161**	0.186**	0.208**
				(0.073)	(0.075)	(0.082)
Hansen J	0.201	0.340	0.339	0.199	0.228	0.202
AR(1)/AR(2)	0.002/0.399	0.02/0.361	0.00/0.482	0.00/0.400	0.00/0.882	0.00/0.179

Source: Authors' own.

Table 4 shows GMM results with all the three models, (I) shows the results with baseline model, (II) shows results with interaction term of interest rate and deposits and (III) shows results with interaction term of interest rate and Tier 1 capital. *, **, *** indicates the level of significance at 10%, 5% and 1% (two tailed test), respectively. The coefficients are presented and standard errors are given in parenthesis.

The Hansen test of over identification is under the null that all instruments are valid. The model reveals that risk in the previous period significantly influences the risk in the current period. Hence, by taking the second order difference, the problem of endogeneity from data is removed and the first lag is significant to capture the dynamic effects estimated by the system GMM. Additionally, the model incorporates both bank-level and macroeconomic-level control variables. The AR (2) test indicates second-order serial correlation in the first-difference residuals, operating under the null hypothesis of no serial correlation.

In column (I), the coefficient on the indicator of monetary policy, i.e., risk-free rate is found to have significant negative impact on the risk-taking as measured by -Z-score ($p < 0.05$). This shows that any decrease in interest rate leads to enhanced risk-taking by banks. The results are in accordance with the findings of Delis and Kouretas (2011) who also found an inverse relationship between interest rate and banks' risk-taking. Based on these findings, the study's first hypothesis, which posits a negative relationship between interest rate and bank risk-taking, is accepted.

Column (II) of Table 4 presents the differential results of the GMM, where deposits/total assets serve as the moderator. This is analysed using an interaction term of deposits/total assets and the risk-free rate. The focus is primarily on the size and sign of the coefficient of this interaction term. It bears a negative sign, indicating that deposits/total assets negatively moderate the relationship between the risk-free rate and risk-taking ($p < 0.05$). This finding indicates that banks with higher deposits are less sensitive to changes in interest rates and exhibit less variation in risk-taking compared to banks with lower deposits. This could be attributed to their excess liquidity and a reduced risk of runs, making their risk-taking less responsive to interest rate fluctuations than banks with fewer deposits. They (low deposit banks) may adopt the search for yield phenomenon and lend more to risky borrowers aiming to increase their profits in response to any low interest rate and vice versa. Thus, the results demonstrate clearly that the effect of change in interest rate is a function of capital and deposits. On the basis of these results, the second hypothesis that deposits (funding liquidity) moderate the relationship between interest rate and risk-taking, is accepted.

The study reveals that lower interest rates lead to increased liquidity for banks, prompting them to lend more. This increased lending boosts economic activity, as businesses gain more working capital, leading to higher production levels. Consequently, low interest

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rates also serve as a tool for controlling final economic output. Conversely, under a contractionary monetary policy, higher interest rates result in limited liquidity for banks. This situation leads banks to tighten their lending criteria, making loans more expensive and reducing lending. Such a reduction in lending can lead to decreased production and ultimately a lower final output in the economy. Moreover, the result demonstrates that low deposits banks are more sensitive to any change in interest rate. So, they are more vulnerable to any liquidity crisis and they don't have the capacity to survive a crisis. The failure of numerous low deposit banks could result in systemic risk. Therefore, central banks and monetary authorities should take into account the risks associated with changes in interest rates for low deposit banks, aiming to prevent any financial vulnerabilities.

Column (III) of Table 4 shows the differential effect of bank capital on risk-taking as proxied by the interaction term between risk-free rate and Tier 1 capital/total risk weighted assets. The interaction term maintained positive relationship with the risk-taking of the bank ($p < 0.05$). It shows that Tier 1 capital/total risk weighted assets positively moderate the relationship between risk-free rate and risk-taking and the relationship is significant at 5% level of significance. It demonstrates that least capitalised banks are more sensitive to any change in interest rate and consequently, there is more variation in their risk-taking as compared to well capitalised banks. When monetary policy is tightened, these banks tend to take less risk, whereas they assume more risk during periods of looser monetary policy. This effect is consistent with the search for yield channel of monetary policy. These results are in coherence with the results of Jimenez et al. (2014, p. 463) and in contrast with the results of Dell'Ariccia et al. (2017, p. 613). They found a negative coefficient on interaction term implying that the effect is more pronounced for well capitalised banks.

The results across all cases confirm that risk is influenced by bank capital, aligning with the traditional risk shifting channel. However, the divergent findings suggest that the interplay between risk-taking, interest rate, and capital may vary depending on the specific circumstances of each country. Based on these results, the second hypothesis, which posits that bank capital moderates the relationship between interest rate and risk-taking, is accepted. This aligns with the risk-shifting literature, which asserts that risk-taking is contingent upon bank capital, a stance supported by the study. Additionally, the final economic output is influenced by the banks' extension of credit, which is, in turn, affected by the interest rate. Capital requirements guide banks in their risk exposure by setting limits on their credit extension.

The results of NPL ratio are given in column (VI, V & VI) of Table 4. In the baseline model, the interest rate does not maintain any significant relationship with bank risk as measured by the NPL ratio. It shows that in the study's model, any change in interest rate does not affect the NPL, however, the introduction of interaction term of deposits/total

assets and risk-free rate brings significant impact on the relationship between the above said variables. The coefficient of interaction term carries the same sign as obtained from the main dependent variable ($p < 0.01$). Furthermore, interest rate has a significant positive impact on the NPL ratio. Any increase in interest rate increases the NPL of banks by eroding repayment capacity of the borrower. Model III shows an insignificant relationship with the interaction term of interest rate and Tier 1 capital. Overall, the NPL ratio enhances the results of model (II) given in column (V).

3.3. GMM Results (Contractionary / Expansionary Monetary Policy)

To assess the impact of contractionary monetary policy, quartiles of the interest rate were established (quantile 1 = 5.251, quantile 2 = 7.189, and quantile 3 = 8.4535), determining the median point at quantile 2 (7.189). Any interest rate above this median is considered high, reflecting contractionary monetary policy, while rates below this median are deemed low, indicative of expansionary monetary policy.

Table 5: GMM Results of Contractionary and Expansionary Monetary Policy

	Contractionary Monetary Policy			Expansionary Monetary Policy		
	(I)	(II)	(III)	(I)	(II)	(III)
Risk-free Rate	1.344	1.254***	1.116*	-0.622	0.769	-2.270***
	(0.574)	(0.477)	(0.659)	(0.450)	(2.051)	(0.638)
Deposit / Total Assets	40.375	30.471	19.543	-11.301	-8.146	-98.909**
	(47.296)	(60.217)	(48.651)	(30.867)	(40.279)	(50.712)
Tier 1 Capital / Total Risk Weighted Assets	-26.929	-20.483	-95.174	-3.428	-3.818	-43.440
	(33.940)	(30.878)	(69.984)	(8.332)	(8.668)	(34.147)
Return on Assets	-2.536	-2.372	-2.603	3.395*	3.266*	8.251*
	(3.732)	(3.363)	(3.301)	(1.978)	(1.928)	(4.376)
Size	-11.590	-12.557	-10.225	-68.349***	-	-54.277*
	(13.427)	(13.995)	(12.100)	(13.626)	(10.878)	(29.996)
Loans	3.031	5.424	12.444	62.416***	75.228***	17.551
	(24.358)	(23.189)	(22.907)	(21.167)	(19.497)	(33.783)
GDP	-0.653	-0.940	-0.556	-0.481	-0.609	0.744
	(0.573)	(0.623)	(0.466)	(0.725)	(0.838)	(1.093)
Unemployment	-0.310	-0.143	0.303	-0.820*	-1.175**	-0.950
	(1.990)	(2.087)	(2.255)	(0.481)	(0.459)	(0.979)
Inflation	0.463	0.146	0.017	16.156***	15.484***	19.383***

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	(0.390)	(0.451)	(0.393)	(3.212)	(3.591)	(5.026)
Risk-free Rate* Deposits / Total Assets		0.454			-2.098	
		(2.097)			(3.094)	
Risk-free Rate*Tier 1 Capital/ Total Risk Weighted Assets			9.387			5.267
			(7.562)			(4.435)
-Z-score(-1)	0.505***	0.484***	0.479***	0.557***	0.556***	0.867***
	(0.020)	(0.032)	(0.024)	(0.036)	(0.031)	(0.107)
-Z-score(-2)						-0.265***
						(0.055)
Hansen J	0.660	0.515	0.665	0.458	0.198	0.464
AR(1)/AR(2)	0.00/0.7062	0.00/0.761	0.00/0.551	0.99/0.436	0.96/0.371	0.09/0.526

Source: Authors' own.

Table 5 shows GMM results with all the three models - (I) shows the results with the baseline model; (II) shows results with interaction term of interest rate and deposits; and (III) shows results with interaction term of interest rate and Tier 1 capital. *, **, *** indicates the level of significance at 10%, 5% and 1% (two tailed test), respectively. The coefficients are presented, and standard errors are given in parenthesis. The Hansen test of over identification is under the null that all instruments are valid. AR (2) shows second order serial correlation in the first difference residuals under the null of no serial correlation. The p -value of second order correlation clearly shows that there is no issue of serial correlation.

Table 5 indicates that the interest rate maintains a significant positive relationship with bank risk-taking. During a contractionary period, an increase in interest rates heightens bank risk-taking as it renders loans more expensive, thereby elevating the risk of borrower default. Moreover, the deposits/total assets or Tier 1 capital/total risk weighted assets does not act as moderator during high interest rate periods, but the introduction of interaction term makes the relationship of risk-free rate and bank risk-taking significant. During the expansionary period, interest rate shows significant negative effect on bank risk only when the interaction term of risk-free rate with Tier 1 capital/total risk weighted assets, is introduced. This shows that any decrease in risk-free rate increases risk-taking by a bank as it starts giving more riskier loans. The deposits/total assets also maintain a significant negative relationship as shown in model (III) of expansionary monetary policy. Banks with lower deposits tend to take more risks in order to increase their

returns. Furthermore, during expansionary periods, banks with a higher volume of loans and profitability engage in more risk-taking. This is also true for smaller banks, as indicated by the significant negative relationship between the natural logarithm of total assets and bank risk-taking.

4 CONCLUSION AND RECOMMENDATIONS

The study aimed to explore how fluctuations in monetary policy affect banks' risk-taking, particularly through the lenses of bank capitalisation and funding liquidity risk, focusing on banks operating within the SAARC region. It was argued that along with bank capital, funding liquidity risk also moderates the effect of monetary policy on banks' risk-taking. Data was collected from 'The Bankers' database and World Bank indicators and analysed using GMM due to endogeneity of risk. The study used $-Z$ -score and NPL ratio as proxies for risk. The empirical findings suggest that interest rate negatively affects a bank's risk-taking. Unlike previous literature, this paper provides evidence that risk-taking is a function of capitalisation and funding liquidity risk. Banks having low capital and high funding liquidity risk are more sensitive to any change in interest rate and consequently, more variation in the risk-taking. Both liquidity ratio and minimum capital requirement jointly restrict risk-taking of the financial sector.

Authorities should rigorously monitor these ratios, particularly for banks with lower deposits and capitalisation, considering the banking sector's role in maintaining financial stability. To prevent cross-border spillover effects in constituent countries, effective regulation and supervision of bank-specific characteristics are recommended to ensure prudent banking behaviour. While supervision incurs costs, the benefits of implementing strict regulations for financial stability should be carefully weighed. While keeping interest rate low, regulators may take complementary measures to ensure that banks risk-taking may be restrained by imposing strict capital and liquidity requirements.

By highlighting the significance of capital and funding liquidity risk, this study underscores the importance of a macroprudential policy approach in regulating the banking sector, complementing the microprudential approach. Macroprudential policy focuses on the stability of the whole financial system. The final output of the economy is also dependent on the extension of credit by banks that is ultimately affected by interest rates. Low deposit and weak capitalised banks are more vulnerable to liquidity crises, hence, they must be reviewed on a monthly basis. During expansionary periods, capital requirements may be set higher, as banks are typically able to raise more capital during economic booms, and conversely lower during contractions. Moreover, the study highlights the crucial roles of both capital and liquidity in sustaining financial stability, stressing that liquidity cannot be an alternative to capital, and vice versa. Future research

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could expand the scope to include all financial firms, including banks, to ascertain if this relationship remains consistent.

REFERENCES

- Abbate, A. and Thaler, D. 2019, 'Monetary Policy and the Asset Risk-Taking Channel', *Journal of Money, Credit and Banking*, vol. 51, no. 8, pp. 2115-2144, <<https://doi.org/10.1111/jmcb.12621>>.
- Acharya, V. and Naqvi, H. 2012 'The Seeds of a Crisis: A Theory of Bank Liquidity and Risk Taking over the Business Cycle', *Journal of Financial Economics*, vol. 106, no. 2, pp. 349-366, <<https://doi.org/10.1016/j.jfineco.2012.05.014>>.
- Acharya, V.V. and Viswanathan, S. 2011, 'Leverage, Moral Hazard, and Liquidity', *The Journal of Finance*, vol. 66, no. 1, pp. 99-138, <<https://doi.org/10.1111/j.1540-6261.2010.01627.x>>.
- Adrian, T. and Shin, H.S. 2009, 'Money, Liquidity, and Monetary Policy', *American Economic Review*, vol. 99, no. 2, pp. 600-605.
- Begenau, J. 2020, 'Capital Requirements, Risk Choice, and Liquidity Provision in a Business-Cycle Model', *Journal of Financial Economics*, vol. 136, no. 2, pp. 355-378.
- Bonfim, D. and Soares, C. 2018, 'The Risk-Taking Channel of Monetary Policy: Exploring All Avenues', *Journal of Money, Credit and Banking*, vol. 50, no. 7, pp. 1507-1541.
- Brana, S., Campmas, A. and Lapteacru, I. 2019, '(Un) Conventional Monetary Policy and Bank Risk-Taking: A Nonlinear Relationship', *Economic Modelling*, vol.81, pp. 576-593.
- Delis, M.D. and Kouretas, G.P. 2011, 'Interest Rates and Bank Risk-Taking', *Journal of Banking & Finance*, vol. 35, no. 4, pp. 840-855.
- Dell'Ariccia, G., Laeven, L. and Suarez, G.A. 2017, 'Bank Leverage and Monetary Policy's Risk-Taking Channel: Evidence from the United States', *The Journal of Finance*, vol. 72, no. 2, pp. 613-654.
- Drehmann, M. and Nikolaou, K. 2013, 'Funding Liquidity Risk: Definition and Measurement', *Journal of Banking & Finance*, vol. 37, no. 7, pp. 2173-2182.
- Dreschsler, I., Drechsel, T., Marques-Ibanez, D. and Schnabl, P. 2016, 'Who Borrows from the Lender of Last Resort?', *The Journal of Finance*, vol. 71, no. 5, pp. 1933-1974.
- Fishburn, P.C. and Burr Porter, R. 1976, 'Optimal Portfolios with One Safe and One Risky Asset: Effects of Changes in Rate of Return and Risk', *Management Science*, vol. 22, no. 10, pp. 1064-1073.
- Gilchrist, S. and Zakrajšek, E. 2011, 'Monetary Policy and Credit Supply Shocks', *IMF Economic Review*, vol. 59, no. 2, pp. 195-232.

- Hong, H., Huang, J.Z. and Wu, D. 2014, 'The Information Content of Basel III Liquidity Risk Measures', *Journal of Financial Stability*, vol. 15, pp.91-111.
- Jiménez, G., Ongena, S., Peydró, J.L. and Saurina, J. 2014, 'Hazardous times for Monetary Policy: What do Twenty-Three Million Bank Loans say about the Effects of Monetary Policy on Credit Risk-Taking?', *Econometrica*, vol. 482, no. 2, pp.463-505.
- Khan, M.S., Scheule, H. and Wu, E. 2017, 'Funding Liquidity and Bank Risk Taking', *Journal of Banking & Finance*, vol.8282, pp.203-216.
- Lee, S.J., Liu, L.Q. and Stebunovs, V. 2022, 'Risk-taking Spillovers of US Monetary Policy in the Global Market for US Dollar Corporate Loans', *Journal of Banking & Finance*, vol.138, DOI: 10.1016/j.jbankfin.2019.05.006.
- Lucchetta, M. 2007, 'What do Data Say about Monetary Policy, Bank Liquidity and Bank Risk Taking?', *Economic Notes*, vol.36, no. 2, pp.189-203.
- Meckling, W.H. and Jensen, M.C. 1976, 'Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure', *Journal of Financial Economics*, vol. 3, no. 4, pp.305-360.
- Mishkin, F.S., 2011, 'Monetary Policy Strategy: Lessons from the Crisis', Working Paper 16755, Cambridge, MA: National Bureau of Economic Research, <<https://www.imf.org/external/np/seminars/eng/2011/res2/pdf/fm.pdf>> .
- Neuenkirch, M. and Nöckel, M. 2018, 'The Risk-Taking Channel of Monetary Policy Transmission in the Euro Area', *Journal of Banking & Finance*, vol. 93, pp.71-91.
- Woodford, M. 2012, 'Inflation Targeting and Financial Stability', Working Paper 17967, Cambridge, MA: National Bureau of Economic Research, <https://www.nber.org/system/files/working_papers/w17967/w17967.pdf> .