ASIAN ACADEMY *of* MANAGEMENT JOURNAL *of* ACCOUNTING *and* FINANCE

AAMJAF Vol. 18, No. 1, 1–31, 2022

ECONOMICS OF RISK-TAKING, RISK-BASED CAPITAL AND PROFITABILITY: EMPIRICAL EVIDENCE OF ISLAMIC BANKS

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ABSTRACT

This study aims to explore the interrelationship between risk-based capital, risk-taking, and profitability. This study employs two-stage least square (2SLS) methods on the annual data of 217 Islamic banks from 35 countries ranging from 2010 to 2019. We find that the relationship between risk-based capital and risk-taking behaviour is negative, and the results are heterogeneous across different regions concerning both signs and significance. Consistent with the theory of moral hazard, we find the negative relationship between risk-based capital and Islamic banks' risk-taking behaviour, implying that managers in Islamic banks could increase their investment in risky assets and keep only smaller amounts of capital. The concept of profit and loss sharing motivates them to take a higher risk and aim to get a higher yield. This relationship is also in line with the agency theory, inferring that bank managers could take excessive risk to get higher compensation to align with higher profitability. The results also reveal a positive relationship between risk-taking and profitability, which is in line with

Publication date: 29 July 2022

To cite this article: Abbas, F., Ali, S., Yousaf, I., & Wong, W-K. (2022). Economics of risk-taking, risk-based capital and profitability: Empirical evidence of Islamic banks. *Asian Academy of Management Journal of Accounting and Finance, 18*(1), 1–31. https://doi.org/10.21315/aamjaf2022.18.1.1

To link to this article: https://doi.org/10.21315/aamjaf2022.18.1.1

the portfolio theory in finance. The findings in our paper would be useful for decision-makers and bank managers in understanding the interrelationship between risk, capital, and profitability and no factor alone could be good enough to ensure bank soundness. Furthermore, our findings imply that regulators and bank managers should not only focus on bank capital for increasing banks' stability. They should also look into both profitability and capital ratios in addition to bank capital because all three factors could increase banks' stability simultaneously.

Keywords: Islamic banks, risk-taking, risk-based capital, profitability

INTRODUCTION

There are distinctive financial frameworks in the world, but traditional banking and Islamic finance are the most esteemed ones. The conventional banks' fundamental power can be synthesised as the banks acquire funds at lower interest rates to lend at higher margin rates. Conversely, the Islamic financial system relies on the norms of partnership. As per the Shariah law, the basic principle behind Islamic banking ideology is the sharing of benefits (profits) and misfortune (losses) among investors (contributors, shareholders, depositors). The concern of how Islamic banking works is beyond the scope of this study because our focus is to obtain the quantitative analysis for bank capital ratio, net profit value, and advances for businesses net results as reported by Islamic banks in their financial statements at a particular time for ten years in chronological order. The Islamic Financial Services Board (IFSB) is the standard body for Islamic finance. After a few improvements to the impact of Islamic banks' understanding of assets and liabilities, the IFSB adopted the Basel III institutional framework. Due to the financial crunch in the 2007–2008 period, deregulation of late 1990, technological transformation, financial innovation, and global financial integration, the financial system has significantly changed. The authorities and regulators have been concentrating on stabilising the financial system over the last three decades.

The review of literature for Islamic banking has evidenced that researchers mainly focus on the performance of Islamic banks (Mrad & Mateev, 2020; Paltrinieri et al., 2020; Said et al., 2013), risk-taking in Islamic banking (Basher et al., 2017; Mollah et al., 2017; Saeed et al., 2020; Srairi, 2019), and liquidity dynamic in Islamic banking (Abdul-Rahman et al., 2018; Alzoubi, 2017; Ashraf et al., 2016; Mahdi & Abbes, 2018). The enrich studies explore the comparison between the conventional and Islamic banks (Jawadi et al., 2016; Tafri et al., 2011; Rahmawati & Karim, 2016). In recent literature, numerous studies explore the interrelationship among bank capital level, risk-taking, and

profitability for conventional banks (Balla & Rose, 2019; Bitar et al., 2018; 2016; Deelchand & Padgett, 2009; Dias, 2020; Ding & Sickles, 2018; Paroush & Schreiber, 2019). Surprisingly, in Islamic banking, researchers have ignored a similar investigation of bank capital, risk-taking, and profitability. No study in the literature provides evidence into the relationship between bank capital, risk-taking and profitability for Islamic banks, particularly in the post-crisis era. The concern about bank risk-taking is an important indicator to influence bank profitability and regulatory capital ratios. In light of the depth and trend of some recent studies, we are interested in answering the following questions in Islamic banking for the post-crisis period: How do Islamic banks' risk-based capital ratio influence the risk-taking and financial performance in the post-crisis period? How do Islamic banks' profitability influence the risk-taking and risk-based capital ratio? How do Islamic banks' risk-taking affect profitability and risk-based capital ratios? Do the Islamic banks' capital ratio, risk-taking, and banks' profitability interrelate? Do the results of different regions of the globe similar, and if it is not, why?

The three significant indicators of Islamic banks are bank capital, risk-taking, and profitability. These indicators are usually investigated in pairs; that is, capital and profitability, profitability and risk-taking, and risk-taking and bank capital in the conventional banking system (Paroush & Schreiber, 2019). The empirical results indicate that bank capital, profitability, and risk-taking are interrelated and determined simultaneously (Aggarwal & Jacques, 1998; Jacques & Nigro, 1997; Shrieves & Dahl, 1992; Tran et al., 2016). To date, it is not clear whether the increase in bank capital will cause an increase or decrease in risk-taking in the banking literature. Some studies suggest the positive relationship between risk-taking and bank capital ratios, for example, as stated in the "regulatory assumption theory" (Iannotta et al., 2007; Shrieves & Dahl, 1992). The negative relationship is not less appealing, see, for example, the theory of moral hazard (Agusman et al., 2008; Jacques & Nigro, 1997). According to the empirical and theoretical literature, the relationship between bank profitability and bank capital could be positive or negative. The positive link between bank profitability and capitalisation is due to the efficiency of banks as per the hypothesis of structure conduct performance (Berger, 1995; Lee & Hsieh, 2013). The negative relationship between profitability and bank capitalisation is in line with the hypothesis of bad management. The third connection to investigate is the relationship between profitability and risk-taking. The positive relationship between bank profitability and risk-taking in banking is in line with portfolio risk and return theory (Berger, 1995; Moudud-Ul-Huq et al., 2020). In this paper, we test the theories and the hypotheses in Islamic banking for the post-crisis periods.

Our study contributes to Islamic banking literature in the following areas: First, our study is the first systematic attempt in the literature to investigate the interrelationship among risk-based capital, risk-taking, and profitability of Islamic banks in the post-crisis period. Second, this is the first study that examines the pro-cyclicality and counter-cyclicality of the business trends for risk-taking, risk-based capital, and profitability in the context of Islamic banks. Third, our study contributes to the regional literature by segregating the data in the MENA region, South Asia region, South East Asia region, Europe, and Central Asia region, and Africa region. Fourth, this research adds to the literature by using two-stage least squares (2SLS) in Islamic banking to control the simultaneity bias due to endogenous variables.

THE THEORY AND HYPOTHESES DEVELOPMENT

Various theories in banking literature provide the rationale for the relationship between risk-taking, bank profitability, and bank capital theoretically. For example, the moral hazard hypothesis suggests that bank managers take a higher risk on the cost of deposit insurance providers (Demirgüç-Kunt & Kane, 2002; Jacques & Nigro, 1997). The regulatory hypothesis states that banks increase their level of capital with an increase in the level of risk (Iannotta et al., 2007; Shrieves & Dahl, 1992). The portfolio theory supports the positive relationship between risk-taking and bank returns that is consistent with the idea in finance that higher risk yields higher returns (Markowitz, 1991). The bad management hypothesis postulates that the low level of efficiency of the bank is the result of decisions on poor management, which is reflected in poor credit management (Berger & DeYoung, 1997). The bad luck hypothesis is in line with the happening of unexpected events, which are not in the control of human beings. For example, the poor performance of the organisations during the COVID-19 is not because of the poor decision-making of management. In addition, agency theory always remains in the center of the organisations concerning the interest of the management and wealth of shareholders (Jensen & Meckling, 1976; Myers, 2001). In this paper, we probe the Islamic banks' profitability, risk-risking, and capital level under the above-mentioned theories of banking.

HYPOTHESES DEVELOPMENT

Bank Capital and Risk-taking

The literature contains conflicting commentary on the relationship between bank capital and bank risk-taking. Some empirical studies favor a positive

relationship and others provide negative co-movement between risk-taking and bank capital ratios. On the contrary, some studies explore that bank capital and risk-taking are interrelated and should be determined simultaneously (Aggarwal & Jacques, 1998; Bitar et al., 2018; Ding & Sickles, 2018; Jacques & Nigro, 1997; Rime, 2001; Shrieves & Dahl, 1992). In this regard, the evidence in most of the literature in the context of conventional banking, notwithstanding, is the lack of relationship between bank capital and risk-taking in Islamic banks. Due to this reason mix, literature is reported for the relationship of bank capital and risk-taking in this study. Masood and Ashraf (2012) concluded that Islamic banks with higher assets tend to take higher risks in emerging economies. The positive relationship between bank capital and risk-taking is supported by (Bougatef & Mgadmi, 2016; Ding & Sickles, 2018; Ghosh, 2014; Iannotta et al., 2007; Jokipii & Milne, 2011; Mahdi & Abbes, 2018; Shim, 2010; Shrieves & Dahl, 1992; Tan & Floros, 2013). In contrast, the negative association between risk-taking and bank capital holding is also not less appealing in banking as per the following studies among others (Hassan Al-Tamimi et al., 2015; Jacques & Nigro, 1997; Maji & De, 2015; Rahman & Shahimi, 2010; Saunders et al., 1990). To understand the relationship between risk-taking and bank capital in the context of Islamic banking, we are interested to test the following hypothesis:

H1: There is a positive and statistically significant relationship between risk-taking and the risk-based capital ratio of Islamic banks.

Bank Capital and Profitability

The literature presents conflicting results regarding the relationship between bank capital and bank profitability. Many empirical studies support positive relationships, while others have a negative relationship between risk-taking and bank capital ratios. Masood and Ashraf (2012) argue that capital is an influential factor in the profitability of Islamic banks. The study concluded that high equity decreases the risk of banks and increases the loss absorption ability of banks; the argument is in with the findings of (Berger, 1995). Bashir (2001) concludes in his study that an increase in leverage ratio boosts the profitability of Islamic banks. Chowdhury and Rasid (2016) conduct a study by using the data for Islamic banks of GCC economies over the period 2003 to 2015. The study provided information that the relationship between equity capital and profitability of Islamic banks in GCC countries is positive and statistically significant. Tarawneh (2006) investigates the financial performance of Islamic banks and concludes that capital is a significant indicator to influence the profitability of Islamic banks. Loghod (2010) reveals in his study that an increase

in bank capital increases the profitability of Islamic banks. The following studies are in line with the positive relationship between bank capitalisation and profitability (Beltratti & Stulz, 2009; Bitar et al., 2017; Bougatef & Mgadmi, 2016; Ding & Sickles, 2018; Islam & Nishiyama, 2016; Ozili, 2017; Tan, 2016; Terraza, 2015). On the contrary, the following studies conclude an inverse relationship between bank capital and profitability (Alavinasab & Davoudi, 2013; Ali et al., 2011; Berger & Di Patti, 2006; Boyd & Runkle, 1993; Harris & Katz, 1988; Maudos, 2017; Micco et al., 2007; Sharifi et al., 2016; VanHoose, 2007). In light of the literature review, the following is the hypothesis:

H2: There is a positive and statistically significant relationship between profitability and the risk-based capital ratio of Islamic banks.

Risk-taking and Profitability

The effect of capital sufficiency gauges on a bank's profitability is important even in gathering conventional banks. The corporate theory suggests that risk is the primary factor of profit for financial as well as non-financial firms. The profitability of Islamic banks, however, is marginally sensitive to risk-taking (Mrad & Mateev, 2020). Paltrinieri et al. (2020) explore that revenue diversification is irrelevant for Islamic banks' risk-taking in OIC countries. Lepetit et al. (2008) argue that non-interest-based activities decrease the level of risk higher than traditional activities in banking. On the contrary, De Jonghe (2010) explores that non-interest-based activities increase the risk-taking of banks. Using the data for emerging economies over the period from 2004 to 2015, Moudud-Ul-Huq et al. (2020) conclude that higher risk-taking is associated with higher profitability. Williams (2016) provides proof in his study that non-interest-based income and bank risk-taking are positively related. The positive relationship between risk-taking and bank profitability is supported by (Demirgüç-Kunt & Huizinga, 2010; Fiordelisi et al., 2011; Masood & Ashraf, 2012; Misman & Bhatti, 2020; Abbas, Yousaf, et al., 2021). Hassan Al-Tamimi et al. (2015) conduct a study by using the sample of Islamic banks and conclude that risk-taking and performance are negatively associated. In light of the literature review, the following is the hypothesis:

H3: There is a significantly positive relationship between risk-taking and the profitability of Islamic banks.

DATA AND ECONOMETRIC MODEL

Data Sources and Sample Detail

There are two types of data used for this study analysis. The first type of data is based on the actual information publish for the general public by each cross-section as per the IFRS and IAS or the regulatory authorities in their respective countries. The second type of data means the economic growth of the respective economy. The objective of the study also includes incorporating the effect of business conditions while studying the relationship between bank capital, risk-taking and profitability of Islamic banks.

Therefore, we used the real gross domestic product to the representation of the overall business trend of the respective country (Abbas, Ali, Yousaf, & Rizwan, 2020). The data for Islamic Banks' financial statements are retrieved from a world-renowned banking database named Bankscope/BankFocus over the period ranging from 2010 to 2019. The collection of data from a uniform source decreases the bias of reporting of Islamic banks for analysis. The banks are filtered as per for following criteria:

1. Banks must have an active status on 31st December 2019.
2. Specialisation should be Islamic banks.
3. Banks are in profit for the last five years.

The data retrieved from the BankFocus include the following countries Tanzania, Tunisia, Syria, Supranational, Sri Lanka, South Africa, Singapore, Senegal, Saudi Arabia, Philippine, Oman, Nigeria, Mauritian, Maldives, Libya, Lebanon, Kenya, Guinea, Egypt, Cyprus, Brunei, Algeria, United Kingdom, UAE, Turkey, Sudan, Qatar, Pakistan, Malaysia, Kuwait, Jordan, Iran, Iraq, Indonesia, Bangladesh and Bahrain. To save the space the detail of banks from each country is not report however available at request for each country and region-wise. The detail and measurement of the variables used in this study are reported in Table 1.

Table 1
Definitions and measurement of variables

Proxies	Measurements	References
Capital ratios (BC)		
Risk-based capital	Tier-I plus tier-II/ Risk-weighted assets	(Abbas, Ali & Rubbaniy, 2021; Abbas & Ali, 2021)
Capital ratio	Total equity/Total assets	(Ali et al., 2022; Yousaf et al., 2019a)
Bank Risk (BR)		
LLPTA	Loan loss provisions/ Total assets	(Abbas & Ali, 2020; Abbas, Ali, Yousaf, & Wong, 2021)
RWATA	Risk-weighted assets/ Total assets	(Basher et al., 2017; Ding & Sickles, 2018)
Profitability (BP)		
Profitability	Net profit/Total assets	(Abbas & Masood, 2020; Yousaf et al., 2019b)
Spread	Profit on loans less profit on deposit/Total assets	(Hassan et al., 2020)
Operating Efficiency	Operating expenses/ Total assets	(Abbas, Ali, Yousaf, & Rizwan, 2020; Bitar et al., 2018)
Loan Growth	Net Loans/Total assets	(Basher et al., 2017)
Bank Size	Natural log of total assets	(Ali et al., 2019; Hanif et al., 2021)
Liquidity	Liquid assets/Total assets	(Ali et al., 2020)
Business trend	Yearly change in GDP	(Abbas, Yousaf, Ali, & Wong, 2021; Yousaf & Ali, 2020)

Econometric Model

The main objective behind the selection of the simultaneous equation model is to find out the interdependence among bank capital, bank risk-taking, and bank profitability. The researchers frequently use the based equation of a single dependent variable to explore the relationship between multiple explanatory variables by ignoring the concept of endogeneity and simultaneity. Although GMM is a widely used technique for controlling the endogeneity (Bitar et al., 2018; Han et al., 2012; Kasman & Carvallo, 2014; Luo et al., 2016; Moudud-Ul-Huq, 2019; Abbas, Ali, Moudud-Ul-Huq, & Naveed, 2021), it does not account for the simultaneity of the relationship between risk, capital, and profitability that have been well-documented in the literature (Aggarwal & Jacques, 1998; Bitar et al., 2018; Ding & Sickles, 2018).

Due to this reason, by following Abbas, Ali and Ahmad (2021), Aggarwal and Jacques (1998), Shrieves and Dahl (1992), and others, we develop the following set of simultaneous equations to estimate the unbiased and consistent estimators:

$$BR_{i,t} = \lambda_0 + \lambda_1 BC_{i,t} + \lambda_2 BP_{i,t} + \lambda_3 X_{i,t} + \lambda_4 u_{i,t} \quad (1)$$

$$BC_{i,t} = \beta_0 + \beta_1 BR_{i,t} + \beta_2 BP_{i,t} + \beta_3 Z_{i,t} + \beta_4 u_{i,t} \quad (2)$$

$$BP_{i,t} = \gamma_0 + \gamma_1 BC_{i,t} + \gamma_2 BR_{i,t} + \gamma_3 Y_{i,t} + \gamma_4 u_{i,t} \quad (3)$$

in which BR represents bank risk-taking, BC means bank capital, BP indicates bank profitability; all are endogenous variables, X represents a set of controlled variables for Equation 1, Z represents a set of control variables for Equation 2, and Y represents a set of control variables for Equation 3. The aim is to discover the interrelationship of capital, bank risk-taking, and bank profitability; the simultaneous equation model was applied. There are different techniques in simultaneous equations to find out structural parameters as Indirect Least Square (ILS), 2SLS and Three-Stage Least Square (3SLS). The choice can be made through the identification status of the equation under consideration. Identification status indicates that the above equations are over-identified for which 2SLS is an appropriate option to calculate consistent and unbiased estimators. Bank capital, bank risk-taking, and profitability are taken as endogenous variables while bank size, business trend, bank operating efficiency, loan growth, and liquidity are exogenous variables. The proxies are in line with studies of (Altunbas et al., 2007; Deelchand & Padgett, 2009; Dias, 2020; Ding & Sickles, 2018; Jokipii & Milne, 2011; Lee & Hsieh, 2013). After the transformation, the above equations can be written as:

$$\begin{aligned} BR = &\left(\frac{\lambda_0 + \lambda_1\beta_0}{1 - \lambda_1\beta_1}\right) + \left(\frac{\lambda_1\beta_2 + \lambda_2}{1 - \lambda_1\beta_1}\right) BC + \left(\frac{\lambda_1\beta_3}{1 - \lambda_1\beta_1}\right) BP \\ &+ \left(\frac{\lambda_1\beta_4}{1 - \lambda_1\beta_1}\right) X + \epsilon_1 \end{aligned} \quad (4)$$

By rearranging the above expression, we can get the following reduced forms for the Equations in (1), (2), and (3):

$$BR = \pi_{10} + \pi_{11} BC + \pi_{12} BP + \pi_{13} X + V_1 \quad (5)$$

$$BC = \pi_{20} + \pi_{21} BC + \pi_{22} BP + \pi_{23} X + V_2 \quad (6)$$

$$BP = \pi_{30} + \pi_{31} BC + \pi_{32} BP + \pi_{33} X + V_3 \quad (7)$$

The above models show that bank risk-taking, bank capital, and bank profitability are interdependent. Thus, we cannot check whether all the variables affect each other in a single equation. To circumvent the limitations, we use the above simultaneous equations to test the relationships among the three interdependent variables and estimate Equations 5, 6 and 7 simultaneously under the assumption of 2SLS as stated in Al-Kayed et al. (2014), Basher et al. (2017), Mahdi and Abbes (2018), Maji and Hazarika (2018), Shrieves and Dahl (1992), and Abbas, Rubbaniy and Ali (2021).

RESULTS AND DISCUSSION

We exhibit in Table 2 the descriptive statistics information for the variables used in the analysis. The summary statistics represent the mean, standard deviation, minimum value, and maximum values of each variable using observation for the full sample of Islamic banks data over the period from 2010 to 2019. The last two columns represent minimum and maximum values for proxies used in the analysis. The first column provides information for the number of observations of each proxy, and the second column consists of the average values of variables. The third column contains the standard deviation for each variable from its means based on the annual data used in this study. The descriptive information is consistent with the number provided in previous studies for Islamic banks (Al-Kayed et al., 2014).

We display in Table 3 the correlation matrix for the variables used in the study. The numbers indicate that there is no high correlation among variables. The signs of the relationships are as per the economic theories that allow testing the relationship among profitability, risk-taking, and bank capitalisation. For example, there is a negative correlation between profitability and loan loss provisions. It indicates that an increase in loan loss provisions decreases the profitability of banks. In a similar context, the correlation between risk-taking and bank capital ratio is positive that is in line with the regulatory hypothesis

theory. The overall findings suggest that there is no high correlation among explanatory variables. The low correlation indicates that there is no problem of high multicollinearity bias in data (Yousaf et al., 2018). The relationship sign and significance is in line with the previous literature of Islamic banks (Al-Kayed et al., 2014).

Table 2
Descriptive statistics

Variable	Observations	Mean	S. D.	Min	Max
Risk-weighted assets	2170	83.961	28.539	0.008	484.209
Loan loss provision	2170	0.515	11.564	−365.205	132.013
Risk-based capital	2169	25.673	27.62	0.067	415.919
Capital ratio	2170	29.09	42.116	185.216	503.369
Profitability	2170	0.701	9.617	−100.415	126.309
Loan growth	2170	49.134	35.724	−25.312	76.268
Bank size	2170	13.818	2.368	3.656	18.607
Operating efficiency	2170	73.492	37.906	247.057	549.707
Liquidity	2170	14.478	30.882	33.389	36.9861
Business trend	1890	7.449	5.4410	−6.2760	4.6710

Table 3
Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Risk-weighted assets	1									
Loan loss provision	−0.011	1								
Risk-based capital	−0.027	−0.048	1							
Capital ratio	0.149	−0.048	0.563	1						
Profitability	0.013	−0.184	0.026	0.121	1					
Loan growth	0.135	0.101	−0.250	−0.253	0.144	1				
Bank size	−0.043	−0.016	−0.448	−0.606	0.010	0.278	1			
Operating efficiency	0.362	0.002	−0.105	−0.133	0.113	0.071	0.173	1		
Liquidity	−0.588	0.013	0.020	0.088	0.005	0.050	−0.097	−0.686	1	
Business trend	0.056	−0.005	−0.080	−0.066	−0.008	0.052	0.096	0.071	−0.050	1

Source: Authors' calculation by using Stata

Full Sample Results of Islamic Banks

We exhibit in Table 4 the findings of the 2SLS method for the full sample of Islamic banks. Column 1 represents the relationship between risk-taking and risk-based capital in Islamic banking. There is a bidirectional relationship between bank risk-taking and the risk-based capital ratios of Islamic banks, as argued by Shrieves and Dahl (1992). The behaviour of Islamic banks to increase risk-weighted assets is similar to conventional banks. When risk-based capital is increased, the risk of banks decreases vice versa, the findings are in line with (Altunbas et al., 2007; Bitar et al., 2018). The theory suggests that Islamic banks use risk-weighted assets to adjust their risk-based capital ratios. This is also observed that when the banks decrease their risk-weighted assets, the risk-based capital ratio is increases and vice versa. The second reason is also appealing for the relationship between risk-taking and the risk-based capital ratios. When the retained earnings and equity capital is increasing, banks also increase their risk-weighted assets in proportion.

Table 4 also contains the results for the relationship between bank profitability and the risk-based capital ratio. The relationship between profitability and the risk-based capital ratio is not bidirectional for Islamic banks as evidence in the present findings. The findings show that an increase in the risk-based capital ratio increases the profitability of Islamic banks that is similar to the findings of (Berger, 1995). The relationship between risk-based capital and profitability is positive and statistically significant when ROA is taken as a dependent variable, and the risk-based capital ratio is taken as the independent variable the findings are consistent with (Bitar et al., 2017; Bougatef & Mgadmi, 2016). The outcomes indicate that the impact of profitability on the risk-based capital ratio is not significant, but the sign of the coefficient is positive. One of the explanations for the insignificant impact of profitability on the risk-based capital ratio in Islamic banks is the distributions of profit among partners. The Islamic banks retain lower profits as unexpected reserves; therefore, the impact of retained earnings in equity remains limited.

The results explicate that bank risk-taking and profitability move in a similar direction that is in line with the argument of corporate finance theory of higher risk leads to higher profits the findings are in line with (Berger, 1995). The findings of Islamic banks' data are similar to the results of conventional corporate finance theories in the short run; other things remain similar. There is a bidirectional significantly positive relationship between bank risk-taking and profitability for Islamic banks. The increase in risk-taking increases the profitability of Islamic banks that is in line with portfolio theory. In absolute

terms, Islamic banks need to take higher risks for lower profits just because of Islamic restrictions for business.

Table 4
Full sample results

Variables	(1)	(2)	(3)
	Bank risk-taking	Risk-based capital	Bank profitability
Risk-based-capital	−1.238***		0.149**
	(0.080)		(0.061)
Profitability	3.411***	−5.906	
	(0.673)	(3.992)	
Loans growth	−0.162**		
	(0.067)		
Bank size	−1.038***	−1.205***	1.406**
	(0.148)	(1.745)	(0.550)
Bank risk-taking		−0.745***	0.882***
		(0.067)	(0.136)
Operating efficiency		−1.051**	
		(0.506)	
Liquidity			0.805***
			(0.178)
Constant	26.512	27.544	−10.660
	(18.07)	(31.932)	(11.240)
Observations	2,170	2,170	2,170
R^2	−7.093	−0.228	−2.049

Notes: robust standard errors in parentheses, *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Mena Region and Africa Region Islamic Banks Results

Columns 1, 2, and 3 of Table 5 report the result for the Mena regions. The findings explore that an increase in risk-based capital reduces bank risk-taking of the Mena region Islamic banks. The outcomes provide information that due to an increase in risk-taking of Islamic banks, the risk-based capital level remains unaffected, the findings contradict the following studies (Bitar et al., 2018; Bougatef & Mgadmi, 2016; Das & Ghosh, 2004; Ding & Sickles, 2018). The relationship between risk-taking and bank profitability is statistically

significant and negative. The negative relationship between risk-taking and profitability contradicts the portfolio theory of finance and contract basic Islamic principles which discourage excessive risk-taking and remain satisfied at a lower profit. The impact of bank profitability on Islamic banks' risk-based capital ratio is not significant. The findings indicate that an increase in the risk-based capital ratio of Islamic banks reduces the profitability of Islamic banks in the Mena region; the outcomes remain in line with the previous studies (Alavinasab & Davoudi, 2013; Berger & Di Patti, 2006). These results for the Mena region deviate from baseline findings due to many reasons. the region is plagued by war and is in economic turmoil, and lacks financial stability with expected future growth showing a downward trend. Furthermore, the ability of the region to recirculate savings between countries also seems to have decreased, especially since 2014, when the world's oil market restructuring became quite obvious.

Columns 4, 5 and 6 in Table 5 report the findings of the African region Islamic banks. The relationship between risk-taking and profitability is significant and negative similar to the studies of (Berger & Di Patti, 2006). The negative relationship between profitability and bank risk-taking contradicts the portfolio theory and basic Islamic principles. In African region Islamic banks, the effect of an increase in profitability is positive on risk-based capital. The findings show that Islamic banks in the African region do not distribute all of their profits to shareholders and instead keep a portion of their revenues as a reserve for future unforeseeable events. Due to this reason, the level of bank capital increases. The increase in the risk-based capital ratio, on the other hand, diminishes bank profitability. This discussion confirms that in Africa, the Islamic banks' risk-based capital ratio is at an optimal level and a further increase in risk-based capital is not beneficial to partners. The findings show that the relationship between risk-taking and the risk-based capital ratio is inverse and statistically significant. The negative relationship between risk-taking and the risk-based capital ratio is in line with the moral hazard hypothesis theory in banking as argued by (Altunbas et al., 2007; Bitar et al., 2018; Das & Ghosh, 2004). African Islamic banks' findings deviate from the baseline results for a variety of reasons. First, Africa's countries are presently experiencing rapid growth, owing to their abundant natural resources and improving political stability, and the continent's peacefulness has continuously improved since 2007. Second, return on investment in Africa is highest in developing countries. Third, African countries' growth rates are higher than the global average.

Table 5
Mena and Sub-Saharan African region results

Variables	Mena Region			Africa Region		
	(1)	(2)	(3)	(4)	(5)	(6)
	Bank risk-taking	Risk-based capital	Bank profitability	Bank risk-taking	Risk-based capital	Bank profitability
Risk-based-capital	−1.641***		−0.057***	−0.011		−0.641*
	(0.408)		(0.019)	(0.282)		(0.385)
Profitability	−2.874**	−1.765		−4.539***	0.436**	
	(1.373)	(3.209)		(1.043)	(0.212)	
Loans growth	−0.001			1.127***		
	(0.258)			(0.189)		
Bank size	−2.776***	−1.695***	−0.967***	9.911***	1.411	−3.447*
	(0.876)	(0.668)	(0.367)	(2.263)	(1.104)	(1.906)
Bank risk-taking		−0.611	−0.035		−0.826***	2.029***
		(0.393)	(0.151)		(0.088)	(0.545)
Operating efficiency		0.004			0.335***	
		(1.061)			(0.065)	
Liquidity			−0.001			2.631***
			(0.151)			(0.797)
Constant	55.28***	33.714	19.31	−95.29**	47.98***	−14.23***
	(14.47)	(69.89)	(18.97)	(38.91)	(14.26)	(3.087)
Observations	1,169	1,169	1,169	300	300	300
R^2	.460	.1781	0.370	.170	0.350	.306

Notes: Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

South Asia Region and East Asia Regional Banks

Columns 1, 2 and 3 in Table 6 represent the result for the South Asian region Islamic banks. The findings confirm that an increase in the risk-based capital ratio increases risk. The positive relationship between the risk-based capital ratio and bank risk-taking is in line with the regulatory hypothesis in banking, as argued by (Bougatef & Mgadmi, 2016; Ding & Sickles, 2018). There is a negative relationship between bank risk-taking and profitability. The impact of profitability on the risk-based capital ratio is significantly negative, and findings are consistent with (Alavinasab & Davoudi, 2013; Berger & Di Patti, 2006).

The negative connection between profitability and the risk-based capital ratio is justified in the sense that getting higher profits decreases the excessive need for external fundraising. The results confirm that an increase in risk-based capital has a negative effect on profitability. Theoretically, in normal profits, an increase in equity decreases the return of shareholders because they restrict themselves from investing in risky investments and vice versa.

Table 6
South Asia and East Asia region results

Variables	South Asia Region			East Asia Region		
	(1)	(2)	(3)	(4)	(5)	(6)
	Bank risk-taking	Risk-based capital	Bank profitability	Bank risk-taking	Risk-based capital	Bank profitability
Risk-based-capital	4.793**		−0.0895**	−8.480***		−0.942*
	(2.644)		(0.0470)	(1.093)		(0.373)
Profitability	−1.434**	−9.170**		4.207***	−3.907***	
	(0.622)	(4.172)		(1.653)	(0.472)	
Loans growth	0.864			1.584		
	(1.177)			(2.866)		
Bank size	−8.356	3.807	0.0832	5.867	−0.177	−0.707
	(1.239)	(4.707)	(0.205)	(1.163)	(1.170)	(2.033)
Bank risk-taking		9.008***	0.101**		−0.283	4.785**
		(9.352)	(0.0560)		(0.185)	(2.603)
Operating efficiency		−8.588			0.153	
		(8.653)			(0.143)	
Liquidity			−0.119			−4.965
			(0.074)			(12.13)
Constant	18.92**	−11.36***	10.14**	33.94***	29.97**	48.53***
	(1.385)	(1.606)	(6.124)	(2.302)	(1.635)	(1.171)
Observations	201	201	201	330	330	330
R^2	0.232	0.313	0.293	0.341	0.109	0.552

Notes: Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Columns 4, 5 and 6 in Table 6 report the findings for East Asian regions of Islamic banks in the East Asian regions. The results show that the risk-based capital ratio is no influence on the risk-taking behaviour of Islamic banks in the East Asian region. The impact of profitability on risk-taking is significant and positive. The positive relationship between risk-taking and bank profitability is consistent with the portfolio theory of finance, which implies "high risk, high returns". The study finds no association between bank risk-taking and the risk-based capital ratio, on the other hand, risk-based capital has a detrimental effect on banks' profitability. The negative relationship between risk-based capital ratio and profitability of Islamic banks is in line with the theoretical justification that in normal profits an increase in equity decreases the ROA.

Europe and Central Asia Regional Banks

The Europe and Central Asia region comprises a mix of upper-middle and low-income economies with major strategic importance due to their geographic location and natural resource endowments. The world bank is working with these countries to eliminate poverty and promote shared prosperity through boosting human capital, enabling markets, and building and strengthening institutions. Table 7 reports the findings for European and Central Asian Islamic banks. The findings indicate that the relationship between risk-based capital and risk-taking is a negative one, which is consistent with the moral hazard theory and the findings of previous studies including (Bitar et al., 2018; Das & Ghosh, 2004; Lee & Hsieh, 2013). Banks' profitability has a negative (positive) relationship with risk-taking behaviour (risk-based capital ratio) of Islamic banks in Europe and Central Asia is negative and significant. The result of the present study is similar to the findings of (Berger, 1995; Bitar et al., 2017). The positive effect of profitability on the risk-based capital ratio indicates that banks retain profits to boost their risk-based capital ratio internally. The findings show that an increase in the risk-based capital ratio decreases the profitability of Islamic banks in Europe and Central Asia. The impact of risk-taking on the profitability of Islamic banks in Europe and Central Asia is positive and significant that is in line with the portfolio theory of finance "getting higher the risk yields higher the returns".

Table 7
Europe and Central Asia Region Results

Variables	(1)	(2)	(3)
	Bank risk-taking	Risk-based capital	Bank profitability
Risk-based-capital	−0.716***		−9.722***
	(0.131)		(2.539)
Profitability	−6.186***	3.681***	
	(4.395)	(2.309)	
Loans growth	0.293		
	(0.283)		
Bank size	−3.838	−3.035***	−1.603
	(3.446)	(1.038)	(4.079)
Bank risk-taking		−0.203***	1.093***
		(0.806)	(2.895)
Operating efficiency		0.363*	
		(0.210)	
Liquidity			5.404**
			(2.656)
Constant	63.84	44.93**	−8.094
	(50.48)	(21.27)	(21.69)
Observations	140	140	140
R^2	0.128	0.134	0.137

Notes: Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Effect of Business Trend

This study estimates interdependence between risk-taking, profitability, and risk-based capital in the presence of a business trend. We incorporate the business trend proxy in each equation of the baseline model to access the impact of business changes on risk-taking, bank risk-based capital, and profitability of Islamic banks by controlling the endogeneity and simultaneity bias. Table 8 Columns 1, 2 and 3 reports the baseline model results for the full sample period. The findings show that business trends positively affect bank's risk-taking, profitability and risk-based capital requirements.

In economic terms, the relationship between risk-taking, risk-based capital, and bank profitability, and the business trend is pro-cyclical. Theoretically, when economic conditions are favourable, banks take greater risks, earn greater profits, and require greater capital to capitalise on these growth opportunities. With the inclusion of business trend proxy in the baseline model, the signs of risk-taking, bank profitability, and risk-based capital remain consistent, but the size of the coefficient varies. To conserve the space, only variables of interest are reported in Table 8.

Table 8
Full sample results (effect of business trend)

Variables	(1)	(2)	(3)
	Bank risk-taking	Risk-based-capital	Bank profitability
Risk-based capital	−1.165***		0.156**
	(0.078)		(0.061)
Profitability	3.426***	−1.276	
	(0.643)	(1.147)	
Business trend	1.333***	1.841***	1.814***
	(0.024)	(0.007)	(0.041)
Bank Risk-taking		−0.723***	0.834***
		(0.133)	(0.149)
Constant	26.11	33.63	−10.40
	(18.56)	(85.41)	(11.63)
Observations	1,890	1,890	1,890
R^2	.329	.280	.469

Notes: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Robustness Checks

In this study, we use several alternative treatments to reach unbiased and consistent conclusions. In the second stream, the study uses the alternative proxies for each endogenous variable to check the robustness. To do this, we use similar model equations and just replace one endogenous variable at a time to verify the baseline findings. We keep the model over-identified throughout the analysis. In the first attempt, the study uses the equity to total assets ratio instead of the risk-based capital ratio. To check the robustness of profitability, the study uses a spread ratio instead of ROA (Umar, Yousaf, & Aharon, 2021).

In the last endeavor, the study applies the loan loss provision to the ratio of the total assets for risk-taking instead of RWATA. Table 9 contains the findings for the robustness check of the risk-based capital ratio. The findings confirm that results are consistent with respect to the sign and significance. However, the whole results are not in line with the base model findings. The difference in results is due to the change in the measurement of capital ratio.

Table 9
Full sample results (Risk-based capital measured through Equity Capital Ratio)

Variables	(1)	(2)	(3)
	Bank risk-taking	Equity capital ratio	Bank profitability
Equity capital ratio	−2.878		0.139***
	(18.93)		(0.049)
Bank profitability	4.841**	−1.029	
	(3.206)	(4.413)	
Bank risk-taking		0.052**	0.992***
		(0.075)	(0.099)
Constant	5.045	2.602	−1.214
	(3.280)	(3.529)	(1.122)
Observations	2,170	2,170	2,170
R^2	.3351	.4891	.2228

Notes: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 10 exhibits the results for the robustness of the profitability ratio of Islamic banks. The findings reveal that with the increase in spread ratio, Islamic banks decrease their risk-taking. The result of the spread ratio remains robust for risk-taking, however, the increase in bank risk-based capital decreases the spread of Islamic banks. The difference in results is due to the change in the measurement of profitability ratio.

Table 11 provides proof for the robustness of bank risk-taking when measuring as loan loss provisions to total assets instead of risk-weighted assets to total assets. The findings remain consistent with the baseline model results with minor differences in coefficients. It is confirmed in the results that Islamic banks' loan loss provision and risk-based capital do not influence each other. The findings for regions remain robust and not reported due to saving space and detailed results are available as per requirement.

Table 10
Full sample results (Profitability measured through spread ratio)

Variables	(1)	(2)	(3)
	Bank risk-taking	Risk-based capital	Spread ratio
Risk-based capital	−3.144**		−0.157**
	(1.444)		(0.0636)
Spread ratio	−1.545**	−3.008**	
	(5.421)	(1.776)	
Bank risk-taking		−0.802***	0.397**
		(0.062)	(0.156)
Constant	3.007	2.887***	−1.255
	(9.694)	(2.954)	(1.216)
Observations	1,882	1,882	1,882
R^2	.2548	0.2322	.3340

Notes: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 11
Full sample results (Bank Risk-taking measure through loan loss provision)

Variables	(1)	(2)	(3)
	Bank risk-taking	Risk-based capital	Bank profitability
Risk-based capital	0.001		0.444***
	(0.007)		(0.120)
Profitability	−0.028***	−9.489	
	(0.006)	(6.760)	
Bank Risk-taking		2.304	2.328**
		(27.71)	(1.024)
Constant	1.699	8.812*	−6.610***
	(1.722)	(5.068)	(1.840)
Observations	1,890	1,890	1,890
R^2	0.3015	.4769	.3994

Notes: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

DISCUSSIONS AND CONCLUDING REMARKS

Risk-based capital, Risk-taking and profitability are important indicators to measure the growth, stability, and performance of banks, including both conventional and Islamic banks. Thus, it is important to explore the interrelationships between risk-based capital, risk-taking, and profitability for banks, including both conventional and Islamic banks, because the relationships will enable banks to make better decisions making to get optimum use of resources, as shown in many studies. However, most, if not all, of the studies in the literature examine the interrelationships for the conventional banks, but not for the Islamic banks, especially during the post-2008-financial-crisis era. The lacking of insights in the context of the Islamic banking system motivates us to bridge the gap in the literature to explore the interrelationships between risk-based capital, risk-taking, and profitability for the Islamic banks in the post-crisis era in the extended period from 2010 to 2019. To do so, we use several theories to examine the interrelationships between risk-based capital, risk-taking, and profitability for the Islamic banks, including the theory of moral hazard, the theory of regulatory hypothesis assumptions, agency theory, portfolio theory, and the theory of performance conduct. Based on the theories, we set three hypotheses to state the relationships from profitability, risk-taking, and risk-based capital to growth, stability, and progress for the Islamic banks. To test the hypotheses, we use the 2SLS technique because it helps to control the issues of endogeneity, autocorrelation, and cross-sectional heteroscedasticity. In addition, it can incorporate the lag of dependent/endogenous variables (Umar, Yousaf, & Zaremba, 2021; Umar, Gubareva et al., 2021).

We find that risk-based capital and risk-taking behaviour are negatively related in the full sample of the Islamic banks. We also find that the results of different regions are heterogeneous with respect to both signs and significance. For example, the impact of risk-based capital in the Mena region's Islamic banks is negative on risk-taking. In contrast, the risk-taking and the risk-based capital ratio are positively related in the South Asia region's Islamic banks. The results of the Mena, Europe, Central Asia, and East-Asian regions show that the effect of risk-taking on profitability is positive whereas, the relationship is negative in the South-Asia region. In a similar manner, the influence of the risk-based capital ratio on profitability is negative in most of the cases in our study. The findings reveal the existence of both positive and negative effects of profitability on the risk-based capital ratio of Islamic banks for East Asian, Mena, and South-Asian (Europe, Central Asia and Africa) regions.

Our findings are in line with the regulatory hypothesis, moral hazard hypothesis, performance conduct hypothesis, and portfolio theory. For example, our findings on the negative relationship between risk-based capital and Islamic banks' risk-taking behaviour are consistent with the findings for conventional banking, the theory of moral hazard holds for the Islamic banks. According to the theory of moral hazard, managers in Islamic banks increase their investment in risky assets and keep a smaller amount of capital. The concept of both profit and loss sharing motivates managers to take a higher risk and yield a higher return. This relationship is also in line with the agency theory for corporate finance, which states that bank managers take excessive risk to get higher compensation to align with higher profitability. The relationship between the risk-taking of the Islamic banks and profitability is positive which is in line with the portfolio theory in finance. Thus, our findings enable the Islamic banks to make better decisions making to get optimum use of resources.

One may wonder whether it is crucial to choose risk-taking behaviour is crucial and whether it is realistic to choose risk-taking behaviour in the study. We note that it is indeed crucial to choose risk-taking behaviour in the study because it is well known that risk-taking behaviour is an important indicator to influence both bank profitability and regulatory capital ratios and the profitability of banks is found to be sensitive to risk-taking (Mrad & Mateev, 2020). We also note that it is realistic to choose risk-taking behaviour in the study because some studies, see, for example, Moudud-Ul-Huq et al. (2020), have found that higher risk-taking is associated with higher profitability. The above argument sheds light on the reality of our findings and the contributions of our findings to the literature.

Moreover, the findings in our paper would be useful for decision-makers and bank managers in understanding the interrelationship between risk, capital, and profitability and no factor alone could be good enough to ensure bank soundness. Furthermore, our findings imply that regulators and bank managers should not only focus on building bank capital for increasing banks' stability. They should also look into both profitability and capital ratios in addition to bank capital because all three factors could increase banks' stability simultaneously, which, in turn, contribute to the stability of Islamic banks. We note that there could be some other factors that could contribute to bank soundness and the stability of Islamic banks. We leave this to further study. Our findings in heterogeneity are useful for policymakers in Islamic banking for the improvement of the Islamic financial system. The findings help managers in Islamic banks to consider both regulatory capital ratio and profitability before they take any risk. Moreover, the regulators and policymakers may consider both profitability and

risk-taking of Islamic banks then formulate the guidelines for the regulatory capital ratio. For example, the expectation of Islamic banks in the Mena regions on their managers to manage their risk-taking behaviour and the risk-based capital ratio is different from that in the South Asia regions. Similarly, our study has implications for the relationship between risk-taking and profitability for different regions. For example, managers need to consider the negative (positive) effect of profitability on risk-taking in the Mena, Europe and Central Asian, and the South Asian (East Asian) regions.

One limitation of our study to the analysis of quantitative information for Islamic banks is that we only use banks listed at Bankscope. Another limitation is that we cannot get longer period data. Thus, further studies could extend our work to use a longer period of data and study banks in other areas. Future research could also be conducted to study the interrelationships between risk-based capital, risk-taking, and profitability of Islamic banks by incorporating the mediating/moderating role of other economic variables and bank regulations to get better in-depth insights.

ACKNOWLEDGEMENTS

The authors thank the Editor-in-Chief, Professor Chee-Wooi HOOY and the anonymous referees for their helpful comments which help to improve our manuscript significantly. The fourth author would like to thank Robert B. Miller and Howard E. Thompson for their continuous guidance and encouragement. This research has been partially supported by grants from University of Central Punjab Lahore, Air University, Asia University, China Medical University Hospital, The Hang Seng University of Hong Kong, the Research Grants Council of Hong Kong (Project Number 12500915), and Ministry of Science and Technology (MOST, Project Numbers 106-2410-H-468-002 and 107-2410-H-468-002-MY3), Taiwan.

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