Pakistan Journal of Applied Economics, Vol.28 No.2, (213-234), Winter 2018

AN ASSESSMENT OF BANK CAPITAL EFFECTS ON BANK-RISK-TAKING IN PAKISTAN

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Abstract

This study examines the empirical impacts of capital-level on risk-taking behaviour of banks in Pakistan, using the bank-level panel data covering the period 2006 to 2015. It also explores the impacts of bank-size, profitability and the interest/financing rate on banks risk-taking. Panel co-integration test is applied to examine the presence of long-run relationship among the variables. Dynamic ordinary least square (DOLS) and the two-step system generalized method of moments are applied for estimation of the panel vector error correction model, to obtain the long-run and short-run estimates, respectively. Significant positive impact of capital on risk taking behaviour of banks was found. The short-run estimate, also shows that change in capital level is positively and significantly related to banks risk-taking. The positive capital effect on risk, suggest that banks with capital level above the regulatory requirements tends to invest more in risky assets. Findings of the study also reveal that bank-size has a negative impact on risk-taking; whereas, the interest rate is positively related to risk. Overall, the results are in line with finance theories and the existing empirical analyses on links between the capital and risk.

Key Words: Risk-Taking, Capital Adequacy Ratio, Risky Assets, Profitability, Bank Size; DOLS, Panel VECM, Co-integration, Long-Run Estimates.
JEL Classification: G32; G33.

I. Introduction

In banking literature, the association between bank-capital and risk-taking has become an important issue, since financial crisis of 2007-08. According to the World Bank, a bank is in crisis when it has the liquidity and solvency issues at the same time. This situation could be either due to external shocks or because of failure of big banks in the system. According to Cannata and Quagliariello (2009), during financial crisis

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Note: Authors would like to thank the anonymou referees and the Editor of PJAE, for their feedback and comments. Thanks are also due to Maria Karim, PhD. Scholar at the IIIE, Islamabad, for her valuable suggestions.

of 2007-08, many institutions were not in position to recover their losses. Due to excessive investments in risky assets, capital reserves of banks was far below the overall debt ratio and the credit expansion. According to Festic, et al. (2011), during the recent global financial crisis, Pakistan was able to recognize the empirical determinants of banks risk-taking. Among several other bank-specific determinants, bank-capital is one of the important determinants of risk. In fact, several existing empirical studies have examined and documented significant capital effects on risk across the world, using bank-level panel datasets.

Indeed, in response to the 2007-08 financial crisis, the Basel Committee on Banking Supervision (BCBS) updated the guidelines for requirement of bank- capital and regulations for banking, and suggested several new standards for banks liquidity, leverage, and quality of bank-capital (aka Basel III rules, 2013). The main aim of these newly proposed standards is to strengthen risk management process further, and proper supervision in banking industry. Under these new capital standards, banks are not only required to hold more capital but have also to improve the quality of capital as compared to the under Basel II rules. In principle, holding more capital may cause both the favourable and adverse effects on banks performance and risk-taking. Therefore, it is no surprise that investigation of bank-capital and its effects on banks, have recently received a lot of attention by the researchers, particularly in developed countries. However, empirical evidence on relationship between capital and banks risk-taking in developing countries, like Pakistan, is either, limited, mixed, or ambiguous. In this context, it is worth examining as to how the level of bank-capital affects risk-taking behaviours of banks.

Over the last two decades, policymakers have proposed and recommended several sustainable changes in the prudential regulations to strengthen and supervise the banks and to enhance the stability and performance of financial markets. In 1988, BCBS set forth the Basel Accord I, to propose banking regulations with respect to capital risk, market risk, and operational risk management. However, after the 1996 amendment, these regulations went into effect in 1998. The main objective of the Basel Accord 1998 was twofold. The first one was to put some restrictions on banks by increasing the minimum capital requirements. The second objective was to promote financial stability by distorting incentives for banks-risk-taking behaviour and also by introducing relatively simple techniques for managing credit risk. First of all, the banks in developed countries adopted the guidelines. After few years, the Asian banks adopted these rules. However in 2004, the BCBS proposed the Basel II rules to further ensure the liquidity position of banks. Under Basel II rules, new minimum level of required capital was proposed for financial institutions, which they kept aside to counterbalance the potential losses from investment which is a risky asset. As mentioned above, after the financial crisis of 2007-08, Basel III rules were released in January 2013, which were mainly built on 2004 version of the Basel Accords. Under Basel III, both the common equity and Tier I capital requirements were set higher than under Basel II rules. Further, a minimum leverage ratio defined as Tier I capital scaled by total assets of a bank and two required liquidity

ratios, namely, the liquidity coverage ratio and the net stable funding ratio; were introduced in Basel III. Pakistani banks are currently following the Basel III Accord-2013.

Lee and Hsieh (2013) stated that rules introduced under Basel III are better than the previous ones as these rules demand to raise capital level and improve quality of capital. The centre of attention for Basel III is to save banks from the bank-run situation. Therefore, various reserve requirements for different accounts were introduced in it. Major changes included in Basel III were an increase in minimum capital requirement ratios, leverage ratios, and liquidity ratios. Strict requirement of reserves are helpful in raising the overall capita levels of banks and in turn, it will help to enhance financial stability of the banking system.

Minimum capital requirement for banks was first introduced in 1996. The purpose of this mandatory requirement was to restrain banks to invest in highly risky ventures. Minimum capital requirement is one of the effective tools which ensure that banks are not exposed to such practices which results in insolvency. According to Dalla and Pellegrino (2008), the requirement of minimum capital is not relevant to the Islamic financial institutions as investment made by Islamic banks is on the basis of tangible assets. In Islamic banking, as the deposit accounts are PLS (profit and loss sharing) therefore, chances of insolvency are less than the conventional counterparts [Adebayo and Hassan (2013)]. However, due to imperfect market conditions, conceptual theories are difficult to be implemented in practice, in letter and spirit. Thus, the importance of capital requirement still remains the same for both types of banking. To understand this issue further, there is a dire need to do an empirical analysis, especially in countries where both types of banking is being practiced. Pakistan's banking sector provides an interesting laboratory for empirical analysis, as both types of banking (Islamic and conventional) is being operated parallel in the country. Likewise, dual banking system has increased the need to understand, as to how the bank-capital affects bank risk in an environment of different investment modes.

With regard to viewing the relationship between capital accumulation and risk, researchers are divided in different groups. Their contradictory views are mainly attributed to varying the capital requirements. Kahane (1977) is of the view that minimum capital requirement became mandatory for banks in response to banks' behaviour in light of 'moral hazard theory'. The minimum capital requirement do not decrease the overall risk, unless the assets portfolio is also of optimal nature. In addition to strict the minimum capital requirements, Kareken and Wallace (1978) suggested that banks have to implement all other necessary regulations to avoid insolvency and the stage of collapse. The stringent capital requirement do not guarantee the stability of banks; as Koehn and Santomero (1980) stated that capital requirement is not an efficient measure to restrict banks from risk-taking activities. Thus, instead of implementing the rigid regulatory capital tools, the level of capital and ways of its composition should be improved. In contrast, Furlong and Keeley (1989), Shrieves and Dahl (1992), and Goddard, et al. (2004) are of the view that by increasing minimum capital requirements, the overall risk level of banks

can be decreased. The well-capitalized banks are less exposed to risk as they hold higher capital and invest it by making optimal assets portfolios. Yet, some studies points that there is a puzzle between the capital level and risk; and both of these important variables are affected by profitability [Altunbas, et al. (2007)]. According to Barth, et al. (2004), when government directs the banking sector to control the risk then banks increase the capital buffer and strengthen capital level to meet the regulatory capital requirements.

Theoretically, relationship between bank-capital and risk is ambiguous. According to the 'regulatory hypothesis', the level of bank-capital is positively related to banks' risk. Under this hypothesis, banks are encouraged by regulators to accumulate their capital with an amount of investment in risky assets. Nevertheless, the 'moral hazard hypothesis' explains negative relationship between bank-capital and the level of risk taken by banks. According to this hypothesis, banks may have benefits to exploit the existing flat deposit insurance schemes and thus their level of risk declines with capital accumulation.

There are different studies available in the literature that empirically examine the relationship between capital ratios and risk for different countries [see, Kahane (1977), Shrieves and Dahl (1992), Atunbas, et al. (2007); Karim et, al. (2014)], and others. A common finding emerging from these studies is that there is a significant relationship between the level of bank-capital and risk-taking. Besides, the capital adequacy, bank size, profitability, and interest rate are also important variables in determining the risk-taking behaviour of banks. The State Bank of Pakistan implemented the Basel accord for the first time in 1997. Banks in Pakistan are currently following the Basel III standards of capital adequacy ratio (CAR) against risk-weighted assets (RWA). Currently, in light of Basel III, the CAR increased to 16.3 per cent in March 2016. Basel rules play a vital role in making the banking institutions more stable and efficient [Nazir, et al. (2012)]. Due to the financial innovations in the underdeveloped capital markets like Pakistan, bank-capital regulations are likely to have more important and prominent effects on risk. The existing literature on the association between bank-capital and risk has mostly concentrated on banking sectors of Europe and USA. Developing countries have very limited studies that have explained relationship between the underlying variables.[1] One of the reasons is the late adoption of Basel guidelines and data limitations in these countries.

There are few studies that have examined the association between capital level and risk level of banks. For instance, according to Ashraf, et al. (2016), the higher capital requirement has reduced the overall portfolio risk of commercial banks in Pakistan. In another study, Kamran, et al. (2016) examined relationship between performance and risk of banks. By taking into account the financial liberalization, they documented that the impact of financial liberalization can be changed from negative to positive by implementing strict capital regulations on banks. Further, they suggested that banks having higher capital ratios and assets in terms of investments are less exposed to risk

[1] Ito (2000) and Chiuri, et al. (2001) are few studies available on developing countries; having assessed the relationship between lending behaviour and capital requirements in banks.

and have an advantage of earning high profit. Although, both these studies provided evidence of negative capital effects on risk-taking, but they suffer from several limitations. For instance, these studies are limited in their scope; they did not take into account the time series properties of the data. Further, they did not examine the long-run relationship between bank-capital and risk. Furthermore, they did not estimate the short-and long-run effects (elasticities) of capital on risk. Rather, they simply explored the association between capital and risk. Ignoring these aspects, the extant if studies on Pakistan, presents ambiguous evidence on effect of bank-capital on risk. However, by taking into account these factors, one can present more robust empirical evidence.

The present study contributes to the existing literature by presenting empirical evidence on short-run, as well as on long-run relationship between banks-capital and the risk-taking behaviour of banks in Pakistan. The article also aims to check the impact of bank-size, profitability and the interest/financing rate on risk-taking behaviours. The empirical analysis is based on bank-level panel dataset of 26 commercial banks. The analysis covers the period of 2006 to 2015. After testing for unit root, panel co-integration test is applied to examine the long-run equilibrium relationship. Dynamic ordinary least square (hereafter DOLS) and the two-step system GMM estimator are applied to achieve the set objectives of the study.

The results indicate that bank-capital has significant and positive effects on risk-taking behaviour of banks; both in the long-run as well as, in the short-run. Specifically, the results of this study reveals that variables and capital adequacy ratio (proxy for bank-capital), and the ratio of risk-weighted assets (proxy for risk-taking) along with the bank-size; interest rate and its profitability ratios are co-integrated in the long-run. The estimated long-run coefficients show that the effect of capital on risk is positive and significant. Analogously, results of the panel vector error correction model provide evidence of positive effect of increasing bank-capital on risk in the short-run. The results, regarding control variables show that size of the bank is significantly and negatively related to risk-taking. This finding suggest that large banks are either less likely to invest in risky assets or are more capable to manage risk in a better and effective way. It is also found that banks do more investment in risky assets, during periods of higher interest rates. This finding implies that banks may find it difficult to invest in safe assets when cost of borrowing increases. Finally, the results indicate that the effect of profitability on risk is ambiguous.

Findings of this study are of significance to customers and investors, to select better financial intermediaries for their deposits and investments. The evidence of positive effect of bank-capital on risk is in support of 'regulatory hypothesis'. However, one should note that positive bank-capital-effect on risk-taking does not support the 'moral hazard hypothesis'. The findings also suggest that larger banks are less risky, due to more expertise, economies of scale and economies of scope. The positive association between profitability and risk implies that keeping in view the overall capital and assets, the banks may make investment and take risk to some extent. If banks have an appropriate capital ratio and assets level, then the money of depositors and investors would be in safe hands.

The analysis of the paper may also help regulatory authorities to set better regulations for improving efficiency and assets' quality of banks in Pakistan. It may also provide useful guidelines to bank managers to maintain an adequate level of banks-capital and construct a well diversified portfolio while making investments in risky assets.

The rest of this paper is structured as follows. Section II reviews the relevant literature and Section III describes the data sources. Section IV presets the empirical models estimated herein. Section V discusses the empirical results and finally, Section VI concludes the study.

II. Literature Review

The empirical relationship between capital level and bank-risk is one of the central topic in the banking sector; as it has the potential implications for regulatory policies. It is assumed that capital regulations have a homogeneous impact on banking sector. Due to heterogeneity of the countries and banks, this assumption may be questioned.[2] The impact of capital regulation may vary across different countries. Agoraki, et al. (2011) explored the impact of regulatory requirements on the bank risky assets. By doing estimation using data of European banking sector, they concluded that increases in capital requirement reduce the overall risk of banking sector. They further explained that limited capital requirements could strongly restrict the banks to take risk and also, significantly decrease the non-performing loans. Their study also stated that market power of banks is an important determinant of banks' risk-taking.

Klomp and Haan (2012) documented that high capital requirements can constrain banks from taking high risk. However, the impact is not much significant for low capitalized banks. Further, they suggested that bank size is positively related to both the capital and risk. On similar lines, Haq and Heaney (2012) showed the negative association between capital adequacy ratio (CAR) and the credit risk. They further explained that regulatory capital is one of the potential indicators in determining banks-risk. Tan and Floros (2013) found that CAR is negatively and significantly related to risk-taking behaviour of banks. It was also explained that banks with higher liquidity prefer to maintain higher level of capital. Bouheni, et al. (2014) concluded that minimum CAR requirements could decrease the level of risk in banks. Further, they also found a negative association between strict regulations and the profit of banks. Moreover, they explained that these requirements might increase profitability and boost the performance of European banking sector.

Lee, et al. (2015) studied the impact of minimum capital requirements on risk-taking behaviour of banks, using bank-level panel data. Specifically, a sample of 171 Chinese

[2] According to Beatty and Gron (2001), capital level has a significant impact on banks with lower level of capital, but not for others. Banks in different countries are exposed to different risks, due to heterogeneous factors. Therefore, results of the association between capital level and risk are different for different countries [Delis, et al. (2010)].

commercial banks during the period 1997 to 2011, selected for carrying the empirical analysis. They found that capital is significantly and negatively associated with risk-taking activities of banks. They further explained that after joining the World Trade Organization (WTO) in 2001, bank-capital level has a noteworthy effect on risk-taking behaviour and profitability in Chinese banking sector. They also showed that the effect of capital level on risk-taking is significantly different for small and large banks. Recently, Ben Selma, et al. (2016) analysed the data of 30 commercial banks of MENA region for from 2002 to 2009. They concluded that capital adequacy ratios and investment in risky assets are significantly and negatively associated. There are also some more studies that have provided the evidence of a positive association between the minimum capital requirements and risk. The positive association is in accordance with 'moral hazard theory', where managers take risk on the basis of miss-priced insurance. Altunbas, et al. (2007) investigated the association between risk and capital by using dataset of 15 European banks. Their results suggested that there is a significant and positive relationship between capital the levels and risky assets. Moreover, the liquidity ratio has direct association with risk. The results also revealed that effects of capital on risk are different across banks. The nature and extent of effects, mainly depends on the functions of banks and behaviour of managers. Specifically, they showed that capital effects on risk are significantly different for commercial, savings, and the co-operative banks.

Shim (2010) conducted the research on American financial institutions to examine the association between regulatory capital, profitability, and risk. The author used 3SLS technique to estimate the empirical model using panel dataset covering the period 1993 to 2004. Results of the study suggested a strong, positive relationship between bank-capital and bank-risk. On similar lines, Lee and Hseih (2013) took the data of Asian banks to explore statistical relationship between the level of capital and risk of banks by using the generalized method of moments (GMM) estimation technique. They concluded that bank capital is significantly and positively related to risk-taking behaviour of banks. They justify their findings by stating that higher level of capital will lead to enhance the profits of banks and thus, in turn banks take more risk. They showed that effect of capital on risk considerably vary across the categories of banks. They further showed that the effect of capital on risk and profitability also significantly depends on the level of income of countries included in the sample. Adverse capital effects on bank risk are higher in lower-middle income countries, whereas, these effects are lowest in high-income countries. Finally, they documented the risk-taking behaviours of banks operating in Far East and Central Asian countries which are more adversely affected by the bank-capital; yet, these adverse capital effects on risk-taking are lower for banks working in the Middle Eastern countries. By taking sample of banks of the OIC countries, Karim, et al. (2014) confirmed positive association between risk taking behaviour and capital levels. These countries have the mixed banking, and therefore they estimated the model for both types of banks, separately. Their results suggested that with increase in bank capital, the conventional bank tends to make more investments in risky assets.

They also found that Islamic banks also take more risk when they have surplus capital. Another strand of literature suggests that capital has no specific effects on risk of banks. Specifically, Sheldon (1996) used the information of G-10 countries to check the impact of bank-capital on risk. By using the option-pricing model, he found that increase in regulatory capital do not have any significant effect on banks' portfolio. Aggarwal and Jacques (1998) used the data of 2,552 American insured banks (1990 to 1993) showed the significant link between the level of bank-capital and risk-taking activities. Rime (2001) tested the relationship between risk and capital by using data of Swiss banks. He showed that when threshold limit of capital requirement is adjusted, then the banks try to increase their capital levels. However, his empirical results shows that there is no significant relationship between bank-capital and the level of bank-risk.

Based on the review of literature, can we conclude that empirical evidence on link between the bank-capital and risk-taking behaviour is not conclusive. Some studies have reported that the level of capital has a positive impact on risk; whereas, some other studies have documented a negative impact of capital on risk-taking behaviour of banks. There are also some studies which have failed to find any significant link between bank-capital levels and their decisions to take risk. The present study also observe that, effects of capital on bank-risk-taking activities vary with categories of banks, levels of income of a country, and functions of the bank. Finally, it is observed that most of the research work on this topic has been undertaken for developed countries, with no or little attention on developing and emerging economics, like Pakistan. Therefore, it is worthwhile to examine the impact of capital on risk-taking decisions of banks, further,. Empirical evidence on low level of capital affects risk-taking behaviour of banks is also very limited for countries where both the Islamic and conventional banks are operating. Therefore, examination of the impact of bank-capital on risk-taking behaviour of banks, both in the short-run as well as in the long-run, would definitely enhance the understanding of how the banks decide regarding their investment in risky assets, when they have different levels of bank-capital.

III. Data

This study uses the panel data-set of 26 commercial banks of Pakistan, regulated by the State Bank of Pakistan, for the period 2006 to 2015. Information was collected from income statements, balance sheets of relevant banks, and financial analysis reports of the State Bank of Pakistan. Reviewing the past literature, it is found that researchers have utilized different proxies[3] to measure the risk in banking sector. Risk is dependent variable in empirical analysis of this study; the ratio of risk-weighted assets (RWA)[4] is

[3] In reviewing the previous literature it is found that loan loss provisions, Z-score and ratios of non-performing loans to total assets have also been used to measure risk in banking sector.

[4] RWA is the sum of categorized assets of the entire banks multiplied by their specified risk weights.

taken to total the assets as a proxy for risk. According to Avery and Berger (1991), the risk-weighted asset ratio can be a good indicator of bank-risk-taking. Several other researchers including Shrieves and Dahl (1992), Agarwal and Jacques (1998) and Delis and Kouretas (2011) have also used the RWA, as a proxy for bank-risk.

The CAR represents the level of capital of banks.[5] It helps bank managers to analyse as to how much a bank is permitted to recover from unexpected losses. Following Shrieves and Dahl (1992) and Altunbas, et al. (2007), CAR is defined as ratio of total capital to total assets. Specifically, it has been calculated as a capital base over the total assets. The study calculates the total capital base by adding Tier I plus Tier II capital. Jacques and Nigro (1997) have also calculated the capital base in similar way. The interest/financing rate is the control variable used in the model. According to Delis and Kourtetas (2011), the interest rate is positively related to investment in the risky assets.

The size of bank has an important role to play in determining the risk-taking behaviour of banks, due to its relationship with investment opportunities, risk diversification, and access to equity capital [Rime (2001)]. Owning to better information of market and the desired portfolio diversification, the larger banks can get the high returns. Since large banks have generally more reserves, the probability of their being insolvent is less, as compared to their small counterparts. Therefore, a negative association between the bank- size and bank risk is expected. Earlier, the studies of Zribi and Boujelbene (2011), Beltratti and Stulz (2012), and Ben Selma, et al. (2016) have documented the negative association between bank-size and risk. In this article, bank size is measured by taking natural log of total assets of a bank.

For profitability measures, two variables are used: return on assets (ROA) and return on equity (ROE). ROA is calculated by total profit of banks over total assets, while ROE is defined as total profit over the total equity of banks. According to Atunbas, et al. (2001), higher profits can improve the overall capital level of banks and can restraint banks from investing in risky assets. Lending/financing rate at a proxy for interest rate in the analysis is also considered, in this study.

IV. Empirical Models

To examine the panel data of banks operating in Pakistan, the dynamic panel data method was used and carried out the empirical analysis in four steps. First of all, the panel unit root tests, namely, the Im, Pesaran and Shin W test, the ADF-Fisher test, and the PP-Fisher Chi square unit root tests were taken, to check the order of integration of the underlying variables. In the second step, Pedroni panel co-integration test was ap-

[5] Ratio of risk-weighted car (RWCAR) is a measure for capital adequacy ratio by Jacques and Nigro (1997). This study do not employ it to avoid the serial multicollinearity. As risk-weighted assets are dependent variable in the model; so the use of RWCAR in the model is not appropriate. The solution to deal with this issue is to define a substitute measure of CAR. Thus, the sum of all assets, used as denominator, in place of risk-weighted assets. The same variable is used by Rime (2001) and, Shrieves and Dahl (1992).

plied, to confirm the long-run equilibrium relationship between variables of interest. Next, the dynamic ordinary least square estimator was applied to obtain the long-run estimates of the impact of bank capital on risk-taking behaviour of banks. Finally, the two-step generalized method of moments (GMM) estimator was implemented to estimate the panel vector error correction model PVECM) for examining the short-run relationship between bank-capital and risk-taking behaviour of banks. The optimal DOLS model was estimated to analyse the long-run effects of variables, expressed as follows:

$$\Delta RWA_{it} = B'X + \sum_{j=-k}^{k} \beta_{j1}\, \Delta CAR_{it-j} + \sum_{j=-k}^{k} \beta_{j2}\, \Delta Rate_{it-j} + \sum_{j=-k}^{k} \beta_{j3}\, \Delta Size_{it-j} + \sum_{j=-k}^{k} \beta_{j4}\, \Delta ROA_{it-j} + \sum_{j=-k}^{k} \beta_{j5}\, \Delta ROE_{it-j} + e_{it} \quad (1)$$

$B = [c, \alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5,]'$

$X = [1, CAR_{it}, Rate_{it}, Size_{it}, ROA_{it}, ROE_{it}]$

The model, represents the time period and cross section where eit is the error term which captures shocks in the model. The estimated residuals (error term) in the error correction model was used from the long-run equation and the lagged error correction term was used in the PVECM model. The conventional OLS is not used to estimate the dynamic model because the simple OLS can experience the problem of biasness, heteroskedasticity and serial correlation due to which it does not provide robust and unbiased results. Therefore, to estimate dynamic model, the dynamic OLS is recommended by Stock and Watson (1993); according to whom, the dynamic OLS is the most appropriate estimator to be used, particularly, in case of small sample.

The use of DOLS yields many advantages. For instance, it provides solution to problems of simultaneity by allowing researchers to consider regressors having different orders of integration. To deal with variables having different orders of integration, DOLS used the parametric technique. The DOLS supposes that all variables used in the model have co-integration relationship. According to Masih and Masih (1996), DOLS has the ability to resolve issues of simultaneity by taking lead and lag values of variables. The use of DOLS is feasible in estimation as data of this study is relatively small; and thus, application of conventional OLS estimator can cause the issue of endogeneity and biasness. Therefore, DOLS method is used to examine log-run association between the risk and capital. Secondly, long-run model also tells the impact of bank size (Size), the interest/financing rate (Rate) and profitability (ROA and ROE) on the risk-taking behaviour of banks.

The basic aim of this study is to examine the long-run association between the risk and capital. The relationship between bank-capital and risk-taking behaviour of banks is also analysed in the short-run. For this purpose, the panel vector error correction model is estimated by using the dynamic system GMM estimator. One of the advantages of

ECM is that without losing the long-run information and it integrates the short-run dynamics with long-run equilibrium. The PVECM takes the following form:

$$\Delta RWA_{it} = \theta_1 + \sum_k \theta_{11ik} \Delta RWA_{it-k} + \sum_k \theta_{12ik} \Delta CAR_{it-k} + \sum_k \theta_{13ik} \Delta Rate_{it-k}$$
$$+ \sum_k \theta_{14ik} Size\Delta_{it-k} + \sum_k \theta_{15ik} \Delta ROA_{it-k} + \sum_k \theta_{16ik} \Delta ROE_{it-k} + \lambda_{1i} \hat{e}_{it-1} + \mu_{it} \quad (2)$$

In Equation (3) the lagged error term $\hat{e}_{it-1}$ is used and obtained by estimating the long-run equation of co-integration. For any co-integrating relationship, there is a related vector error correction model [Engle and Granger (1987)]. Therefore, the error correction mechanism and co-integration relationships are linked. The error correction model corrects disequilibrium through error correction term. The panel vector error correction model employ replacement for conventional error correction model. The PVECM is estimated by implementing the two-step system GMM estimation method using a special command 'xtabond2' in Stata 14. The two-step system GMM estimation method controls the endogeneity and biasness in estimating the dynamic model [Arellano and Bond (1991)]. One of the good features of GMM system is that it decreases biasness and impreciseness by adding additional moment conditions at level, as well as at the first differences. According to Lee and Hseih (2013), the GMM method has an ability to control the biasness and endogeneity even in case of short sample. For post estimation diagnostic tests, autocorrelation test is used to check whether estimated residuals are free from problem of the second order serial correlation. Similarly, to ensure the validity of instruments used in estimation, the Sargan test is employed. This test, checks whether the instruments and lagged values of first-differenced variables included in the analysis for equations in levels, and the lagged values of variables in levels for equations in the first differences, are not correlated with the estimated residuals.

V. Empirical Results

1. Summary Statistics

Table 1 provide a summary statistics of variables of the proposed model. Mean, standard deviation, minimum and maximum values of risk measures, capital and interest rate, size, and profitability ratios are also given in the table. These statistics are helpful to understand the economic significance of variables used in the estimation. To measure central tendency or central value of underlying variables, mean or simple average is used. The standard deviation describes the spread or dispersion of variable around its mean value. To explain the range and limit of variables, minimum and maximum values are estimated. The mean value of CAR is 0.5366 while its maximum value is 5.2123. On an average, the interest/finance rate is 0.2210 with standard deviation of 0.2408. Mean value of bank size is 18.7459 while standard deviation value is

1.4119. The standard deviation of ROA (2.3664) shows the highest dispersion among all variables, while interest rate has the lowest value of dispersion (0.2408). The mean values of ROA and ROE are 0.3975 and 0.0033, respectively.

2. The Unit Root Tests

Testing unit root is the first step in estimation to check the order of integration for series. The unit root test check if series are integrated of order zero I(0) or order one I(1). In order to test stationary of variables, the Im, Pesaran, and Shin W test, the ADF Fisher test, and the Fisher Chi square unit root tests are used. All these tests allow the procedure for testing the unit roots, individually. These tests are characterized by combining individual unit root tests to derive a panel-specific statistic/result. In Table 2 the unit root results of all variables are presented. The tests are carried out for levels as well as, for first differences of variables. The optimal lag length for unit root tests based on the SIC (Schwarz Information Criterion) are selected. The results show that at levels, all variables are non-stationary. However, the first difference of variables appear stationary. Hence, it can be conclude that all variables are integration of order 1.

3. Results of Pedroni Panel Co-integration Tests

After examining the order of integration of variables, the study checks if there is co-integration between the underlying variables. Examination of co-integration is important because its presence imply a meaningful long-run association between the variables. Therefore, it is essential to ensure whether the co-integration relationship exists among risk, capital, rate, size, and profitability; before proceeding further. The Pedroni panel co-integration tests are used to check the association between variables in the long-run.

TABLE 1

Summary Statistics

Variable	Mean	Std.Dev.	Minimum	Maximum
CAR	0.5366	0.3528	-0.0121	5.2123
Rate	0.221	0.2408	0.0302	1.5341
Size	18.7459	1.4119	14.7121	21.4121
ROA	0.3975	2.3664	-9.2631	18.7213
ROE	0.0033	1.0738	-14.7121	6.8801

Notes: Table reports the values of mean, standard deviation (Std.Dev), minimum, and maximum values of the parameters in the model used for estimations. Risk is the dependent variable. CAR represents the capital adequacy ratio, Rate is the interest/finance rate of banks, and Size is estimated by taking the natural log of assets and represents the size of a bank.ROA is the return on assets and ROE is the return on equity.

Source: Authors' estimation.

The test has many benefits; one of them is to test the co-integration with multiple regressors. This test also allows considerable heterogeneity between the panel members. The null hypothesis for Pedroni test is that there is no co-integration relationship between the variables. The optimal lag length 1 is selected for co-integration tests based on the SIC.

Results of the co-integration tests are given in Table 3. There are seven statistics in the summary of Pedroni co-integration tests. Three statistics shows the co-integration 'between dimensions' (groups of rho, ADF, and PP-stat.) and the other four statistics indicate the co-integration 'within dimensions'. According to Pedroni (1999), statistics based on 'between dimension' approach of co-integration take an average of individual autoregressive coefficients in unit root regression of the residuals for each individual included in the panel. On the other hand, statistics based on the 'within dimension' approach pool the coefficients of autoregressive terms in the unit root regression (the ADF equation) for the estimated residuals across different groups include in the panel. These statistics take into consideration heterogeneity across different individuals as well as common time factors. All these statistics are normally distributed asymptotically. One of the advantages of using the Pedroni panel co-integration test is that it allows considerable heterogeneity among panel members and also in the co-integrating vectors. The results of the test between dimensions shows that out of three (group rho,[6] group ADF and group PP), two groups have statistics significant at 5 per cent level, while two statistics are sig-

TABLE 2

Results of Unit Root Tests

Variable	Im, Pesaran and Shin W-stat.	ADF-Fisher Chi-square	PP-Fisher Chi-square
CAR	-6.0595	142.090	229.790
	(0.000)	(0.000)	(0.000)
Rate	-4.6992	117.766	221.841
	(0.000)	(0.000)	(0.000)
Size	-2.9558	93.0396	201.883
	(0.000)	(0.000)	(0.000)
ROA	-5.9895	139.902	259.067
	(0.000)	(0.000)	(0.000)
ROE	-5.9833	136.924	263.283
	(0.000)	(0.000)	(0.000)

Source: Authors' estimation.

6 'rho' is derived to indicate that the statistics are based on estimation of autoregressive parameters.

nificant within the dimensions test. Overall, it can be seen that out of seven statistics, four are significant at 5 per cent level. These statistics provide an evidence of the presence of strong co-integration relationship between risk and other variables included in the model. The results confirm the existence of the long-run association between risk, capital, size, and profitability variables when risk is taken as dependent variable. Presence of co-integration among variables indicate that while following equilibrium point, variables move jointly. Results of the test are in line with findings of Wahab, et al. (2017).

4. Results of Dynamic Ordinary Least Square (DOLS)

After finding the co-integration among variables, long-run relationship between capital level and risk is estimated by using the dynamic OLS (DOLS). DOLS is used to estimate the model because sample size is small and DOLS estimator provide consistent and efficient estimates. Results of DOLS estimation are given in Table 4. The results indicate that capital level and risk are statistically and significantly linked in the long-run. The positive coefficient of capital suggests that banks having capital level greater than the required capital tends to invest more in risky assets. The estimated value of coefficient implies that bank-risk increases by 0.5525 units in response to one unit increase in capital level. This fining suggests that higher capital level motivate banks to do more investment in risky assets. Thus, banks having more capital have more risky portfolios. The positive effect of bank capital on risk is in support of the 'regulatory hypothesis'. However, one should note the positive bank capital-effect on risk-taking which does not support the 'moral hazard hypothesis'. Positive and signif-

TABLE 3

Results of Panel Co-integration Test

Tests	Statistics	P-values
Within Dimensions		
Panel v-Statistic	-3.3598	1.0000
Panel rho-Statistic	3.6196	0.9999
Panel PP-Statistic	-2.5027	0.0062
Panel ADF-Statistic	-2.4019	0.0082
Between Dimensions		
Group rho-Statistic	6.1674	1.0000
Group PP-Statistic	-9.9491	0.0000
Group ADF-Statistic	-4.7489	0.0000

Note: The critical values are in Pedroni (1999).
Source: Authors' estimation.

icant association between level of capital and risk-taking is consistent with previous empirical literature [see, for example, Koehn and Santomero (1980), Jokipii and Milne (2011), Altunbas, et al. (2007), Francis and Osborne (2012), and Karim, et al. (2014)]. However, the positive capital effect is in contrast to the findings of Ashraf, et al. (2016).

Statistically, significant and negative long-run association is also found between the bank size and risk-taking behaviours of banks. This finding is in line with the findings of Aggarwal and Jacques (1998). The negative effect of bank-size on risk implies that large banks are less risky, as compared to small banks. This finding also implies that due to more expertise, the economies of scale and economies of scope, large banks may be able to construct more diversified portfolios and manage risk, more effectively. On the other hand, small banks have limited options and they may not be able to make better composition of their assets.

The estimated coefficient of interest rate indicate the significant association between the interest rate and risk. Due to higher interest rate, business firms and investors reduce their demand for bank-loans. Thus, banks may invest excess capital in risky financial securities in the financial markets, like stock exchange and forex markets. Therefore,

TABLE 4

Results of Dynamic Ordinary Least Square

Variable	Statistics
Dependant Variable: Risk	
CAR	0.5525
	(0.003)
Size	-0.1375
	(0.056)
Rate	0.382
	(0.095)
ROA	0.0951
	(0.001)
ROE	-0.1351
	(0.012)
Wald Chi2 (6)	29.13
Prob. > Chi2	0.000
R-squared	0.963
Adj. R-squared	0.199

Notes: The estimation method is dynamic ordinary least square (DOLS) for the dynamic panel data. Risk is the dependent variable in the model. CAR represents the capital adequacy ratio, Rate is the interest/finance rate of banks, Size represents the size of bank calculated by taking log of the total assets, ROA is the return on assets and ROE is the return on equity. The study used the balanced panel dataset of 22 commercial banks of Pakistan for the period 2006-2015.

Source: Authors' estimation.

such investments may increase the risk. The positive relationship between interest rate and bank-risk is consistent with findings of Delis and Brissmis (2010).

The results also indicate that there is a positive and statistically significant impact of ROA on bank-risk. ROA is used as a proxy for profitability of banks. Therefore, results of this study suggest that more profitable banks are more likely to take risk. The point estimation implies that one per cent increase of ROA, results in about 0.9 per cent increase in bank-risk. This finding support the theory of risk and return. The results of estimation are in line with the study by Tan, et al. (2016) and in contrast to findings of Miller and Noulas (1997). The coefficients of ROE indicate the negative and significant association between return on equity and the bank risk. Return on equity has been used as control variable in estimation, as it has the capacity to affect the risk-taking behaviour of banks in the long-run. Overall, results of estimation of this study are in line with the studies of McNamara and Bromiley (1999) and Tan, et al. (2016).

5. Results of Panel VECM

To examine the short-run capital level effects on risk, panel VECM is estimated by using the two-step system GMM estimation method. The model, also include the first lag of dependent as an independent variable to examine the inertia in risk-taking behaviour of banks. It is important to mention that lagged value of estimated residuals (error term) from the long-run equation is estimated by using the DOLS method which is also included as an independent variable in the model estimated in the VECM framework. The residuals are obtained from DOLS while testing the long-run association among the underlying variables. The error correction term exhibits the speed of adjustment at which the banks get back in equilibrium. The coefficient of error correction term also indicate that financial system will show as to how much time will it take to come back to the equilibrium after getting affected by an adverse shock. It is important for stability of the model that sign of coefficient of error term must be negative. The statistically significance of coefficient of error term confirms the existence of long-run relationship among variables included in the model.

Table 5 presents the results of estimation of PVECM. The estimated value of Sargan test provide evidence that instruments used in the estimation are robust and valid. Further, the AR(2) test indicates that the estimated model does not suffer from the problem of serial correlation; and that it is negative and appear to be statistically significant. The negative sign of coefficient indicates that there is a significant convergence whenever the equilibrium is affected by any adverse shock. The estimated value of coefficient of error term suggests that about 32 per cent correction occur in one-year. Differently, it takes about three years for full convergence to the long-run equilibrium, whenever the variables deviate from the equilibrium in the short-run.

Turning to the short-run effect of capital level on bank-risk-taking, it is found that estimated coefficient is positive and statistically significant, suggesting a positive associ-

ation between the capital level and risk. Specifically, the estimated value of coefficient is 0.45, which suggest that bank-risk increases by 0.45 units when the bank-capital increases by one unit. This finding suggest that banks having higher level of capital can invest more in risky assets in the short run. Highly capitalized banks may invest more in risky assets to gain higher returns. Higher level of capital encourages banks to invest in assets without diligent scrutinizing. Therefore, this can result in formation of risky portfolios. The sig-

TABLE 5

Results of PVECM by suing the two-step system GMM Estimator

Variables	Statistics
e_{t-1}	-0.3156
	(0.000)
$\Delta Risk_{t-1}$	0.3538
	(0.000)
ΔCAR_{t-1}	0.4503
	(0.000)
$\Delta Size_{t-1}$	0.1439
	(0.000)
$\Delta Rate_{t-1}$	-0.075
	(0.636)
ΔROA_{t-1}	0.0141
	(0.276)
ΔROE_{t-1}	0.0206
	(0.000)
Constant	2.9726
	(0.000)
Sargan Test	24.4031
	(1.0000)
AR (2)	1.3528
	(0.1761)

Notes: The estimation method used herein is the two-step GMM dynamic panel estimator.Dependent variable in the model is risk. First difference or lag of risk is used as one of the independent variables in our estimation. CAR represents the capital adequacy ratio, Rate is the Interest/Finance rate of banks, and Size here represents the log of assets of banks. ROA is the return on Assets and return on equity is represented as ROE. The study used the balanced panel data set of underlying variables from 2006 to 2015.To confirm that the there is no correlation among the instrumental variables and residuals, we imply the Sargan test. We also imply the serial correlation test to ensure that the errors have serial correlation. The Sargan test (or Hansen test) tests the null hypothesis that the instruments used in estimation are orthogonal to the estimated residuals. The AR(2) test tests the null hypothesis that the estimated residuals do not exhibit any second-order serial correlation. P-values are in parentheses.

Source: Authors' estimation.

nificant positive impact of capital level on risk is consistent with previous empirical work of Koehn and Santomero (1980), Jokipiand Milne (2011), Atunbas, et al. (2007) and Karim, et al. (2014). Taken together, and based on estimates of the long-run and short-run effects of capital, it can be said that the level of capital has a positive and significant impact on risk-taking behaviour of the banks, both in short run as well as in the long run.

In contrast, the long-run effect of bank size on risk of the results, it indicate that in the short-run the size of bank is positively and statistically significantly, related to risk. This finding implies that large banks are more likely to invest in risky assets in the short-run, although they make less investment in risky assets in the long-run. It is also observed that interest rate is negatively related to risk; yet, this relationship is not statistically significant. The short-run estimates of ROA and ROE suggest that profitability of banks is positively and significantly related to risk in the short-run. The positive relationship between profitability and risk is consistent with findings of Tan, et al. (2016) and in contrast to results of the study of Miller and Noulas (1997).

VI. Conclusions

In this study, it is examined as to how the capital level is related to risk-taking behaviour of banks in Pakistan. Specifically, it is empirically analysed whether banks with higher amount of capital take more risk in short and long-run risk-weighted assets and capital adequacy ratios are taken as proxies for risk and capital level, respectively. An annual panel data of a sample of 22 commercial banks is used. The empirical analysis covers the period 2006 to 2015. The findings of co-integration tests suggest that there is a long-run equilibrium relationship between the risk and other variables included in the model. The empirical results of dynamic OLS shows that the impact of capital level on bank-risk is significantly positive in the long-run, supporting the 'regulatory hypothesis'.

Similarly, the results of PVECM indicate that increasing bank capital has a significant and positive effect on risk in the short-run. These results suggest that banks are likely to invest more in risky assets when they have more capital than the regulatory requirements. Analysis of the study also suggests that finding of positive capital effects on risk, hold both in the short-run as well in the long-run. Further, this finding is in accordance with 'regulatory hypothesis' suggesting that higher level of capital are positively and significantly related to risk-taking and the behaviour of banks. This finding implies that the highly capitalized banks prefer to invest in assets having higher risk. The results reveal that risk-taking behaviour of banks is negatively and significantly related to bank size in the long-run, whereas, it is positively related to bank size in the short-run. These findings imply that although large banks take more risk in the short-run but they take less risk in the long-run. Large banks may do so in the long-run by diversifying their investment portfolios and harvesting the benefits of economies of scale and economies of scope. Finally, the results suggest that more profitable banks are more likely to take risk in the short-run as well as in the long run.

Findings of this study provide several useful guidelines to regulators and bank managers. In particular, findings help regulatory authorities to set better regulations for improving efficiency and asset quality of banks in Pakistan. This study may also provide useful guidelines to bank managers to maintain an adequate level of bank capital and construct well-diversified portfolios while making investments in risky assets. The findings may also help the customers and investors to select suitable banks for borrowing and investing activities.

The regulations on allocation of risk-weighted assets are same for both the conventional and Islamic banks in Pakistan. However, the asset portfolios made by Islamic banks are different than that of the conventional banks. This study has the limitation that it does not provide a separate policy implication for Islamic banks as the dataset taken for estimation consisting of both the conventional and Islamic banks. This study do not analysis capital effect on risk for only Islamic banks' sample, due to limited data available of the full-fledge Islamic banks in Pakistan. Overall, results of the study recommend that all banks should maintain an adequate capital level to run the business, efficiently. The soundness of banking sector is strongly related to their capital levels; yet, more profitable banks take more risk. These findings definitely help investors, depositors, and customers to think carefully while making business with banks.

Bibliography

Adebayo, R.I., and M.K. Hassan, 2013, Ethical principles of Islamic financial institutions, Journal of Economic Cooperation and Development, 34(1): 63-90.

Aggarwal, R., and K.T. Jacques, 1998, Assessing the impact of prompt corrective action on bank capital and risk, Economic Policy Review, 4(3): 23-32.

Agoraki, M.-E.K., M.D. Delis and F. Pasiouras, 2011,. Regulations, competition and bank risk-taking in transition countries, Journal of Financial Stability, 7(1): 38-48.

Agusman, A., G.S. Monroe, D. Gasbarro and J.K. Zumwalt, 2008, Accounting and capital market measures of risk: Evidence from Asian banks during 1998–2003, Journal of Banking and Finance, 32(4): 480-488.

Altunbas, Y., S. Carbo, E.P. Gardener and P. Molyneux, 2007, Examining the relationships between capital, risk and efficiency in European banking, European Financial Management, 13(1): 49-70.

Arellano, M., and S. Bond, 1991, Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations, Review of Economic Studies, 58(2): 277-297.

Ashraf, B.N., S. Arshad and Y. Hu, 2016, Capital regulation and bank risk-taking behavior: Evidence from Pakistan. International Journal of Financial Studies, 4(3): 16-28.

Avery, R.B., and A.N. Berger, 1991, Risk-based capital and deposit insurance reform, Journal of Banking and Finance, 15(4): 847-874.

Barth, J. R., G. Caprio and R. Levine, 2004, Bank regulation and supervision: What works best? Journal of Financial Intermediation, 13(2): 205-248.

Beatty, A.L., and A. Gron, 2001, Capital, portfolio, and growth: Bank behavior under risk-based capital guidelines, Journal of Financial Services Research, 20(1): 5-31.

Beltratti, A., and R.M. Stulz, 2012, The credit crisis around the globe: Why did some banks perform better? Journal of Financial Economics, 105(1)L 1-17.

Ben Selma, R.M., M.T. Rajhi, H. Rachdi and J. Connelly, 2016, Bank risk taking in the MENA region: A comparison between Islamic banks and conventional banks, International Journal of Social Economics, 43(12): 1367-1385.

Blum, J., 1999, Do capital adequacy requirements reduce risks in banking? Journal of Banking and Finance, 23(5): 755-771.

Bouheni, F.B., H.B. Ameur, A. I. Cheffou and F. Jawadi, 2014, The effects of regulation and supervision on European banking profitability and risk: A panel data investigation, Journal of Applied Business Research, 30(6): 1665-1685.

Cannata, F., and M. Quagliariello, 2009, The role of Basel II in the subprime financial crisis: Guilty or not guilty? CAREFIN Research paper, 3/09.

Chiuri, M.C., G. Ferri and G. Majnoni, 2001, Enforcing the 1988 Basel capital requirements: Did it curtail bank credit in emerging economies? Economic Notes, 30(3): 399-419.

Claessens, S., A. Demirgüç-Kunt and H. Huizinga, 2000, The role of foreign banks in domestic banking systems. The Internationalization of Financial Services: Issues and lessons for developing countries, 117-138.

Dalla Pellegrina L., 2007, Capital adequacy ratios, efficiency and governance: A comparison between Islamic and Western banks, Centro Paolo Ba¢, Bocconi University, Milan.

Delis, M.D., and S.N. Brissimis, 2010, Bank heterogeneity and monetary policy transmission ECB working paper, 1233.

Delis, M.D., and G.P. Kouretas, 2011, Interest rates and bank risk-taking. Journal of Banking and Finance, 35(4): 840-855.

Festić, M., A. Kavkler, and S. Repina, 2011, The macroeconomic sources of systemic risk in the banking sectors of five new EU member states, Journal of Banking and Finance, 35(2): 310-322.

Francis, W.B., and M. Osborne, 2012, Capital requirements and bank behavior in the UK: Are there lessons for international capital standards? Journal of Banking and Finance, 36(3): 803-816.

Furlong, F.T., and M.C. Keeley, 1989, Capital regulation and bank risk-taking: A note, Journal of Banking and Finance, 13(6): 883-891.

Goddard, J., P. Molyneux and J.O. Wilson, 2004, The profitability of European banks: A cross sectional and dynamic panel analysis, The Manchester School, 72(3): 363-381.

Haq, M., and R. Heaney, 2012, Factors determining European bank risk, Journal of International Financial Markets, Institutions and Money, 22(4): 696-718.

Iannotta, G., G. Nocera and A. Sironi, 2007, Ownership structure, risk and performance in the European banking industry, Journal of Banking and Finance, 31(7): 2127-2149.

Ito, T., and Y.N. Sasaki, 2002, Impacts of the Basle capital standard on Japanese banks' behavior, Journal of the Japanese and international Economies, 16(3): 372-397.

Jacques, K., and P. Nigro, 1997, Risk-based capital, portfolio risk, and bank capital: A simultaneous equations approach, Journal of Economics and Business, 49(6): 533-547.

Jokipii, T., and A. Milne, 2011, Bank capital buffer and risk adjustment decisions, Journal of Financial Stability, 7(3): 165-178.

Kahane, Y., 1977, Capital adequacy and the regulation of financial intermediaries, Journal of Banking and Finance, 1(2): 207-218.

Kamran, H.W., N. Chaudray, M.M. Murtaza, N. Zafar, A.Yousaf and H. Nazish, 2016, Financial market development, bank risk with key indicators and their impact on financial performance: A study from Pakistan, American Journal of Industrial and Business Management, 6 (3): 373-381.

Kareken, J.H., and N. Wallace, 1978, Deposit insurance and bank regulation: A partial-equilibrium exposition, Journal of Business, 51(3): 413-438.

Karim, M.A., M.K. Hassan, T. Hassan and S. Mohamad, 2014, Capital adequacy and lending and deposit behaviors of conventional and Islamic banks. Pacific-Basin Finance Journal, 28(6): 58-75.

Klomp, J., and J. De Haan, 2012, Banking risk and regulation: Does one size fit all? Journal of Banking and Finance, 36(12): 3197-3212.

Koehn, M., and A.M. Santomero, 1980, Regulation of bank capital and portfolio risk, Journal of Finance, 35(5): 1235-1244.

Lee, C.-C., and M.-F. Hsieh,. 2013, The impact of bank capital on profitability and risk in Asian banking, Journal of international Money and Finance, 32(2): 251-281.

Lee, C.C., S.L. Ning and C.C. Lee, 2015, How does bank capital affect bank profitability and risk? Evidence from China's WTO accession, China and World Economy, 23(4): 19-39.

Masih, R., and A.M. Masih, 1996, Stock-Watson dynamic OLS (DOLS) and error-correction modelling approaches to estimating long-and short-run elasticities in a demand function: New evidence and methodological implications from an application to the demand for coal in mainland China, Energy Economics, 18(4): 315-334.

McNamara, G., and P. Bromiley, 1999, Risk and return in organizational decision making, Academy of Management Journal, 42(3): 330-339.

Miller, S.M., and A. G. Noulas, 1997, Portfolio mix and large-bank profitability in the USA, Applied Economics, 29(4): 505-512.

Nazir, M.S., A. Daniel and M.M. Nawaz, 2012, Risk management practices: A comparison of conventional and Islamic banks in Pakistan, American Journal of Scientific Research, 68(1): 14-122.

Pedroni, P., 1999, Critical values for cointegration tests in heterogeneous panels with multiple regressors, Oxford Bulletin of Economics and Statistics, 61(1): 653-670.

Rime, B., 2001, Capital requirements and bank behavior: Empirical evidence for Switzerland. Journal of Banking and Finance, 25(4): 789-805.

Sheldon, G., 1996, Capital asset ratios and bank default probabilities: An international comparison based on accounting data, Swiss Journal of Economics and Statistics, 132(4): 743-754.

Shim, J., 2010, Capital-based regulation, portfolio risk and capital determination: Empirical evidence from the US property–liability insurers, Journal of Banking and Finance, 34(10): 2450-2461.

Shrieves, R.E., and D. Dahl, 1992, The relationship between risk and capital in commercial banks, Journal of Banking and Finance, 16(2): 439-457.

Stock, J.H., and M.W. Watson, 1993, A simple estimator of cointegrating vectors in higher order integrated systems, Econometrica, 61(4): 783-820.

Tan, A.Y., B. Floros and J. Anchor, 2016, The profitability of Chinese banks: Impacts of risk, competition and efficiency, Review of Accounting and Finance, 16(1): 86-105.

Tan, Y., and C. Floros, 2013, Risk, capital and efficiency in Chinese banking, Journal of International Financial Markets, Institutions and Money, 26(10): 378-393.

Wahab, A.H., S.A. Rosly and A.M.M. Masih, 2017, Risk taking behavior and capital adequacy in a mixed banking system: New evidence from Malaysia using dynamic OLS and two-step dynamic system GMM estimators, Emerging Markets Finance and Trade 53(1): 180-198.

Zribi, N., and Y. Boujelbène, 2011, The factors influencing bank credit risk: The case of Tunisia, Journal of Accounting and Taxation, 3(4): 70-85.