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Article

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FINANCIAL ECONOMICS | RESEARCH ARTICLE

The impact of bank capital, bank liquidity and credit risk on profitability in postcrisis period: A comparative study of US and Asia

Faisal Abbas^{1*}, Shahid Iqbal¹ and Bilal Aziz²

Abstract: The purpose of this study is to explore the influence of bank capital, bank liquidity level and credit risk on the profitability of commercial banks in the post-crisis period between 2011 and 2017 in Asian developed economies in comparison with the USA banking industry. The findings show that bank capital and credit risk influence profitability in Asian developed economies similar to in the USA commercial banks, whereas the impact of liquidity on the profitability of the USA large commercial banks is negative and positive on Asian developed economies commercial banks in the postcrisis era. The findings indicate that a 6% increase in capital leads to a 1% increase in profit, a 3.5% increase in liquidity leads to a 1% increase in profit. Specifically, larger banks generate 1% profit against a 1% increase in liquid assets. Medium size banks make 1% profit against a 3% increase in liquid assets, and small size banks produce 1% profit against a 7% increase in liquid assets. The findings show that liquidity influences profitability more intensively than capital, whereas the sign of coefficients is similar for large, small and medium-size

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PUBLIC INTEREST STATEMENT

In this study, we tend to advocate the literature of banking and empirical findings for the postcrisis period. The last financial crisis 2007–08 explores the importance of bank capital and bank liquidity in banking sectors. This study also aims to highlight the impact of bank capital, bank liquidity and credit risk on profitability of commercial banks in developed economies of Asia in postcrisis period in comparison with the large commercial banks of the USA. This study may be valued for the decision makers. They may seek guidance from this study for formulating policies in this area in future. This study may also open a new horizon for researchers.

banks. The results of this paper indicate that liquidity and bank capital have a positive impact on profitability, while credit risk has a negative influence on the profitability of banks. The findings of the simultaneous equations model indicate that bank capital has a positive impact on profitability in large and medium banks, whereas the profitability of banks influences the bank capital positively in case of large banks and negatively in case of medium banks.

Subjects: Economics; Corporate Finance; Banking

Keywords: bank capital; bank liquidity; bank profitability; bank credit risk

JEL classification: G21; G32; G33

1. Introduction

This study examines the influence of bank capital, bank liquidity level and credit risk on the profitability of commercial banks in the postcrisis period between 2011 and 2017 in Asian developed economies in comparison with the USA banking industry. The available literature on the topic includes theoretical discrepancies thus misleading the researchers, scholars, managers, analysts, decision makers and regulators. Therefore, the purpose of this study is to provide new insights based on empirical investigations in order to fill this gap. To accurately define the scope of this study, the data of USA commercial banks are used as a benchmark to compare the findings of Asian commercial banks. The significance of the under-consideration subject is clearly manifested by observing the studies conducted by Boyd and Graham (1988), Shrieves and Dahl (1992), Jacques and Nigro (1997), Rime (2001), Philip Molyneux and Thornton (1992), Berger (1995), Akhavein, Berger, and Humphrey (1997), Färe, Grosskopf, and Weber* (2004), Laeven and Levine (2009), Altunbas, Carbo, Gardener, and Molyneux (2007), which focused on bank capital, risk and profitability. More recently, the following studies investigated the connection among bank capital, risk, liquidity, profitability and efficiency: Chiamonte and Casu (2017), Cole and White (2012), DeYoung and Jang (2016), Lee and Hsieh (2013), Diamond and Kashyap (2016), Distinguin, Roulet, and Tarazi (2013), Francis and Osborne (2012), Haneef, Archer, and Karim (2018), Laeven and Levine (2009) Ozili (2017), Beltratti and Paladino (2015), Deyoung, Distinguin, and Tarazi (2017), Beltratti and Paladino (2015), Deyoung et al. (2017), Beltratti and Paladino (2015), Deyoung et al. (2017), Horváth, Seidler, and Weill (2014), Goddard, Liu, Molyneux, and Wilson (2013), Tran, Lin, and Nguyen (2016), and Berger and Bouwman (2013).

The Basel Committee on Banking Supervision (BCBS) formulated new regulations regarding equity capital and bank liquidity levels in response to the last financial crunch 2007–08. Due to globalization and global financial integration, the role of financial institutions has become highly significant. The BCBS regulators recommend that financial institutions be required to maintain a higher proportion of capital and liquid assets, which provide protection from a bank run. In response to these regulations, financial institutions and economies have to bear a heavy cost in terms of lower profitability and slower economic activities.

This study investigates the impact of higher capital requirements, higher amount of liquid assets and credit risk on the profitability of commercial banks in Asian developed economies. The main purpose of financial institutions is to maximize profit for which banks collect funds at a lower rate and lend at a greater rate of return (Rivai, Veithzal, and Idroes, 2007). The impact of credit risk on the profitability of banks is not clear-cut; it may be positive or negative. On one hand, when banks take higher credit risk they normally earn a higher profit. On the other hand, the profitability of banks may drop when bank management fails to collect the loans. The literature indicates that there is an inverse relationship between bank liquidity and profitability. Theoretically, when banks hold a greater amount of liquid assets they lose the gains in term of opportunity cost. However, the banks holding a lesser amount of liquid assets normally earn a greater profit (Pracoyo and Imani,

2018). The high level of bank capital boosts the confidence and trust of the public about the soundness of the bank. Stronger banks can channelize available funds in business activities and make high profits (Pasaribu and Sari, 2011). The theory suggests that bank capital is one of the key determinants of profitability increase and decrease. The theory also suggests that bank capital increases bank return in the start and up to trade-off levels; then, it causes a decrease in profit (Berger, 1995; Siamat, Kusumawardhani, and Agustin, 2005). There are several reasons for the disagreement about the nature of the relationship among bank capital, bank liquidity level, credit risk, and the profitability of commercial banks.

This study answers the following questions. Does the holding of a higher amount of bank capital influence the profitability of commercial banks in Asian developed economies in the postcrisis era? Does the holding of a higher amount of bank liquidity affect the profitability of commercial banks in Asian developed economies in the postcrisis era? How credit risk influences the profitability of commercial banks in Asian developed economies in the postcrisis era? Is the relationship similar in small, medium and large size commercial banks? Is the impact of bank capital, bank liquidity and credit risk similar to that in the USA banking industry in the postcrisis period? Does the impact differ according to the bank size (small, medium and large) in comparison with the USA banking industry? Finally, which of the three factors is more influencing in the profitability of commercial banks in Asian developed economies in the postcrisis era.

This paper enriches the literature on banking and finance in different manners. It explains how commercial banks in Asian developed economies are using bank capital, bank liquidity and credit risk to obtain profit as compared to the developed and well-regulated banking sector of the US. Moreover, this study examines the influence of the latest banking regulations concerning commercial banks in Asian developed economies. In addition, this study reviews the literature on the management of capital, liquidity and credit risk in Asian developed economies in the postcrisis period for future recommendations, particularly for Asia. The findings are robust and appropriate because similar denominator (average of total assets) is used for liquidity, bank capital, and profitability with the exception of credit risk for which the average of risky loans is used. The results provide a new aspect for researchers to investigate in future research.

This study highlights the impact of the liquidity level on the profitability of commercial banks in Asian developed economies because the available evidence on this topic is rare in this region. This is the first study that examines the impact of bank capital, credit risk and liquidity on the profitability of commercial banks in Asian developed economies, particularly in the postcrisis period. Significantly, this is the only study that sheds light on the effect of the intensity of liquidity, capital and credit risk on profitability in commercial banks of Asian developed economies in postcrisis era in comparison with the USA banking industry.

The findings of this study provide constructive feedback to regulators about the impact of liquidity and capital on profitability for further decision-making and regulations. However, these results are regardless of the intervention of monetary factors and economic conditions, which are held constant. The rest of this paper is sequenced as follows: the second section contains hypothesis development and relevant literature review. The third section contains data collection sources, variables measurement and the mathematical model of the study. The fourth part contains discussions and analysis of results. Finally, conclusions, suggestions, and recommendations for further research are presented.

2. Hypotheses development and literature review

2.1. The relationship between bank capital and profitability in banking

The relationship between bank capital and profitability in banking has been investigated by several researchers. For example, Ozili (2017) concludes in their paper that regulatory bank capital has a positive impact on the profitability of commercial banks in Africa. Berger and Bouwman (2013)

opine that bank capital influences the performance of small banks in that it enables them to survive. It also improves the performance of large and medium banks, particularly in a crisis period. Recently, Islam and Nishiyama (2016) suggest that equity capital has a positive impact on the profitability of South Asian commercial banks. Tran et al. (2016) conclude that capital and performance do not have a linear relationship. They document an inverse relationship in capital and profitability of larger banks and a positive relationship in smaller banks. Lee and Hsieh (2013) state that capital and profitability of commercial banks in Asian countries have a positive relationship. Phil Molyneux and Forbes (1995) and Philip Molyneux and Thornton (1992) concluded in two different studies that bank capital has a positive effect on the performance of banks. They argued that due to the lower cost of bank capital, managers can earn higher profits by making diversified investments. Akhavein et al. (1997) suggest that capital remains positive up to a certain level called (optimal) and then becomes negative. Athanasoglou, Brissimis, and Delis (2008) and Flamini, Schumacher, and McDonald (2009) favor the positive impact of bank capital on the profitability of banks. P. Ozili (2015) and Echengreen and Gibson (2001) document that leverage has a positive impact on the profitability of banks. however, Boyd and Runkle (1993), Micco, Panizza, and Yanez (2007), M. E. Francis (2013) and Naceur (2003) concluded a negative relationship between bank capital and profitability. Significantly, the condition imposed by regulators to hold a higher amount of equity capital is found to enhance risk absorption capacity of banks in earlier studies such as Aggarwal and Jacques (2001) and in recent studies such as Ng and Roychowdhury (2014). Barth, Caprio, and Levine (2008) and Berger and Bouwman (2013) argued that the impact of regulatory capital on bank profitability is yet not clear. Based on the above arguments, the following is hypothesized:

H1: Bank Capital (Equity to Total Assets) has a positive impact on profitability (performance) of commercial banks in developed economies of Asia

2.2. The relationship between bank liquidity and profitability in banking

The relationship between bank liquidity and profitability in banking is investigated in many studies. Bourke (1989) opines in their paper that banks which have well-diversified lending portfolio earned higher profits along with higher liquidity. Echengreen and Gibson (2001) revealed that liquidity has a positive impact on bank profitability. Philip Molyneux and Thornton (1992) opine in their paper that liquidity and profitability have a negative relationship. Islam and Nishiyama (2016) document that liquidity, as measured by total loans to total deposit ratio, has a positive impact on profitability in case of net interest margin, but this relationship is insignificant. Tran et al. (2016) argue in their paper that the banks which create higher liquidity earn lower profits. This empirical argument of Tran et al. (2016) recommends that liquidity management is needed to earn higher profits. Bordeleau and Graham (2010) argue in their study that banks which hold a higher amount of liquid assets generate greater profitability. They argue that higher liquid assets reduce the illiquidity and financing cost of banks. Goddard et al. (2013) point out in their study that there is a negative relationship between liquidity and performance of banks. Based on the above arguments, the following is hypothesized:

H2: Bank Liquidity Level (Liquid Assets to Total Assets) has a positive impact on profitability (performance) of commercial banks in developed economies of Asia

2.3. The relationship between credit risk and profitability in banking

The relationship between credit risk and profitability in banking is investigated in different studies. Ozili (2017) opines that credit risk as measured by loan loss provisions is a significant variable influencing the profitability of commercial banks in Africa. Tarus, Chekol, and Mutwol (2012) reveal that credit risk has a positive impact on the profitability of commercial banks in case of net interest margin. Angbazo (1997), Demirgüç-Kunt and Huizinga (1999), Mendes and Abreu (2003) and Carbo Valverde and Rodríguez Fernández (2007) favor the positive relationship between credit risk and profitability of commercial banks. P. Ozili (2015) documented that in a market where the quality of

lending is not good, there would be a high loan loss provisions, and the higher would be non-performing loans which lead to lower profitability of banks. Recently, Islam and Nishiyama (2016) concluded that credit risk as measured by non-performing loans has a negative but insignificant impact on profitability in case of net interest margin in South Asian commercial banks. Dietrich and Wanzenried (2011), Vong and Chan (2009), Ongore and Kusa (2013), and Miller and Noulas (1997) reported a negative relationship between credit risk and bank profitability. Duca and McLaughlin (1990) provide empirical results that policy for credit risk influences the portfolio of loans, and a decrease in the quality of lending causes an increase in the non-performing loans and profitability of banks. Jackson et al. (1999) recommend that poor quality of lending increases the loan loss provision, which leads to non-performing loans and actual losses. P. Ozili (2015) reports a negative and insignificant impact of credit risk on profitability while testing the Nigerian commercial banks. In the light of the above arguments, it seems necessary to test the impact of credit risk, particularly, when measured as loan loss provision to risky loans ratio in Asian developed economies for the postcrisis period. Under the guidelines of the above arguments, the following is hypothesized:

H2: Credit risk (Loan Loss Provisions to Risky Loans Ratio) has a negative impact on profitability (performance) of commercial banks in Asian developed economies

3. Sample selection, data and econometric model

3.1. Sample selection criteria and data sources

There are more than 40 countries in the Asian region, but the list of developed countries is limited there. The countries ranked as developed in Asia, as per the information of IMF/World Bank and rating agencies, are South Korea, Hong Kong, Singapore, Japan, Saudi Arabia, the United Arab Emirates, Cyprus, Qatar, Brunei, and Israel. Each country contains different types of banks like commercial banks, savings banks, cooperative banks, housing banks, investment banks, agricultural banks, industrial banks. In addition, some of these countries include Islamic banks such as Qatar, the United Arab Emirates, and Saudi Arabia. Notably, this study focuses on commercial banks only. The selection criterion for the banks included in this study is a minimum paid up capital of a 100 billion dollar. Banks having less than 8% risk-weighted capital, less than 4% tier one capital and less than 4% leverage was excluded from the sample. Moreover, the banks that have more than two-year missing data for required variables were dropped from the sample. After the filtration process, the sample was reduced to 174 banks. The details of the sample are South Korea 8 out of 13, Hong Kong 28 out of 35, Singapore 11 out of 13, Japan 86 out of 137, Saudi Arabia 6 out of 10, United Arab Emirates 14 out of 21, Cyprus 9 out of 13, Qatar 4 out of 6, Brunei 1 out of 4 and Israel 7 out of 11. The annual data were collected from the Bankscope database and from financial statements of respective banks. The short-listed banks were classified based on total assets of the last year into three categories: large banks, small banks, and medium banks. This is because smaller banks contain little capital as compared to larger ones Berger and Bouwman (2013). Most of the studies focus on the impact of the crisis on banks, but the evidence is lacking for the postcrisis period. Therefore, data were collected for the postcrisis period between 2011 and 2017. The banks that are insured, chartered and having greater than \$300 million consolidated assets were selected to obtain the standard results for comparison in this study. There were 942 large commercial banks for which data is collected.

3.2. Measurement of variables

Profitability is a dependent variable in this study. Three proxies for profitability were used including return on average assets (Net Income/Average Total Assets), return on average equity (Net Income/Average Total Equity) and return on average earning assets (Net Income/Average Earning Assets). The reason for using average assets is the over or underestimation of simply computed return on assets and return on equity. Roman and Sargu (2015), Chiorazzo and Milani (2011), and Chiamonte and Casu (2017) used these proxies in their studies. Liquidity is

considered an explanatory variable and was measured based on liquid assets to total assets ratio. This proxy represents the level of liquidity holding by banks rather than liquidity risk, which is linked with liabilities payments. Islam and Nishiyama (2016) and Kim and Sohn (2017) used this proxy in their studies. Bank Capital is another explanatory variable of core concern in this study. This proxy is measured as the total equity to risk-weighted assets. Significantly, in most of previous studies, researchers used equity to total assets ratio as the capital ratio such as Carlson, Shan, and Warusawitharana (2013), Munteanu (2012), Chiorazzo and Milani (2011), Islam and Nishiyama (2016), Chiaramonte and Casu (2017), Kim and Sohn (2017) and Aydemir and Guloglu (2017). Credit Risk is also an explanatory variable in this study. This proxy is measured as loans loss provisions to risk loans of banks. In different studies, it is used with different bases like gross loans, total assets and the log of loans loss provisions, and more Chiorazzo and Milani (2011); Kim and Sohn (2017); Tarus et al. (2012). The control variables used in this study include Market funding, loans growth, assets growth bank efficiency, and bank size.

3.3. Econometric models

3.3.1. Regression analysis

The conditions and assumptions should be clear; otherwise, the results will become bias. Whenever there is an issue of heteroscedasticity, autocorrelation, and multicollinearity in data, the results of regression become bias. In this case, alternative methods are used to resolve these issues. There is an option to use a random or fixed model to discover consistent parameters. If the data contains an endogeneity issue, this method will also become biased. The following is the standard form of this model:

$$Y_{i,t} = \alpha + \beta_1 X_{i,t} + \beta_2 Z_{i,t} + \varepsilon \quad (1)$$

Here, α represents constant, I , represents a cross-section, t represents time Y represents a dependent variable (profitability), X represents explanatory variables (Liquidity, Capital, and Credit Risk), Z represents control variables which includes market funding, loans growth, and bank efficiency, β_1 , β_2 represent the coefficient and ε is error term in the above equation. The coefficient of this model can predict the true value, when there is no multicollinearity, autocorrelation, heteroscedasticity, and issue of endogeneity.

3.3.2. Arellano–Bond generalized methods of moments (GMM) estimator

GMM estimators is another estimation technique to address the endogeneity, heteroscedasticity and serial correlation problem among variables in econometrics introduced by Arellano and Bond (1991). The reason to use Arellano and Bond technique instead of multiple ordinary least square (OLS) regression and the Least-Squares Dummy Variable (LSDV) estimator is that the latter cannot incorporate the problem of Endogeneity in panel data. In fact, OLS and LSDV provide inconsistent estimator under the availability of endogeneity in panel data settings. Arellano and Bond (1991) claimed in their dynamic panel setting that their technique is better as compared to the conventional estimators due to the following: Firstly, this method corrects the problem of heteroscedasticity, autocorrelation, and endogeneity in panel data setting. Secondly, the technique uses lagged numbers for dependent variables and controls the incorporate problem of instruments. Thirdly, this method provides an estimator which captures correlations among explanatory variables. GMM was used in many studies to obtain consistent estimators in banking Ozili (2017); Luo, Tanna, and De Vita (2016); and Jokipii and Milne (2011).

The standard form of this model contains lagged value of dependent variables:

$$Y_{i,t} = \alpha + \beta_3 Y_{i,t-1} + \beta_1 X_{i,t} + \beta_2 Z_{i,t} + \varepsilon \quad (2)$$

Here, α represents constant, i represents a cross-section, t represents time Y represents the dependent variable (profitability), $Y_{i,t-1}$ represents lagged variables of the dependent variable profitability, X represents explanatory variables (Liquidity, Capital, and Credit Risk), Z represents

control variables which include market funding, loans growth, and bank efficiency, β_1 , β_2 , β_3 represent the coefficient and ε is error term in above the equation. The coefficient of this model has the features to control the problems of multicollinearity, autocorrelation, heteroscedasticity, and issue of endogeneity.

3.3.3. Simultaneous equation model

If the data contains interdependence, the simultaneous equation model can be applied to control this issue and to determine the consistent parameters. In this study, this technique is applied to a system of equations to find the structural parameters. There are three methods to find structural parameters called ILS, 2SLS, and 3SLS. If there are lagged values of dependent variables, this approach will not be a good choice. Thus, some other methods should be applied to resolve the issue of the lagged value of dependent variables and the issue of endogeneity at the same time. Simultaneous equations technique was used in many studies to estimate the parameters (Ghosh, 2014; Shrieves & Dahl, 1992). The standard form of this model is as under:

$$Y_{i,t} = \alpha + \beta_1 X_{i,t} + \beta_2 C_{i,t} + \varepsilon \quad (3)$$

$$X_{i,t} = \alpha + \delta_1 Y_{i,t} + \delta_2 Z_{i,t} + \varepsilon \quad (4)$$

Here, α represents constant, i , represents a cross-section, t represents time Y and X represent endogenous variables (profitability, Liquidity), Z and C represent control variables market funding, loans growth, bank efficiency, assets growth and, size, β_1 , β_2 , δ_1 , δ_2 , represent the structural parameters and ε is error term in the equations. The structural parameters of this model have the features to control the problems of multicollinearity, autocorrelation, heteroscedasticity and the issue of endogeneity.

4. Results and discussion

Table 1 shows the data including the number of observations of each variable, the mean value of the respective variables, the standard deviation of each variable, and the minimum and maximum values of each variable. The measurement of profitability, liquidity, capital and credit risk is given in the methodology section in detail.

Table 2 contains the information of dependent and explanatory variables and their correlation with each other. The results indicate that the correlation matrix is quite good as per the values of correlation among variables. There is no higher correlation among explanatory variables to cause the problem of multicollinearity. The correlation numbers indicated that there is no high degree of correlation among explanatory variables. The sign of correlation follows the economic theory. The findings show that capital and profitability have a positive correlation with each other. A similar association is found for credit risk and profitability on average.

The above Table 3 contains the results of large commercial banks of the USA banking industry as a standard. The impact of bank capital, bank liquidity and credit risk on bank profitability is reported. The findings show that bank capital has a positive and statistically significant effect on bank profitability in the short run, other things remain the same. The results provide that bank liquidity ratio has an inverse and statistically significant impact on bank profitability at 1% level of significance in the short run, other things remain unchanged. The findings indicate that credit risk is also negatively and significantly influencing profitability at 1% level of significance in the short run. The results of the USA commercial banks are taken for comparison to make the difference prominent for a better understanding of the said subject.

Table 4 shows the results of system dynamic panel data estimators under the condition of Two-Step method of GMM. The Robust standard errors results indicate that 6% rise in capital increases only 1% of the profitability of banks from the base point of 100, whereas the other factors remain unchanged. The overall sample shows that bank capital has a positive impact on profitability in the

Table 1. Descriptive statistics shows the list of variables used in this study. Data of Asian developed economies were collected for the period between 2011 and 2017. Bank profitability is considered a dependent variable (ROAA, ROAE, ROAEA). Bank capital (equity to total assets), liquidity, credit risk, loans growth, bank efficiency, market funding, assets growth, size of the bank are used as control variables. The measurement and definitions of all variables are discussed

Variable	Obs	Mean	Std.Dev.	Min	Max
Profitability-1	237	.006	.005	.001	.025
Profitability-2	237	.093	.049	.002	.273
Profitability-3	237	.023	.012	.001	.067
Liquidity	237	.158	.118	.001	.650
Credit risk	237	.043	.295	.005	3.53
Capital	237	.070	.021	.029	.141
Market funding	237	.227	.191	-.860	.936
Loans growth	237	.515	.231	.002	.821
Assets growth	237	.077	.140	-.111	1.60
Efficiency	237	.543	.164	.157	.926
Size	237	18.6	1.47	14.9	21.4

currently analyzed sample. These results are similar to the USA large commercial banks. Overall, the impact of capital is pronounced especially for small size banks. The positive relationship between capital and profitability is consistent with Islam and Nishiyama (2016) P. K. Ozili (2017); Tran et al. (2016) and Berger and Bouwman (2013). However, by dividing the sample into large, medium and small size banks, the coefficient remains similar for all the categories altogether but is not significant for large and medium-size banks separately. The overall sample is used as representative of the whole region, and the conclusions for this study is based on the average bank capital and average profitability scaled by the average amount of total assets reported in financial statements. The disagreement among researchers on the positive relationship is due to the measurement of risk and profitability proxies.

Table 5 shows the results of system dynamic panel data estimators under the condition of the Two-Step method of GMM. The Robust standard errors results indicate that 3.5% rise in liquid assets increase only 1% of profitability of banks from the basis point of 100, where the other factors remain unchanged as well. The relationship of liquidity and profitability is not similar in USA banking industry and Asian developed economies commercial banks as the relationship are positive in Asia and negative in the USA. These findings are based on a similar denominator of dependent and independent variables named an average of total assets. The impact of liquidity on profitability is positive in large size, medium size, and small size banks, but the intensity is different to generate profit against liquid assets. Large banks generate an equal proportion profit from liquid assets, while medium banks generate 1% profit against 3% assets, and small banks generate 1% profit against 7% liquid assets. Theoretically, these results indicate that the large banks can utilize their liquid assets in a more diversified manner. Also, the medium size banks can utilize their liquid assets more effectively but not greater than larger ones. As for small banks, they have limited access to capital markets for their short-term funding, and they have to hold liquid assets as compared to larger and medium-size banks. These findings are consistent with the studies by Bourke (1989), (Eichengreen & Gibson, 2001), Tran et al. (2016), and Islam and Nishiyama (2016).

Table 6 shows the results of system dynamic panel data estimators under the condition of the Two-Step method of GMM. The impact of credit risk as measured by loans loss provision scaled by average risk loans of banks is negative on the profitability of commercial banks in Asian developed economies. The credit risk negatively and significantly impacts the profitability of large and medium commercial

Table 2. Matrix of correlations shows the list of variables used in this study. Data of Asian developed economies were collected for the period between 2011 and 2017. Bank profitability is considered a dependent variable (ROAA). Bank capital (equity to total assets), liquidity, credit risk, loans growth, bank efficiency, market funding, assets growth, size of the bank are used as control variables. The measurement and definitions of all variables are discussed

Variables	Profitability	Capital	Liquidity	C.Risk	L.Growth	Efficiency	Funding	A.Growth	Size
Profitability	1.000								
Capital	0.308	1.000							
Liquidity	0.291	0.526	1.000						
Credit Risk	0.020	0.051	0.074	1.000					
L. Growth	-0.041	-0.491	-0.690	0.008	1.000				
Efficiency	-0.593	0.091	-0.072	0.044	-0.140	1.000			
Funding	0.086	0.723	0.269	0.040	-0.348	0.134	1.000		
A. Growth	-0.078	-0.159	0.035	0.181	-0.016	0.046	-0.036	1.000	
Size	-0.196	-0.669	-0.369	0.004	0.156	-0.089	-0.397	0.106	1.000

Table 3. The impact of bank capital, bank liquidity and credit risk on profitability (ROAA) of banks: (Two-Step GMM Results)

Variables	Profitability	Profitability	Profitability
Lagged profitability	0.656*** (0.0233)	0.651*** (0.0233)	0.554*** (0.0300)
Bank Capital	0.0635*** (0.0148)		
Loans growth	-0.00481*** (0.00123)	-0.00706*** (0.00135)	-0.00933*** (0.00139)
Bank efficiency	0.0223** (0.0110)	0.0241** (0.0110)	0.0332*** (0.0110)
Market funding	-0.0577** (0.0262)	0.0325** (0.0147)	0.0369*** (0.0141)
Bank size	-0.00204*** (0.000241)	-0.00144*** (0.000216)	-0.00202*** (0.000253)
Bank liquidity		-0.00819** (0.00363)	
Credit risk			-0.187*** (0.0281)
Constant	0.0587*** (0.0140)	0.00888 (0.00737)	0.0187** (0.00752)
Observations	14,130	14,115	14,085
Number of ID	942	941	939

Standard errors in parentheses*** p < 0.01, ** p < 0.05, * p < 0.1

Table 4. Impact of bank capital on profitability of banks: (Two-Step GMM Results)

Variable	Over all banks	Large banks	Medium banks	Small-size banks
Lagged profitability	0.0378 (0.2570)	0.1570 (0.1472)	0.1707* (0.1022)	0.0728 (0.3780)
Bank capital	0.0603** (0.0242)	0.0495 (0.0340)	0.0328 (0.0424)	0.1499* (0.0903)
Loans growth	0.0061 (0.0134)	0.0109 (0.0087)	0.0265*** (0.0101)	-0.0272 (0.0373)
Bank efficiency	-0.0225** (0.0088)	-0.0132*** (0.0033)	-0.0156*** (0.0057)	-0.0589* (0.0303)
Market funding	-0.0000 (0.0001)	-0.0012 (0.0043)	-0.0104*** (0.0024)	0.0001 (0.0002)
Observations	812	200	425	186
Number of ID	174	46	86	42

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

banks, but the impact is insignificant for returns on average assets and returns on average earning assets in case of smaller banks. The impact of credit risk on profitability is negative in both the USA as well as Asian developed economies banks in the short run; other things remain unchanged. However, the influence of credit risk on profitability in Asia is lower than in the USA banking sector. These results show that Asian banks are more stringent to issue loans as compared to USA banks. The other

Table 5. Impact of liquidity on profitability of banks: (Two-Step GMM Results)

Variable	Overall banks	Large banks	Medium banks	Small-size banks
Lagged profitability-1	-0.0613 (0.2495)	0.2545* (0.1462)	0.0559 (0.0868)	-0.2742 (0.2808)
Bank liquidity	0.0359*** (0.0086)	0.0105* (0.0056)	0.0324*** (0.0092)	0.0734*** (0.0188)
Loans growth	0.0132 (0.0085)	0.0153 (0.0110)	0.0254*** (0.0054)	0.0245 (0.0190)
Bank efficiency	-0.0260*** (0.0082)	-0.0133 (0.0085)	-0.0205*** (0.0028)	-0.0564*** (0.0156)
Market funding	0.0001 (0.0002)	-0.0036 (0.0049)	-0.0063*** (0.0022)	0.0002 (0.0002)
Observations	812	200	425	186
Number of ID	174	46	86	42

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

Table 6. Influence of credit risk on profitability of banks: (Two-Step GMM Results)

Variable	Overall banks	Large banks	Medium banks	Smallsize banks
Lagged profitability	0.1848 (0.3347)	0.0856 (0.1640)	0.2176 (0.2177)	0.7582* (0.4344)
Credit risk	-1.1628* (0.6609)	-0.8522* (0.4773)	-0.7020* (0.3915)	-1.6668 (1.0985)
Loans growth	0.0285** (0.0117)	0.0198 (0.0189)	0.0372*** (0.0101)	0.0152 (0.0239)
Bank efficiency	-0.0142** (0.0069)	-0.0133 (0.0082)	-0.0206*** (0.0071)	-0.0232* (0.0128)
Market funding	-0.0001** (0.0002)	0.0016 (0.0080)	-0.0113*** (0.0036)	-0.0000 (0.0001)
Observations	812	200	425	186
Number of ID	174	46	86	42

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

justification for this difference can be the volume and efficiency of banks management in Asia and the USA.

The profitability of small size banks is not much influenced by credit risk in developed economies of Asia in postcrisis period. These findings are consistent with the following studiesTarus et al. (2012), Angbazo (1997), Demirgüç-Kunt and Huizinga (1999) and Mendes and Abreu (2003).

4.1. Robustness

The robustness is tested in two ways, and similar results are found. The first is taken by replacing the econometric method to produce the coefficients. The second is tested through different proxies of profitability such as return on average equity and return on average earning assets. In both cases, coefficients are found similar. Appendix Tables A1–A5 contain the results of the impact of bank capital, bank liquidity and credit risk on profitability when using return on average equity and returns on average earning assets. Table A6 contains the findings of the simultaneous equations model when

two-stage least squares and structural parameters are calculated. Here, the panel data is used to explore the structural parameters of bank capital and bank profitability under certain assumptions for Asian developed economies of Asia for the postcrisis period between 2011 and 2017. The findings are robust with the results of GMM two-step estimators that provide additional insights of causality between bank capital and bank profitability. The impact of bank capital is positive on the profitability of large as well as medium banks in the postcrisis period. The profitability also affects bank capital positively in large banks and negatively in medium size banks. The credit risk negatively influences, the profitability of large banks as well as medium banks, and the results are consistent with GMM two-step estimators. The findings of the simultaneous equations model are consistent with the findings of GMM two-step estimators in case of the impact of bank capital and credit risk on the profitability of commercial banks in the postcrisis period.

5. Conclusions

The purpose of this study is to explore the influence and intensity of bank capital, bank liquidity level and credit risk on the profitability of commercial banks in the postcrisis period between 2011 and 2017 in Asian developed economies. The data were collected from the world renowned and most reliable database of Bankscope to minimize the bias of sources. Primarily, system dynamic panel data estimators under the condition of Two-Step method of GMM is used. Secondly, the simultaneous equations model under the setting of two-stage least squares is used for robustness purpose. Notably, these results are without the intervention of monetary factors and economic conditions, which are held constant. The results show that the impact of bank capital and credit risk is similar in developed economies of Asia and in large commercial banks of the USA in the postcrisis period in the short run, as other things held constant. However, the impact of credit risk on profit is greater in the USA than in the commercial banks in Asian developed economies. The reason for the difference in credit risk is that Asian banks use a tight credit policy and manage loans more efficiently as compared to US banks. There may be a difference of results in the USA and Asian banks due to the volume of loans and the poor management of monitoring and screening of borrowers. The use of liquidity in Asian developed economies is different from the USA. The impact of liquidity in Asian banks is positive whereas the impact of liquidity on profitability is negative in the case of USA commercial banks in the postcrisis period. The negative relationship indicates that holding of liquidity reduces profit in the USA whereas the availability of liquidity leads to an increase in profit in Asian developed economies commercial banks. According to Robust standard errors, a 6% rise in capital increases only 1% of bank profitability from the base point of 100. Whereas the other factors remain unchanged. According to Robust standard errors, a 3.5% rise in liquid assets increases only 1% of bank profitability from the base point of 100, whereas the other factors remain unchanged. These findings are based on a similar denominator of dependent and independent variables, named an average of total assets. The impact of liquidity on profitability is positive in large size, medium size, and small size banks, but the intensity is different to generate profit against liquid assets. Large banks generate profit in equal proportion from liquid assets. Medium banks generate 1% profit against 3% liquid assets, and small banks generate 1% profit against 7% liquid assets. In response to research questions, liquidity influences profitability more intensive than capital. Whereas the sign of coefficients is similar for large, small and medium-size banks. These results hold a theoretical rationale as large banks can utilize their liquid assets in more diversified manners, while the medium size banks can utilize their liquid assets more effectively but not greater than large ones. Small banks have limited access to capital markets for their short-term funding, and they have to hold a higher amount of liquid assets as compared to large and medium-size banks.

The impact of credit risk as measured by loans loss provisions scaled by bank average risk loans is negative on the profitability of commercial banks in Asian developed economies. The credit risk negatively and significantly impacts the profitability of large size commercial banks and medium banks, but the impact is insignificant for return on average assets and returns on average earning assets in smaller banks. The findings are consistent with the results of GMM two-step estimators, and they also provide additional insights of causality between bank capital and bank profitability.

The impact of bank capital is positive on the profitability of large as well as medium banks in the postcrisis period. The profitability also affects bank capital in large banks positively whereas negatively in medium size banks. Theoretically, large banks profitability becomes part of capital in the form of retained earnings. It means that large banks avoid distributing their profit as dividends to shareholders, which increases the proportion of capital against risky assets. On the other hand, medium size banks distribute their retained earnings in greater proportion to shareholders in the form of dividends, which reduces the capital against risky assets. The credit risk negatively influences the profitability of large banks as well as medium banks, and the results are consistent with GMM two-step estimators. The findings of simultaneous equations model are consistent and robust with the findings of GMM two-step estimators regarding the impact of bank capital and credit risk on the profitability of commercial banks in the postcrisis period.

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Appendix A

Table A1. Impact of bank capital on profitability (ROAE) of banks: (Two-Step GMM Results)

Variable	Over all banks	Large banks	Medium banks	Small-size banks
Lagged profitability	0.2143 (0.2102)	0.6518*** (0.2217)	0.2182 (0.1456)	-0.2272 (0.1929)
Bank capital	0.3466** (0.1395)	0.3950 (0.4902)	0.1260 (0.2932)	0.1520 (0.1733)
Loans growth	0.1737*** (0.0652)	0.1035** (0.0426)	0.1615* (0.0850)	0.2018*** (0.0562)
Bank efficiency	-0.1307** (0.0586)	-0.1010** (0.0500)	-0.0906 (0.0788)	-0.1012 (0.0671)
Market funding	-0.0002*** (0.0001)	0.0322 (0.0515)	-0.0105 (0.0068)	-0.0010** (0.0004)
Observations	812	200	425	186
Number of ID	174	46	86	42

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

Table A2. Impact of bank capital on profitability (ROAEA) of banks: (Two-Step GMM Results)

Variable	Over all banks	Large banks	Medium banks	Small-size banks
Lagged profitability	0.3083** (0.1442)	0.8581*** (0.2179)	0.7498*** (0.1791)	-0.2678** (0.1208)
Bank capital	0.1309** (0.0544)	0.0809 (0.0651)	0.0237 (0.0664)	0.0781 (0.0574)
Loans growth	0.0239*** (0.0086)	0.0119 (0.0127)	0.0212 (0.0137)	0.0185 (0.0151)
Bank efficiency	-0.0140* (0.0073)	-0.0054 (0.0140)	-0.0105 (0.0085)	0.0048 (0.0125)
Market funding	-0.0000* (0.0000)	-0.0244*** (0.0087)	-0.0335*** (0.0043)	-0.0002 (0.0005)
Observations	812	200	425	186
Number of ID	174	46	86	42

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

Table A3. Impact of bank liquidity on profitability (ROAE) of banks: (Two-Step GMM Results)

Variable	Over all banks	Large banks	Medium banks	Small-size banks
Lagged profitability	0.0584 (0.1018)	0.8830*** (0.2109)	0.2181* (0.1304)	-0.2098 (0.1876)
Bank liquidity	0.0927* (0.0552)	0.0088 (0.0819)	0.0457 (0.0823)	0.0674 (0.0551)
Loans growth	0.2270*** (0.0618)	0.1299*** (0.0485)	0.1866** (0.0774)	0.2094*** (0.0285)
Bank efficiency	-0.1402** (0.0603)	-0.0878 (0.0690)	-0.1128 (0.0783)	-0.1058*** (0.0299)
Market funding	-0.0002*** (0.0001)	0.0105 (0.0390)	-0.0065 (0.0103)	-0.0006 (0.0006)
Observations	812	200	425	186
Number of ID	174	46	86	42

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

Table A4. Impact of bank liquidity on profitability (ROAEA) of banks: (Two-Step GMM Results)

Variable	Over all banks	Large banks	Medium banks	Small-size banks
Lagged profitability	0.2300 (0.1417)	0.8869*** (0.2108)	0.6457*** (0.2134)	-0.1892* (0.1117)
Bank liquidity	0.0688*** (0.0109)	0.0273*** (0.0074)	0.0543*** (0.0167)	0.0641*** (0.0181)
Loans growth	0.0233*** (0.0077)	0.0196 (0.0123)	0.0147 (0.0112)	0.0323*** (0.0100)
Bank efficiency	-0.0059 (0.0061)	-0.0110 (0.0110)	-0.0080 (0.0077)	-0.0061 (0.0106)
Market funding	-0.0000 (0.0000)	-0.0281*** (0.0066)	-0.0291*** (0.0078)	-0.0000 (0.0001)
Observations	812	200	425	186
Number of ID	174	46	86	42

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

Table A5. Impact of credit risk on profitability (ROAE) of banks: (Two-Step GMM Results)

Variable	Over all banks	Large banks	Medium banks	Smallsize banks
Lagged profitability	0.0821 (0.1060)	0.6679*** (0.1709)	0.1989* (0.1116)	0.0294 (0.0853)
Credit risk	-11.7354*** (2.5402)	-10.4869** (4.1112)	-10.6063*** (2.4066)	-11.7317** (4.6444)
Loans growth	0.2394*** (0.0808)	0.1988*** (0.0676)	0.2158** (0.0848)	0.2595*** (0.0514)
Bank efficiency	-0.1220* (0.0673)	-0.1083** (0.0506)	-0.1218 (0.0830)	-0.1347*** (0.0432)
Market funding	-0.0002*** (0.0001)	0.0116 (0.0435)	-0.0067 (0.0052)	0.0001 (0.0008)
Observations	812	200	425	186
Number of ID	174	46	86	42

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

Table A6. Impact of credit risk on profitability (ROAEA) of banks: (Two-Step GMM Results)

Variable	Over all banks	Large banks	Medium banks	Small-size banks
Lagged profitability	0.1888 (0.1402)	0.7759*** (0.1731)	0.7297*** (0.1509)	-0.2845*** (0.0622)
Credit risk	0.5723 (0.8153)	0.8365 (1.2532)	-0.1484 (0.5477)	0.0481 (0.4369)
Loans growth	0.0578*** (0.0112)	0.0312*** (0.0115)	0.0291* (0.0150)	0.0237* (0.0137)
Bank efficiency	-0.0309*** (0.0075)	-0.0162 (0.0103)	-0.0152 (0.0114)	0.0070 (0.0096)
Market funding	0.0000 (0.0000)	-0.0205*** (0.0072)	-0.0336*** (0.0062)	-0.0001 (0.0014)
Observations	812	200	425	186
Number of ID	174	46	86	42

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

Table A7. Impact of bank capital on profitability (ROAA) of banks: Simultaneous equations model (2SLS Method)

Variable	Large banks profitability	Large banks bank capital	Medium banks profitability	Medium banks bank capital
Bank capital	0.3508*** (0.0284)		0.2004*** (0.0275)	
Assets growth	0.0002 (0.0021)		0.0107*** (0.0039)	
Market funding	0.0035 (0.0023)		-0.0052** (0.0023)	
Credit risk	-0.0004 (0.0011)	0.0016 (0.0039)	-0.0059 (0.0058)	-0.0627** (0.0281)
Size of bank	0.0012*** (0.0003)	-0.0032*** (0.0012)	0.0018 (0.0015)	-0.0273** (0.0121)
Bank profitability		4.5929 (1.3890)		-3.4908
Bank liquidity		0.0046 (0.0211)		(3.4324)
Bank efficiency		0.0498 (0.0425)		-0.1700*** (0.0622)
Constant	-0.0426*** (0.0070)	0.0757 (0.0474)	-0.0434 (0.0281)	0.6823*** (0.2541)
Observations	812	200	425	186
R-squared	0.5382	0.5291	0.2854	0.3160

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1



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