Impact of Liquidity and Risk on Bank Capital: Empirical Analysis of Commercial Banks

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Abstract

The purpose of this study is to explore the influence of bank liquidity and bank risk on bank capital among emerging economies of Asia in post crisis conditions. The data is collected for 379 banks from Bank scope database. The data for this paper includes post crisis period ranging from 2011 to 2016. Linear regression panel-corrected standard errors approach is used to find consistent estimators. The results confirm that liquidity is negatively influencing bank capital in medium size banks while small banks are positively impacted by liquidity. The overall risk has positive effect on bank capital in all banks which is consistent with regulatory hypothesis. The findings also prove that market funding, banks size and real gross domestic product have negative effect on bank capital.

Keyword: Bank Capital, Bank liquidity, Market Funding, GDP, Bank Size and Z-score

Introduction

The prime focus of this study is to explore the post crisis influence of bank liquidity and bank risk on bank capital among emerging economies of Asia. There are several questions to be asked with respect to bank capital, bank liquidity and bank risk. Does the bank liquidity influence the bank capital in current situation? Is this relationship similar for all banks? Does the risk of bank influence the bank capital if yes then which risk is more important? Does the economic situations influence the bank capital if yes then which economic factors are more critical to consider in managing the bank capital, liquidity and risk? In reaction to the last financial crisis, the Basel Committee recommends new regulations for banks regarding liquidity level and bank capital in Basel Accord III. The Basel III suggests new regulations to protect the banks from different types of risks like liquidity shortage risk, credit risk, operations risk and interest rate risk. The new standards require higher capital buffers and greater level of liquid assets as compared to Basel II. Due to these changes, bank capital and liquidity requirements have become a major concern to test the relationship among bank capital, liquidity and risk of banks. The level of bank capital is directly linked with bank liquidity and bank risk. Despite this fact, empirical evidence on this concept is rare especially in emerging economies of Asia in post crisis era.Barth, Caprio, and Levine (2008)argue that the behavior of Asian countries isnot similar regarding bank capital

requirements. According to their findings, some countries increased their bank capital requirements while others relaxed. The previous studies which are conducted to explore the relationship between bank risk and bank capital provide mixed findings. Some studies found positive relation between risk and capital which is consistent with "regulatory hypothesis" (Shrieves & Dahl, 1992), (Iannotta, Nocera, & Sironi, 2007) and (Demirgüç-Kunt & Huizinga, 2000). In contrast, some researchers found negative relationship between risk and bank capital which refers to "moral hazard hypothesis" where banks normally take more risk due to deposit insurance as concluded by(Asli Demirgüç-Kunt & Kane, 2002),(Brewer & Lee, 1986)(Agusman, Monroe, Gasbarro, & Zumwalt, 2008) They also conclude in their researches that risk and bank capital both lead to influence the profitability of banks.

Theoretically, there are many studies conducted to incorporate the meaningful analysis of bank capital, liquidity and risk but some of the problems are not dispensed with appropriate manners. This research may fill the gap in literature. Firstly, this study will incorporate external factors and internal factors simultaneously whereas the previous studies particularly focus determinants of bank capital, liquidity and risk considering specific factors of firms at industry level ignoring external factors. Secondly, it is found in literature that econometric techniques used by researchers do not incorporate appropriate features of concerned questions making estimates inconsistent and biased. Thirdly, this study helps to reconsider the formulation of regulations with to overcome the issues in current situation of banking system in Asian region in specific. Fourthly, the overall findings of this study would be helpful for the decision makers, analysts, policy makers and other stakeholders like governments and investors. Fifthly, this would be the first study in Asian region to point out the factors which become major concerns in further developments after the effect of Basel Accord III regulations regarding bank liquidity, risk and bank capital. Sixthly, this study will provide results which confirm the effect of currently implemented regulations recommended by Basel Accord III in Asian region. To the best of my information, there is no study to address the above said questions especially in emerging economics of Asian region after the financial crisis of 2007 and 2008. The plenty of studies are conducted in developed countries like US and European countries where very less attention is given to the emerging economies of Asia which is major and rapidly growing part of the whole financial system of the globe. The Second section of this study presents review of relevant literature. The third section contains the data collection sources and econometric model. The fourth section is about the empirical findings.

The fifth part of this paper consists of conclusions and recommendations.

Literature Review

Raz (2018) explored evidence regarding bank capital and bank risk using Indonesian banking sample and concluded negative relationship. Haneef, Archer, and Karim (2018)argued in their recently published paper that losses covered from earnings of banks which included in tier-1 capital. The influence of loan loss provisions are also absorbed by earnings which become cause of decrease in tier-1 capital. Hugonnier and Morellec (2017) described in their paper that bank leverage and liquidity as recommended by Basel-III reduced probability of default. Chiaramonte and Casu (2017) conducted study regarding bank liquidity holding and bank capital as suggested by regulatory authorities and they favor regulations recommended in Basel III. According to their findings, capital ratio found important proxy to manage in case of large banks and their model also favored holding of higher liquid assets to avoid failure. DeYoung and Jang (2016)found empirical evidences in their study regarding loan to deposit rate and net stable fund ratio and also found these ratios influential for all categories of banks. They also found that with increase in bank size, level of liquidity decreases. Diamond and Kashyap (2016)argued that liquidity standards as suggested by regulators in Basel-III influenced incentives of banks. These regulations definitely decreased probability of run but on the other hand higher liquidity cost more to banks. In corporations, capital and liquidity always remained basic instruments to evaluate strengths and soundness. In USA the analysts and rating agencies applied different techniques to judge soundness of organizations like CAMELS methodology approach. Distinguin, Roulet, and Tarazi (2013) conducted a study to find relationship between bank liquidity and regulatory capital and they concluded that banks normally decrease their regulatory capital at the time when they create liquidity and also at the time when banks face lower liquidity funding risk. Beltratti and Stulz (2012) conducted study and concluded results that banks decreased their capital in liquidity creations conditions and at the time of lower liquidity funding requirements. Carmona (2007) explored that illiquidity affected smaller U.S.A banks and suggested them to maintain higher liquidity to reduce their default risk. The following studies presented findings in most recent years and concluded that aggressive lending, more reliance on short term funding, low quality assets, low capitalizations and low profitability are connected with risk, Altunbas, Manganelli, and Marques-Ibanez (2017)and Cole and White (2012). Altunbas et al. (2017) argued that banks capital encourages banks to take risk in

both cases at lower level and higher level as well in nonlinear. The above debate, encourage regulators to motivate the riskier banks to create capital buffers. Delis and Staikouras (2011) found direct relationship between bank capital and risk taking behavior. Following are the earliest studies conducted by renowned scholars in similar domain Cole and Gunther (1995); Wheelock and Wilson (2000), and DeYoung (2003). Pettway (1976) conducted a study to find out the relationship between capital structure and bank risk in U.S.A to cover the period of four years, where they found direct relationship between risk and equity ratio. The similar finding provided by Shrieves and Dahl (1992) in similar sample means U.S.A. (Rime, 2001)and Iannotta et al. (2007) also found positive relationship between bank capital ratio and risk in European banking sample. These findings are favoring the regulatory hypothesis means banks increase their capital as response to their risk. On the other hand, some studies like Daesik Kim and Santomero (1988) Jahankhani and Lynge (1979), (Agusman et al., 2008; Jacques & Nigro, 1997)conducted study in U.S.A banking industry and found negative relationship between bank capital and bank risk which is consistent with "Moral Hazard Hypothesis" in such case banks normally take the advantage of deposits insurance. Shim (2013) explored that capital buffers decrease the chances of default due to this banks hold greater capital buffers in order to manage more risky portfolio. This suggestion depicted that banks having higher level of capital buffer have risk assets in its balance sheets. Jeitschko and Jeung (2005) find the relationship between bank capital and bank risk which can be positive or negative as suggested in moral hazard hypothesis and regulatory hypothesis respectively. There is agency problem in such relationship like shareholder of well capitalized banks would like to invest in less risky assets due to their interest where the managers prefer to invest in more risky portfolio due to their interest where Repullo (2004) found the similar results in his study. The above detail examination of previous studies relating to developed economies (USA & EP) motivates to explore the empirical findings after post crisis in emerging economies especially in Asian region. This study contributes in existing literature regarding bank capital, liquidity and risk in Asia.

Data and Methodology

In this study the population is eight emerging economies of Asia which include Pakistan, India, Korea, China, Thailand, Malaysia, Philippines, and Indonesia. There were more than 400 banks in the list of bank scope database. The data were collected for six year ranging from 2011 to 2016 and banks which have missing data are excluded from sample. The Sample data comprised 379 banks which were found fit for analysis. The banks were divided into three categories of small, medium and large banks as per their volume of assets. The data for economic variables were collected from the World Bank website and Central Banks of respective economy for the period of six years from 2011 to 2016.The banks were divided into different categories due to following reasons. Primary reason is heterogeneity in banks data which may lead to inappropriate findings. Secondly, literature explores the difference in activities of banks according to their size as reported byKashyap and Stein (2000) also reported byCornett, McNutt, Strahan, and Tehranian (2011) and also byBerger and Bouwman (2013).

Econometric Model

In this study, alternative model was used to manage autocorrelation, heteroscedasticity and contemporaneously correlation among panels. In this model, we developed linear regression panel corrected standard errors instead of feasible generalized least squares. The objective was to test the influence of bank liquidity, and bank risk on bank capital after the crisis time period. The desired equation is arranged as below:

$$\text{BC}_{i,t} = \beta_1 \text{Liq}_{i,t} + \beta_2 \text{Risk}_{i,t} + \beta_3 \text{FSV}_{i,t} + \beta_4 \text{MSV}_{i,t} + \varepsilon$$

Here "t" is defined to be as the bank time period till the day we have got data of the bank. (β_1, β_2, β_3, β_4,) are the structural parameters of the equation, "i" defined the bank where, "ε" is the symbolic of error term. Every coefficient in reaction to a variation in the variable attains the short-term influence on bank capital in the model of econometric. There are several problems in panel data which should be addressed properly otherwise the estimators should be biased. The problem includes heteroscedasticity, autocorrelation and cross-dependence. In order to deal with these issues, we used panel corrected standard errors approach to test the above equation. The results were found by using simple panel data ordinary least squares methods, robust standard errors options and panel corrected standard errors to confirm that findings were appropriate.

Dependent Variables

Bank Capital Ratio (BC) was used as dependent variable in above model and the researchers measured ratio of total equity of bank in present to total assets. Bank capital coefficient is expected positive because of the higher equity. Due to this higher equity, loss absorption capacity of banks will be higher as argued by following researchers: Bernanke, Lown, and Friedman (1991), Gambacorta and Mistrulli (2004); Francis and Osborne (2012); and Kapan and Minoiu (2013).

Explanatory Variables

As included in above model, liquidity and risk were prime concerns of this study where the term "FSV" represented other firm specific variables which included market funding, market share and size of firm. The variable liquidity is measured as liquid assets to total assets. The second variable of major concern in above model is (Risk) taken as overall risk factor of banks by calculating Z-Score. The term "MSV" is used to test the influence of economic variables in this study which include growth of real gross domestic product and interest rate. Risk in this study is calculated the sum of equity and return on assets and divided by the standard deviation of return on assets as used by Boyd and Graham (1988); Laeven and Levine (2009); and Barry, Lepetit, and Tarazi (2011).Bank size is another explanatory variable which is used as control proxy in this study taken as natural logarithm of banks total assets. The Bank size influence is not definite. According to theory, larger banks grant higher credits due to bailout expectations from Government. Market funding is also used in this paper as a variable and measured as ratio of total liabilities less total deposits to total assets of bank. The sign for it may vary according to bank size like positive in case of larger banks while negative for smaller banks

Variable Measurement

Variables Name	Symbol	Measurement	Sources
Bank Capital	BC	Bank Equity/Total Assets	Bankscope
Bank Liquidity	LATAR	Liquid Asset/Total Assets	Bankscope
Interest Rate	INR	*Year*-on year change in interest rate	WDI
Bank Size	BS	Log of Total Assets	Bankscope
Gross Domestic Product	GDP	GDP growth rate	WDI
Market Funding	MF	*T.* Liabilities-*Total Deposits/Total Assets*	Bankscope
Bank Risk	Z-Score	Equity PlusReturn on Assets/σ of ROA	Bankscope

Results and Discussion

Table#1Panel Data Regression Results Overall banks

Description: Bank capital as measure bank equity to total assets, Bank Liquidity calculated as liquid assets to total assets. Interest rate is defined as yearly change in interest rate, bank size is measured as log to total assets. Where market funding measured as total liabilities less total deposits divided by total assets, Bank risk is measured as Z-score calculated as equity ratio plus return on assets divided by the variance of return on assets. In this model, we developed linear regression panel corrected standard errors instead of feasible generalized least squares

VARIABLES	Bank Capital (OLS)	Bank Capital (ROBUST S.E)	Bank Capital (PCSE)
Bank Liquidity	0.0523***	0.0523**	0.0523***
	(0.0100)	(0.0258)	(0.0161)
Bank Risk	0.0208***	0.0208***	0.0208***
	(0.0009)	(0.0055)	(0.0034)
Market Funding	-0.0000***	-0.0000***	-0.0000***
	(0.0000)	(0.0000)	(0.0000)
Bank Size	-0.0197***	-0.0197***	-0.0197***

	(0.0009)	(0.0018)	(0.0013)
Interest Rate	0.0029***	0.0029***	0.0029***
	(0.0006)	(0.0007)	(0.0008)
Real Gross Domestic Product	-0.0027**	-0.0027*	-0.0027**
	(0.0014)	(0.0016)	(0.0011)
Constant	0.4600***	0.4600***	0.4600***
	(0.0332)	(0.0348)	(0.0275)
Observations	2,298	2,298	2,298
R-squared	0.4060	0.4060	0.4060
Number of ID	383	383	383

It contains results for overall banks. The model is developed to examine the evidence regarding bank liquidity, bank risk and bank capital in emerging economies of Asia. The results indicate that liquidity has negative relationship with bank capital in emerging economies of Asia. This means as liquidity increases from the required level of bank, capital decreases. Banks normally adjust their capital by adjusting bank loans with liquidity. Due to this reason, bank capital buffer increases. Higher bank capital buffer provides support to absorb higher level of losses occurred due to economic shocks. These findings were given by researchers in last financial crisis. The variable Z-Score is used for banks risk which has positive relationship with bank capital in overall data. These findings are consistent with regulatory hypothesis. The firm specific control variables also depicted their relevance and importance in this study. The variable market funding

and bank size have negative relationship with bank capital. The economic variable gross domestic product has negative and statistically significant relationship with bank capital while rate of interest has positive relationship with bank capital.

Table#2 Panel Data Regression Results Large Banks

Description: Bank capital as measure bank equity to total assets, Bank Liquidity calculated as liquid assets to total assets. Interest rate is define as yearly change in interest rate, bank size is measured as log to total assets. Where market funding measured as total liabilities less total deposits divided by total assets, Bank risk is measured as Z-score calculated as equity ratio plus return on assets divided by the variance of return on assets. In this model, we developed linear regression panel corrected standard errors instead of feasible generalized least squares

VARIABLES	*Bank Capital* (OLS)	*Bank Capital* (ROBUST S.E)	*Bank Capital* (PCSE)
Bank Liquidity	-0.0002	-0.0002	-0.0002
	(0.0201)	(0.0201)	(0.0263)
Bank Risk	0.0566***	0.0566***	0.0566***
	(0.0061)	(0.0061)	(0.0092)
Market Funding	-0.0000	-0.0000	-0.0000

	Bank Capital (OLS)	Bank Capital (ROBUST S.E)	Bank Capital (PCSE)
	(0.0000)	(0.0000)	(0.0000)
Bank Size	-0.0182***	-0.0182***	-0.0182***
	(0.0019)	(0.0019)	(0.0011)
Interest Rate	0.0043**	0.0043**	0.0043***
	(0.0019)	(0.0019)	(0.0016)
Real Gross Domestic Product	-0.0085**	-0.0085**	-0.0085**
	(0.0042)	(0.0042)	(0.0038)
Constant	0.5853***	0.5853***	0.5853***
	(0.0974)	(0.0974)	(0.0925)
Observations	605	605	605
R-squared	0.3456	0.3456	0.3456
Number of ID	101	101	101

It contains the results for large size banks. The similar model is applied to test the influence of banks liquidity and banks risk on bank capital in larger size banks. The findings depict that management of liquidity as measured by liquid assets divided by total assets is irrelevant to bank capital. The findings show positive relationship between bank risk and bank capital. The findings also depict that bank size has negative relationship with bank capital. The firm specific variable market funding is not significant while bank size has negative and statistically significant influence on bank capital. The economic variables gross domestic product is negatively influencing bank capital in emerging economies of Asia. The variable interest is positive and has statistically significant connection with bank capital.

Table#3 Panel Data Regression Results Medium banks

Description: Bank capital as measure bank equity to total assets, Bank Liquidity calculated as liquid assets to total assets. Interest rate is define as yearly change in interest rate, bank size is measured as log to total assets. Where market funding measured as total liabilities less total deposits divided by total assets, Bank risk is measured as Z-score calculated as equity ratio plus return on assets divided by the variance of return on assets. In this model, we developed linear regression panel corrected standard errors instead of feasible generalized least squares.

VARIABLES	Bank Capital (OLS)	Bank Capital (ROBUST S.E)	Bank Capital (PCSE)
Bank Liquidity	-0.0464***	-0.0464***	-0.0464***
	(0.0085)	(0.0089)	(0.0113)
Bank Risk	0.0121***	0.0121***	0.0121***
	(0.0014)	(0.0028)	(0.0019)
Market Funding	-0.0000***	-0.0000***	-0.0000***

	(0.0000)	(0.0000)	(0.0000)
Bank Size	-0.0126***	-0.0126***	-0.0126***
	(0.0010)	(0.0027)	(0.0017)
Interest Rate	0.0018***	0.0018***	0.0018***
	(0.0004)	(0.0005)	(0.0006)
Real Gross Domestic Product	-0.0060***	-0.0060***	-0.0060***
	(0.0007)	(0.0007)	(0.0008)
Constant	0.4677***	0.4677***	0.4677***
	(0.0246)	(0.0489)	(0.0355)
Observations	1,086	1,086	1,086
R-squared	0.3636	0.3636	0.3636
Number of ID	181	181	181

It contains the results of medium size banks. The findings provide that liquidity has negative relationship with bank capital in medium size banks. Theoretically as banks increases loans, the risk weighted assets also increase and proportion of required capital also increases. The findings explore that medium banks are more sensitive with respect to their liquidity level and capital ratio. These banks use other sources to adjust their capital by reducing cost and increasing their profitability and reserves. The worth noting thing is that medium banks are aggressive in use of their liquidity on the cost of retained earnings. When banks are involved in liquidity creation, which is a basic function of banks. It leads to decrease in capital level due to increase in risk weighted assets. The findings confirm when liquidity decreases, the bank required capital increases. The variable risk Z-score has positive relationship with bank capital which means as banks increase their risky assets, they also increase their capital. These findings are consistent with regulatory hypothesis. The results of firm specific control variables also depict their relevance and importance. The variables market funding and bank size have negative relationship with bank capital. The economic variables gross domestic product and interest rate have negative influence on capital and also statistically significant influence on bank capital in medium banks.

Table#4Panel Data Regression Results Small banks

Description: Bank capital as measure bank equity to total assets, Bank Liquidity calculated as liquid assets to total assets. Interest rate is define as yearly change in interest rate, bank size is measured as log to total assets. Where market funding measured as total liabilities less total deposits divided by total assets, Bank risk is measured as Z-score calculated as equity ratio plus return on assets divided by the variance of return on assets. In this model, we developed linear regression panel corrected standard errors instead of feasible generalized least squares

VARIABLES	Bank Capital (OLS)	Bank Capital (ROBUST S.E)	Bank Capital (PCSE)
Bank Liquidity	0.2301***	0.2301***	0.2301***
	(0.0260)	(0.0662)	(0.0549)
Bank Risk	0.0175***	0.0175***	0.0175***
	(0.0016)	(0.0050)	(0.0035)
Market Funding	-0.0000***	-0.0000***	-0.0000***
	(0.0000)	(0.0000)	(0.0000)
Bank Size	-0.0283***	-0.0283***	-0.0283***
	(0.0034)	(0.0052)	(0.0027)
Interest Rate	-0.0006	-0.0006	-0.0006
	(0.0014)	(0.0015)	(0.0031)
Real Gross Domestic Product	0.0029	0.0029	0.0029
	(0.0045)	(0.0063)	(0.0045)
Constant	0.4053***	0.4053***	0.4053***
	(0.1204)	(0.1423)	(0.1064)
Observations	600	600	600
R-squared	0.4870	0.4870	0.4870
Number of ID	100	100	100

It contains results of small size banks. Results depict that liquidity has positive relationship with bank capital while this relationship is negative in case of medium size banks and large size banks. These findings provide new insights to managers regarding banks liquidity and banks capital adjustment according to size. The findings indicate the importance of bank liquidity in small size banks, large size banks and medium size banks in emerging economies of Asian region. These findings provide information to compare the two extremes for appropriate regulations. The overall risk variable Z-Score has positive relationship with bank capital and these findings are consistent with "regulatory hypothesis". The firm specific control variables, bank size and market funding have negative impact on bank capital. In addition, macroeconomic variables including gross domestic product and interest have no influence on bank capital in case of small banks.

Conclusion

The main objective of this study is to explore the impact of bank liquidity and bank risk on bank capital in commercial banks of emerging economies of Asia after financial crisis 2007-2008. The study provides new insights about bank capital in emerging economies of Asia after the development of Base-III. The results confirm the negative relationship between bank liquidity and bank capital in medium size banks and large size banks while bank liquidity and bank capital of small size bank have positive relationship. These results indicate that banks behavior is not similar toward the relationship of bank capital and bank

liquidity in emerging economies of Asia. The findings of this study suggest that there must be different regulations for different categories of banks. The policy makers should consider the needs and constraints of all types of banks in order to develop new regulations. The findings explain that larger banks have no need to manage their liquidity to adjust capital. The medium size banks liquidity has negative impact on bank capital which suggests that medium size banks remain at equilibrium level of their capital and medium size banks use liquidity as a tool to adjust their capital. This means that banks convert their loans into liquid assets to manage their required capital. With the increase in liquidity due to decrease in banks loans causes to reduce banks risk weighted assets that leads to increase in banks capital buffer. The liquidity of small banks has positive influence on bank capital. The findings show the banks risk has positive relationship with bank capital in all banks categories including large size banks, medium size banks and small size banks. These finding are consistent with regulatory hypothesis. The regulatory hypothesis suggests that banks should increase their capital as their risk increases. The interest rate has positive relationship with bank capital while market funding and real gross domestic product have negative relationship with bank capital. These findings are particularly generalizable for post crisis period data ranging from 2011 to 2016.

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