Capital Buffers and Bank Risk: Empirical Study of Adjustment of Pakistani Banks

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ABSTRACT

Regulatory authorities impose regulations on banks to maintain a threshold of capital to asset ratio above the required minimum level defined by capital adequacy regulation. This research has found important relevancy of bank's capital buffer and bank risk to the soundness and stability of financial position in banking sector of Pakistan. Present study is gauged to assess the relationship of capital buffer and risk over the business cycle. Panel data of 24 commercial banks has been analyzed over the period of 2007-2012 by applying generalized methods of moments. The results imply that capital buffers behave pro-cyclically, whereas, bank risk moves counter-cyclically to the economic cycle. The result provides useful insights into effectiveness of regulatory capital minimum and implications of Basel II agreement on the banking industry. This study is valuable for Regulatory authorities in understanding the behavior of banking industry, hence improving the financial health of banking industry and overall economy.

Keywords: Basel II, Capital Buffers, Bank Risk, Regulation, Panel Data, Generalized Method of Moments, Pakistan
JEL Classifications: G2, G31

1. INTRODUCTION

The economic and financial downturn that hit most of the countries in 2008 has questioned the regulatory success of capital related regulations. This has raised considerable attention among researchers to find explanation of success of regulations to avoid such a crunch in future. In order to make such policies more effective and successful for avoiding this situation in future, one significant factor is examining capital buffers. Analyzing this with various other factors is likely to yield important results for improving effectiveness of such policies.

Banks are significant in an economy as financial intermediaries. They act as a medium between suppliers of finance and those who demand it. However, banks also act as businesses by themselves and thus engage in profit making activities. Banks engage in lending and borrowing activities and the spread between them acts as a profit for them. In order to regulate this activity of bank it is important to control the level of lending and borrowing that banks involve in (Rochet, 1992; Dewatripont and Tirole, 1994). Since

banks are an important part smooth working of any economy, it is important to keep them working and operating in a sound manner. It is also important for the overall sustainability of the economic system (Francis and Osborne, 2012). This is one of the reasons that researchers have paid lot of attention to the smooth working of banks in an economy. It is evident even from the fact that over the years the governments have increased their control over the banking system. This has even led to formation of International supervisory authority for bank supervision.

The international committee on Banking supervision is formed specifically for cooperation on banking supervisory matters. It aims to enhance understanding of key supervisory issues and improve the quality of banking supervision worldwide. This committee checks the general strength of the banking institutions in addition to their risk-management skills. In doing so the Basel committee has formed certain bank supervisory accords called Basel accords or agreements. These accords (Basel I, 1988; Basel II, 2004; Basel III, 2010) provide standards for financial regulation including capital adequacy for financial institutions such as banks. The main

function that bank capital regulation performs in safeguarding the financial soundness and stability of the economies around the world has amplified its significance as an element in prudential regulation (Repullo et al., 2010). The focus in establishment of these standards has been that sufficient capital is retained by the banking sectors everywhere and more importantly that the extra stock of capital kept by banks relate to relevant risks of banks (Merton, 1977; Sharpe, 1978). Bank capital is the term denoting the difference between assets and liabilities of a bank or in other words difference in money deposited with the bank and money borrowed. When a bank lends more than deposited with it, it refers to being negatively capitalized. Under such circumstances, a bank can be forced into bankruptcy (Drumond, 2009). Thus to avoid this and ensure sound working of its operations, the banks must maintain a positive capital.

The requirement of capital is a significant tool in avoiding losses and thus default risk in banks. Since most of the banks are formed of deposits made by creditors, there is a chance of creditors demanding their money back. If such a situation occurs, particularly in a short time, the capital held by the bank can be used to cater to this situation and thus pay the creditors. This activity is difficult to do with the assets of the bank only because they may not be liquid enough. Thus an extra amount of capital helps in keeping the bank solvent (Kashyap et al., 2008). This is the main reason Basel accord has set minimum capital limits for banks which have to be maintained by banks (Diamond and Rajan, 2000). Inability to comply with this requirement can lead to penalty. Moreover the extra capital acts as a positive signal to various stakeholders and market leading to credibility and smooth working of the bank and the system of banking (Jackson, 1999).

Amato and Furfine (2004) argue that the Basel agreement not only keeps the financial institutions working smoothly, but also increases the effectiveness of basic cyclicality of banking system. For example it leads to reduction in investment when there is a recession and increase during the boom, thus being related to economy. Therefore, it is of great importance to study the link between capital requirements and growth of the economy.

This study analyses the relationship between capital requirement known as buffers, risk and how they move along with the economic cycle. The key point that makes banking supervision and regulatory framework important is the amount of economic cost due to the failure of the system. This study is pioneer in analyzing the three variables of capital buffer risk and economic cycle together particularly in context of Pakistan. Most of the other studies focus on developed world. Such a study will also allow comparison with those studies done earlier. Moreover, it will point out any divergence issues from the Basel agreement.

The study will be helpful for regulatory authorities like central bank of Pakistan. It will be useful for it in evaluating the risk practices of Pakistani banks as well as in managing their capital and how much they vary from international regulations. Jokipii and Milne (2008) indicate in their study that managing extra capital in affecting cyclical feature of Basel agreement, especially Basel II, is very significant like managing Pillar 1 capital. Thus

it is important and relevant to study the link between creation of capital buffer and risk associated.

The current studies on cyclicality of Basil agreement, especially in current context need to be developed further in terms of application and variety. This research will provide new and current empirical analysis especially in terms of Pakistan, which is useful in applying Basil agreement and decreasing its cyclicality.

The study reviews the recent literature and extends it further by including evidence from Pakistan, which is a vital developing country with its own particular context. It is therefore of significance to examine how capital buffers move up and down with changes in cycle of economy for the context under study and demonstrate their risk taking features and study if such results are similar as in studies done in other parts of the world. The next section of the paper reviews the literature on capital buffer, risk and adjustments. The section following that elaborates the methodology used in this study, and explains various variables. The analysis and results are presented after that. The last section gives the conclusions and limitations of the study.

2. LITERATURE REVIEW

In studying the behavior of banks with respect to the regulations imposed on them, researchers have studied this in relation to the capital ratio, the capital buffer and the risk management employed by banking sectors around the world. For the behavior of capital buffers and risks, researchers have also tried to study the cyclicality of these variables with the economy respectively as well as combined. Milne (2004), Estrella (2004), Milne and Whalley (2001) and Berger et al. (1995) tried to examine the causes of capital buffer being held by banks. One of the explanations they provide is that the extra capital keeps them above the capital required by regulation and thus mitigates risk of penalty (Marcus, 1984). However this is not the only capital cushion they keep. Banks also keep their own minimum capital reserve. Jackson (1999) found that the excess capital is used by banks for signaling their efficiency and credit worthiness among credit rating agencies. These are also called market disciplines as they exist because of market conditions.

Researchers have also examined how cyclicality of business affects capital buffers. The results show that they are related counter cyclically (Ayuso et al., 2004; Lindquist, 2004; Jokipii and Milne, 2008). It has been seen in general and through research studies that capital situation of banks deteriorates during economic downturns. Studies by Stoltz and Wedow (2011), Bikker and Metzemakers (2004), Ayuso et al. (2004) reports that capital buffer and business move counter cyclically. One other study by Jokipii and Milne (2008) report that as credit risk moves in a different direction of economic cycle, the similar move in capital buffers is the proof that the banks are not futuristic for gathering capital when economy is in boom so that they are able to survive during downturns. Banks take a risky approach when economy is good and thus they do not gather capital buffer. This is called short sightedness of financial institutions by the researchers (Borio et al., 2001; Ayuso et al., 2004). This approach leads to worsening of recession because

during recession banks lend lesser, causing financial crisis in the market. Other studies that find the same result include Ayuso et al. (2004), Rime (2001), Lindquist (2004) and Estrella (2004).

Barrios and Blanco (2003) found that pressure of market forces is the main determinant of banks capital requirements, though regulatory constraint is not very important in Spanish Banks.

Swiss banks have been found to keep capital buffers stocks more than what is required by the regulatory authorities. This pattern has been due to specific business environment that Switzerland's rules provide to the investors and the ability of banks at accessing capital markets and also the high costs they may incur for raising new capital. Other set of research work focuses on the cyclicality of Basel II due to its sensitivity to credit risk and the resulting cyclicality of capital buffers as an enhancing effect on the overall cyclical pattern of the Basel II accord.

Zicchino (2005) show that the capital buffers can in fact moderate the recurrent cyclic effects of Basel II. Other related studies with similar results have been done by Rime (2001) and Ediz et al. (1998). However, the overall research on capital needed and effect of risk taking behavior is not conclusive. The results vary. Furlong and Keeley (1989), Jeitschko and Jeung (2005) and Keeley and Furlong (1990) find that need for capital is oppositely associated to the quantity of assets that are risky the bank has, thus the need for extra capital or buffer decrease the quantity of risky assets that banks keep and as a consequence raises the whole financial system's stability.

Risk and business cycle movement have also been variables of research interest in previous studies. In this regard (Allen and Saunders, 2003) found that when there is recession, the quality of credit decreases highly, making default risk of banks to go up. Curry et al. (2008) found the same. Thus credit risk moves countercyclical to economy. However this relationship depends on at which stage is the business cycle (Ayuso et al., 2004). Moreover as Kashyap and Stein (2004) find the prudential regulations of bank can also increase the cyclicality of lending behavior of banks. The capital adequacy requirements proposed by the Basel II accord aim to make the ratio more sensitive to the changes in the riskiness of the assets making up the capital adequacy ratio. But this requirement of capital that is more sensitive to the risk of assets consequently makes it more sensitive to the movement of economic cycle and adds to the cyclicality of the prudential regulations. Heuvel (2002; 2008); Chami and Cosimano (2001), Repullo and Suarez (2004), Markovic (2006) among others found that the association of bank capital with the amount that they lend increases the volatility in the economy at a macro level, due to which banks lending activity increases when economy is doing well and decreases when it is not.

During the economic downturns, the capital buffers that banks hold are normally lower than those needed due to regulation. To handle this sort of situation, banks tend to lend less. However, this is just one of the ways to handle such an issue. Other ways include reducing dividends or to raise the level of retained earnings and thus capital required by regulation. New capital can also be raised by floating shares. However, in reality, banks lend less as the most practiced option. In a study of German banks, Stolz and Wedow (2011) analyzed bank's extra capital and the cycle of economy. The results of their research show that for the banks with low capital, the reduction in risk is not in risk witnessed in comparison to the ones with higher capital. It proposes that banks capital buffers change in opposite direction to economic movement. A possible cause of this can be the risk management patterns of banks having small level of capitalization which are effective in estimating the risks they are exposed to.

Jokipii and Milne (2010) studied US banks in their research and found that there is a positive link between capital buffers and risk adjustment. Fonseca and Gonzalez (2010) examined dataset of 70 countries and found that greater the market power the banks have and the greater the costs of deposits they go through, they will have higher levels of capital buffer. They further found that this association is influenced by the regulatory environment of the country. Drumond (2009) examined the studies discussing the effect of the Basel capital accords and found that the banking market regulation affects economic cycle greatly. He further found that that Basel II enhances the existing cyclical movements of the capital required. So far, in context of Pakistan, there is no previous work considering capital buffer and risk of financial institutions such as banks together and analyzing their association with the economic cycle. In this context only a few studies have considered Basel capital adequacy ratio. One study done by Bokhari and Ali (2012) considers capital adequacy ratio in Pakistan's banking sector. They argue that gross domestic product (GDPG) is not a significant factor of capital adequacy ratio.

3. THEORETICAL FRAMEWORK

Theoretically, the analysis has been done under the framework of moral hazard theory and charter value theory. An overview and relevance of these is described in the next section.

3.1. Moral Hazard Theory

A moral hazard situation occurs when, for sake of some benefit, decision is taken which is not an optimal one but rather a weaker decision. This can happen when the decision-maker is not the one to bear full costs if decision does not work well. In context of risk taking by banks and their chance of not properly utilizing their capital leverage, moral hazard is often described as reason for chances of banks taking higher risk. Literature has explained that the capital regulations will drive the banks towards holding lower levels of risky assets (Merton, 1977; Sharpe, 1978; Furlong and Keeley, 1989). However, practically, bank employees can manipulate the division of risk from clients and they can use this control by a more risky approach as compared to the shown, however, the level and occurrence of such situation is not very high.

3.2. Charter Value Theory

Banks usually hold some extra capital to safeguard them from downturns and handle the default risk. This, along with behavior of trying to manage their risks is not what can be explained

through the former theory. In an attempt to explain the reason for this, charter value theory has been developed in literature (Marcus, 1984). Charter value is the value placed on future assets of a business. The charter value theory forecasts that the banks face loss in future earnings if bankruptcy occurs and the effects of this loss are on number of parties including stakeholders (Diamond and Rajan, 2000). Thus banks tend to maintain a greater amount of capital than fixed by regulation (Keeley and Furlong, 1990). This hypothesis is known as charter value.

4. METHODOLOGY

In the view of thorough literature review and capital buffer theory, two variables i-e capital buffer and risk are figured out. Therefore it suggests developing a system of equations to solve for two endogenous variables simultaneously. Extant research on this topic has largely applied such approach (Rime, 2001; Jokipii and Milne, 2011; 2008; Ayuso et al. 2004). Capital buffers and risk taking behavior are dependent on one another. These studies are evident of this relationship. Based on extensive literature review, following model is proposed for estimation (Jokipii and Milne, 2011 and Shim, 2013). The model showing the relationship of various variables is given below:

$$BUF_{i,t}= \beta_0+\beta_1 CYCLE_t+\beta_2 RISK_{i,t}-\beta_3 BUF_{i,t-1} \\ +\beta_4 SZ_{i,t}+\beta_5 PF_{i,t}+\beta_6 LQ_{i,t}+\varepsilon_{i,t} \tag{1}$$

$$RISK_{i,t}= \gamma_0+\gamma_1 CYCLE_t+\gamma_2 BUF_{i,t}-\gamma_3 RISK_{i,t-1} \\ +\gamma_4 SZ_{i,t}+\gamma_5 LQ_{i,t}+\gamma_6 LLP_{i,t}+\eta_{i,t} \tag{2}$$

Where,
BUF=Capital buffer
Risk=Bank risk
Cycle=Business cycle
SZ=Bank size
PF=Profitability
LLP= Laonloss provisions
LQ=Liquidity ratio
$\varepsilon_{i,t}$ and $\eta_{i,t}$=Error terms
β's and γ's=Structural parameters

Simultaneous equations 1 and 2 are developed to study the how deviation in risk of bank (RISK) leads to variation in capital buffer (BUF) and *vice versa*. The first and second equations are structural. These are also simultaneous. Exogenous variables in the equations are size, profitability, business cycle and liquidity and loan loss provisions whereas, endogenous variables are capital buffer (BUF) and bank risk (RISK). In order to tackle the over-identified sets of equations, and simultaneity problem generalized methods of moments (GMM) has been applied developed by Arellano and Bond (1991).

GMM has the ability to deal with the issues of heteroskedasticity and auto correlation and endogeneity. Estimation by simple OLS cannot tackle the above-mentioned issues hence leading to biased results.

4.1. Description of Variables
4.1.1. Capital buffers
Capital buffer is defined as the Basel capital to risk-weighted capital ratio minus the regulatory requirement (Jokipii and Milne, 2008; 2011; Shim, 2013). This study calculated the value for capital buffer by subtracting the minimum needed by the central bank of Pakistan known as State Bank. This percentage is 10% minimum. Capital Buffer is endogenous variable. This variable is dependent in the first equation and independent in the second.

4.1.2. Risk
Different definitions have come across in different times to assess the bank risk. One of the measures is ratio of risk-weighted assets to total assets (RWA/TA) Shrieves and Dahl (1992), Rime (2001) and Aggarwal and Jacques (1998) have used such measures. Subsequently, many researchers have used non-performing loans to total loans (NPL/TL) ratio (Jokipii and Milne 2011; Fiordelisi et al., 2011; Louzis et al., 2012).

4.1.3. Business cycle
This study explains the business cycle as upward and downward movements of GDP levels. Growth rate of GDP has been taken as proxy variable that shows the period of highs and lows in the level of economic activities (business fluctuations).

Cyclicality means movement of a particular variable along with the economic cycle or opposite of it. When movement is with the cycle it is called pro-cyclicality, when opposite it is called counter-cyclicality.

GDP is the best indicator of the business cycle as evident from many researches (such as Rime [2001]; Lindquist [2004]; Bikker and Metzmaker [2004]). Banks following growth strategies focus to increase buffers in stable economic times to use the same when there is economic down turn (Berger et al., 1995).

4.1.4. Bank size
Bank size is measured through their assets. A natural log is taken for this purpose. A high level of these provides the security that financial health of the institution is sound. Therefore, large banks will keep less capital buffers than smaller ones (Francis and Osborne, 2012). Negative sign is expected in the capital buffer equation as observed by Francis and Osborne (2012); Shim (2013), Jokipii and Milne (2008; 2011); Estrella (2004); Ayuso et al. (2004), among many others. Study included dummy variables of BIG (SMALL) to find out the relationships.

4.1.5. Profitability
Return on assets (ROA) and return on equity (ROE) have been widely used to measure the profitability of an institution (Alfon et al., 2004; Ayuso et al., 2004) have employed ROE as a profitability measure. Jokipii anmd Milne (2011), Stolz and Wedow (2011) have used ROA. In capital buffer equation, profitability measure has a positive expected sign.

4.1.6. Liquidity
Liquidity can be defined as "the degree to which a security or asset can be bought or sold in the market without change in its price."

Higher liquidity means that bank has low default risk therefore will carry less capital buffer. Therefore we expect to have liquidity a negative expected sign in buffer equation and a positive sign for liquidity in the risk equation.

4.1.7. Loan loss provisions/reserves

A loan loss provision is a tool of macro-prudential regulations. Purpose is to protect the bank against future expected losses hence it provides a cushion in the periods of economic downturns (BCBS, April 2009). Higher loan loss provisions, higher will be the amount of RWA held by banks (Aggarwal and Jacques, 2001). Negative sign is expected between bank risk and loan loss provision.

Data sources used in this study include State Bank of Pakistan (SBP) publications, annual reports of banks, financial accounts of banks (for capital adequacy ratio). The purpose of this study is to examine the Pakistani bank behavior. Out of total 38, 24 banks have been taken as sample for the time period of the study 2007-2012. Also foreign banks were not included in the sample as they differ in terms of skills for risk management. Another reason for choosing time period starting from 2007 is to observe the true impact of Basel II accord.

5. RESULTS AND DISCUSSION

The basic nature of the data has been explained through the descriptive analysis in the Table 1. It shows the complete elements of the sample, which include the banks in Pakistan that are incorporated with the SBP. The time frame is from years 2007 to 2012.

The data shows that for banks in Pakistan, average of NPLs is 15.975 and their median is 11.040. Further, their Standard deviation is 15.90 with the lowest value of 0.00 and highest leverage amount of 73.51. As the results show that the Mean is higher than median, and the standard deviation is also not low, this suggests that there is variation in level of NPLs held by different banks. Looking at the capital buffers, the mean value is 4.33% with a median of 3.60. The standard deviation is 7.38. Similarly for TA average of TA, after taking their log is 18.57 with a standard deviation of 1.42. If we consider the profit and loss position of banks, the negative sign shows that the banks have faced net loss on average; though the amount is small with a standard deviation of 4.86. The results also show that liquid assets are present in balance sheets of Pakistani banks as on average the liquidity is 10.49 with a standard deviation of 5.749. The average for growth rate for the economy has been 3.6 during the given period. This indicates a low growth rate.

The next part of analysis is shown with the correlations between independent variables. These are shown in Table 2. Almost all the correlation numbers are below 0.5 except 062, which is the highest value. This indicates absence of problem of multi-collinearity. The co-efficient between capital buffer and cycle of economy is also positive with a value of 0.013. This indicates that better the economy, higher will be the levels of capital buffer, although by the amount of change will be low. The association of LLPs with economic cycle is -0.0763 and between economic cycle and NPLs is -0.0876. Both the negative numbers show a relationship of movements in opposite direction between these variables. Thus bank risk and LLP both move in opposite direction to economic cycle. The correlation of bank size with capital buffer and GDP growth is positive indicating that banks with bigger size tend to have higher capital buffer and move positively with the economic cycle. Similarly ROA also has positive relationship with capital buffer and DP with values of 0.25 and 0.115.

NPLs and bank size and loan loss reserves (LLRs) variables have a negative relationship. This is shown by negative sign of correlation. This shows an opposite direction in changes such as larger banks holding lower level of LLRs and smaller nonperforming loan values. Liquidity ratio has positive relation with capital buffers while a negative relation with LLRs. Economic cycle shows a positive relationship with liquidity ratio, bank size and level of profit of bank whereas it has negative correlation with bank risk and LLRs.

5.1. Generalized Method of Moments (GMM)

In the literature Jokipii and Milne (2011) and Shim (2013) have used GMM for similar studies. Thus we will also use this method to forecast the parameters of both the equations. Using this will allow to examine the outcomes of the two equations together at the same. However, firstly the equations will be estimated as single equation and then both will be estimated simultaneously.

Estimating single-equation GMM with capital buffers indicates a high significance level (at 1% level of significance) for the variables such as size of the bank, economic cycle and level of profit. GDGP is used to estimate movement in economic cycle and is related positively to capital buffers. However, NPLs, capital buffer and liquidity ration are insignificant. Profitability and capital buffer show a negative relationship. This has a negative association with capital buffers. Bank size has been proxied through LTA. This variable has a positive coefficient showing that capital buffer and bank size move in the similar direction. The data also indicates that capital buffer rises to higher levels during increase in upturns. For this equation R-squared is equal to 0.9813 indicating that 98% of change in capital buffer is

Table 1: Descriptive statistics

Descriptive statistics	BUF	GDPG	LLR	LR	LTA	NPL	ROA
Mean	4.3304	3.60000	0.14078	10.4903	18.5790	15.9797	0.20409
Median	3.6000	3.55000	0.07992	8.9200	18.8573	11.0400	0.76000
Maximum	25.6400	5.70000	2.74953	43.9900	21.1996	73.5100	3.72000
Minimum	16.2000	1.60000	0.00032	2.8900	15.5659	0.00000	51.0000
Standard deviation	7.38252	1.23854	0.28288	5.7494	1.41670	15.9004	4.86235

LLR: Loan loss reserves, ROA: Return on assets

explained by independent variables with some variation because of factors not considered in the study. The Durbin-Watson result is almost equal to 2. Thus any serial correlation problem is not detected as such.

5.2. Risk Equation
Table 3 indicates the outcome of GMM single-equation outcomes for risk equation.

Table 3 clearly shows that the coefficients for profitability, liquidity ratio, bank size and economic cycle are all insignificant. The capital buffer has a significant relationship with the lagged buffer capital and risk only. It has a negative relationship with the lagged buffer capital and a positive relationship with the non-performing loans ratio. This implies that when the non-performing loans increase banks increase their capital buffers accordingly.

As the results of Table 4 indicate high t-values, the variables included are significant. One key result presented in this table is the association between risk and economic cycle that is a negative association. This means that the bank risk rises during economic downturns and increases during upturns. The co-efficient for GDPG and risk have a negative relationship, which is also

significant at 1% level. Liquidity ratio, size of banks and LLRs have a positive signs and are significant at 1% level. This indicates that banks with higher liquidity and the banks with larger size engage in risky approach and also do loan loss provisioning once their total risk rises. Risk and capital buffer have shown a negative relationship; thus as the risk of the banks increases their capital buffers tend to go down. This is also one of the main findings as their association was not significant earlier in the capital equation. Bank risk is measured through the variable NPL. The association of NPLs and its own lagged value at 1% significance level is negative. Association of NPLs with lag of NPL is also negative at same significance level. The results also show an R-squared indicating 99.9% variation in bank risk due to independent variables considered.

5.3. Simultaneous Equation Estimation
Table 5 shows the outcome from system GMM forecast. The panel data has been estimated in this study through two-step Blundell and Bond (1998) methodology.

Table 5 shows system GMM risk. The results indicate that 90% of the variation in the dependent variables is due to the explanatory variables considered in the model. Durbin-Watson result also indicates absence of serial correlation as the value is close to 2.

First, let us discuss the results of the risk equation. Risk and GDGP are negatively related at 1% significance level. The results in the literature are similar to ones reached in this study; for example Stolz and Wedow (2011), Shim (2013), Jokipii and Milne (2011). The coefficient for LLPs and bank risk is significant at 5% level and has a negative coefficient showing that an increase in LLP leads to lowering of risk of bank. This result is different from the one found in literature and is due to the fact the context considered in this study i.e., Pakistan has different features as compared to the previous studies. The results also indicate that the banks of larger size in given context engage in higher risk activities as compared to smaller banks, however this result is significant at 10% level. The ratio showing how liquid the assets are is negatively associated to NPL ratio. Further, it can be seen that banks with higher liquidity tend to hold lower level of risky assets. For the relationship of capital buffer and risk, literature has mixed results. This study indicates a positive relationship between the two at 1% significance level. The lag of NPLs is negatively associated to the bank risk. Thus a rise in the bank risk in earlier

Table 2: Correlation matrix

Correlation t-statistic Probability	BUF	GDPG	LLR	LR	LTA	NPL	ROA
BUF	1						
GDPG	0.01	1					
	0.15	-					
	0.88	-					
LLR	0.11	0.08	1				
	0.34	0.91	-				
	0.18	0.36	-				
LR	0.06	0	0.22*	1			
	0.67	0.06	2.81	-			
	0.51	0.96	0.01	-			
LTA	0.11	0	0.16**	0.26*	1		
	0.26	0.02	1.95	3.32	-		
	0.21	0.98	0.05	0	-		
NPL	0.04	0.09	0.62*	0.21*	0.35*	1	
	0.5	1.05	9.61	2.64	4.58	-	
	0.62	0.3	0	0.01	0	-	
ROA	0.25*	0.11**	0.34*	0.44*	0.56*	0.39*	1
	3.13	1.37	4.41	5.96	8.07	5.15	-
	0	0.17	0	0	0	0	-

* and ** represents the significance at 1% and 5% respectively. ROA: Return on assets

Table 3: Single equation GMM- buffer

Independent variable	Coefficient	Standard error	t-statistic	P
C	−22.45*	8.49	−2.64	0.01
ROA	−0.28*	0.06	−4.59	0.00
LR	−0.19	0.15	−1.27	0.21
LTA	1.73*	0.20	8.57	0.00
GDPG	0.255*	0.07	3.38	0.00
BUF(-1)	−0.37	0.46	−0.80	0.42
NPL	−0.10	0.14	−0.75	0.45
R²				0.9,81,838
Adjusted R²				0.9,69,298
Durbin-Watson statistic				2.1,25,014

*indicates the significant coefficients at 1%. GMM: Generalized methods of moments, ROA: Return on assets

year does not mean it can increase in present time period also; they are negatively related.

The capital buffer is associated with lagged buffer positively and risk negatively and significantly. This indicates a rise in NPL once capital buffers rise.

5.4. Risk Equation

The outcome of system GMM demonstrates that the risk of a business and GDGP are negatively associated. The value of this association is −2.043 at 1% level of significance. Both single and system equation give the similar result. Thus it can be concluded that risk moves in opposite direction to cycle of economy. This result is in line with the findings by literature. Repullo and Suarez (2004) and Ayuso et al. (2004) among others suggest similar results of negative co-movement of risk and the economy. This is due to the reason that the credit quality goes down during downturns and default risk by those who borrow is higher as compared to during better economic times when repayment ability tends to be higher. A similar conclusion is reached by Curry et al. (2008). Another key finding is that there is a positive association between risk and capital buffer as estimated through simultaneous equation. Their coefficient is 0.148 and 1% level of significance. This shows that when the banks have ample amount of extra or surplus capital, they become more active towards taking risky activities Heid et al. (2004), Rime (2001), Jacques and Nigro (1997) reached similar conclusions in their research. This is similar to theory of capital buffer that states that higher capital buffers banks will keep their capital requirement ratio instead of enhancing it further, because they tend to engage in risky activities then and keep the buffer at just the minimum amount required.

LLP of banks is the level of reserves kept as extra for the expected losses. This variable in the simultaneous equation shows a value of −2.02, suggesting that the when banks anticipate more losses it leads to decrease in risk taking. In the literature Aggarwal and Jacques (1998) also show a similar result. A positive result for the context under study also shows that if banks in Pakistan anticipate losses in future they will engage in less risky activities. As this is a cautious approach it can indicate smooth and stable functioning of financial industry. Studies considering liquidity of banks have shown that if a bank holds high level of liquid assets, it will tend to involve less in risky activities (Shim, 2013). This study indicates a negative association of lending with bank risk. Regarding size of bank, this study finds that bank size is positively associated to risk that a bank assumes, however, this association is insignificant due to low value of t statistic. If the 0.20 difference of t-value is not taken into account to take it as significant at 5% level, the association is in line with the "too-big-to-fail" theory. This shows that these banks tend to raise their risky assets when their TA go up. Francis and Osborne (2012) have similar finding. This result is in line with the acceptance of moral hazard behaviour instead of precautious performance, which the charter value theory assumes from banks of bigger size.

5.5. Capital Equation

As it is evident from Table 6, the GMM estimation results, relationship of capital buffer with explanatory variables is insignificant mostly.

Table 4: Single equation GMM - risk

Variable	Coefficient	Standard error	t-statistic	P
C	−80.293*	0.03	−2655.802	0.00
GDPG	−1.493*	0.00	−6210.707	0.00
LLR	2.234*	0.00	838.7076	0.00
LTA	5.861*	0.00	3848.185	0.00
LR	0.063*	8.58	745.1228	0.00
BUF	−0.354*	0.00	−1279.847	0.00
NPL(-1)	−0.025*	7.74	−334.2947	0.00
R^2				0.9,99,638
Adjusted R^2				0.9,99,054

GMM: Generalized methods of moments

Table 5: System GMM risk

Dependent variables	Coefficient	Standard error	t-statistic	P
C	−4.253	9.075	−0.468	0.64
GDPG	−2.043*	0.694	−2.943	0.00
LLR	−2.023**	1.050	−1.925	0.05
LTA	0.794***	0.440	1.804	0.07
LR	−0. *	0.172	−2.040	0.04
BUF	0.148*	0.057	2.598	0.01
NPL(-1)	−0.972*	0.038	−25.00	0.00
R^2				0.9,05,107
Adjusted R^2				0.8,91,221
Durbin-Watson stat				2.2,97,562`
J-statistic				30.112

*, ** and *** indicates the significant coefficients at 1%, 5% and 10% respectively

Table 6: System GMM estimation: Buffer

Dependent	Coefficient	Standard error	t-statistic	P
C	7.417	5.234	1.417	0.16
ROA	0.109	0.086	1.259	0.21
LR	0.047	0.076	0.623	0.53
LTA	−0.394	0.244	−1.611	0.11
GDPG	−0.184	0.505	−0.364	0.716
BUF(-1)	−0.940*	0.062	−15.00	0.00
NPL	0.089*	0.027	3.217	0.00
R^2				0.8,45,148
Adjusted R^2				0.8,22,487
Durbin-Watson statistic				2.6,69,739

*indicates the significant coefficient at 1%. ROA: Return on assets

One of the significant variables from results of GMM is the NPL ratio. This denotes risk. The coefficient of this variable in the equation above is positive with a value of 0.0899.

As per risk equation, relationship between bank risk and capital buffer is also positive meaning banks having high amount of capital buffers will take more risk. This result is consistent with the previous studies.

GDPG, was found to be significant in risk equation but not in capital equation showing the pro-cyclical tendencies of capital buffers.

Size of the bank was found to be insignificant both in capital and risk equations. So, it can be safely said that this variable is

not a good estimator related with capital buffer and bank risk in Pakistan.

6. CONCLUSIONS

Present study was gauged to analyze the capital buffers and business risk of Pakistani banks and their adjustment through the framework of Basel II agreement.

Interesting results were revealed when comparison is made to studies conducted for the same purpose in other international contexts. This variation van best be explained by the fact that banking in developing countries is characterized differently than the developed world. Fluctuation of capital buffers is also a contradictory with the Basel II. It could be best explained by the fact that banks in Pakistan calculate their CAD ratios based on standardized measures of CAR.

Results show that size of bank was insignificant in both the equations i-e capital buffer holding and risk taking. So it can be safely stated that for Pakistan, bank's bigger or smaller size is not a suitable variable of variations in level of capital buffer as well for risk taking.

The reason behind is that in Pakistan, banking categorization based on size and capitalization is not very huge. Most of the banks fall only in the mid and lower range. Only few banks are in the high range. Also inefficient financial regulatory system, court process adds on into. Since the system is new, State Bank regulatory authority is not very strict about maintaining a minimum level of CAD ratio.

Risk equation results reveal that they are highly significant and consistent with previous studies conducted on the same subject. It was observed that bank risk moves in opposite direction to cycle in the economy. This indicates that in the context under study, banks hold large amount of NPLs in their balance sheets, when economy is in recession. This rise in the in NPL is due to two important reasons. First, as a reaction to economic depression, probability of default risk increases. One of the remarkable insight is during economy boom periods banks offers more loans and in that they relax the prerequisites of the loaning procedures thereby increasing the likelihood of default risk on loans. Therefore, the relationship of high risk taking and capital buffer can be best explained by this. So banks gets involved in taking high risk by offering large amounts of loans which hence explaining their behavior as high risk takers. These findings implicit many meanings for example it shows that bank managers seek short-term returns hence exhibiting moral hazard behavior. Mangers do not stick to their bank's charter value, get indulge in earning short run profits, hence ignoring the future value of the firm. This shows the lack of association of bank managers to their respective organizations, which can be explained as agency problem. Issue of this agency problem can be eradicated by offering managerial incentives and perks hence correcting it legally. Present study has uncovered interesting relationships of variables like capital buffers, risk and how they move with the economic cycle leading to several policy implications. Also, findings can aid in identifying existing problems with banks and offer

solutions. Banking regulatory authorities must work on the ways to implement the capital adequacy ratio by the banks more effectively and hence controlling the moral hazard behavior of banks.

In general, this research has found important relevancy of bank's capital buffer and bank risk to the soundness and stability of financial position in banking sector. Varied market and investor's characteristics and their behaviors in developing countries led down the need of this research. Moreover, the study is forceful as had used a balanced panel data from banks of Pakistan including all categories of banks i-e commercial banks, Islamic banks, investments banks, and specialized banks.

The study sheds light on being first of its kind in the Pakistani context providing the policy implications for SBP. Regulatory authorities can make best use of this information in understanding the banking industry behavior, hence improving the financial health of banking industry and overall economy. In particular this study will help to implement the Basel II accord effectively that has been implemented in 2007 but not truly practiced in its essence as yet.

7. LIMITATIONS OF THE STUDY AND SCOPE FOR FUTURE RESEARCH

No research is without limitations and the present study also has the same. Presently, banking industry is in developmental stage. After privatization of banks in early 2000s and addition of new banks in the financial sector has improved the situation. Also, regulatory framework is in its infancy stage. Moreover, Basel I and Basel II have been introduced in 2007 and 2008 respectively in banking sector of Pakistan. Therefore, present research had limitation to be restricted only a specific time period, which is considered very small when we want to observe the significant change by a particular regulation. Lack to access to data was another reason. As the Basel I and II are new in the banking system and most of the banks did not have their capital adequacy ratio (CAD) calculated in their financial statements. Therefore manual calculation was being performed making risk of fault very high. To address this issue, banks with already calculated ratio were included in the sample.

These limitations set grounds for opening avenues for future research. Present study can be extended by taking sample of other financial firms like DFIs, investment and leasing companies and mutual funds to get better insight and for comparative studies.

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