Impact of Stringent Capital Requirements on Bank Crises: South Asian Perspective

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Abstract

This paper investigates the impact of stringent capital and regulatory standards on bank crises in South Asia using a multivariate panel logit model. We have followed the conventional and widely used definition of banking crises suggested by Demirguc-Kunt & Detragiache (1998), Davis & Karim (2008), Hosni (2014) and Wong et al. (2010). According to them banking crisis occurs when the banking sector's non perfoming loan ratio exceeds 10 percent. The logit model is widely used in the empirical literature on the causes of banking crises since its inception by Demirguc-Kunt & Detragiache (1998). In the model the probability of banking crisis is assumed to be a function of a set of potential explanatory variables. We have taken a general-to-specific approach by progressively reducing the general model with including only those explanatory variables that are statistically significant at 1%, 5% and 10% level, as done by Caggiano & Calice (2011) and Yan et al. (2012). By using the above function we have got that the likelihood of a bank crisis is negatively associated with capital adequacy ratio, GDP growth and private sector credit to GDP, while positively associated with real interest rate. Particularly, we have found that the likelihood of a crisis would be reduced by 18 basis points if capital adequacy ratio is raised by 1 percentage point.

JEL Classification: E52 (Monetary Policy), E58 (Central Banks and Their policies)

Keywords: Global Financial Crisis, Non Performing Loans, Multivariate Logit Model

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1. Introduction

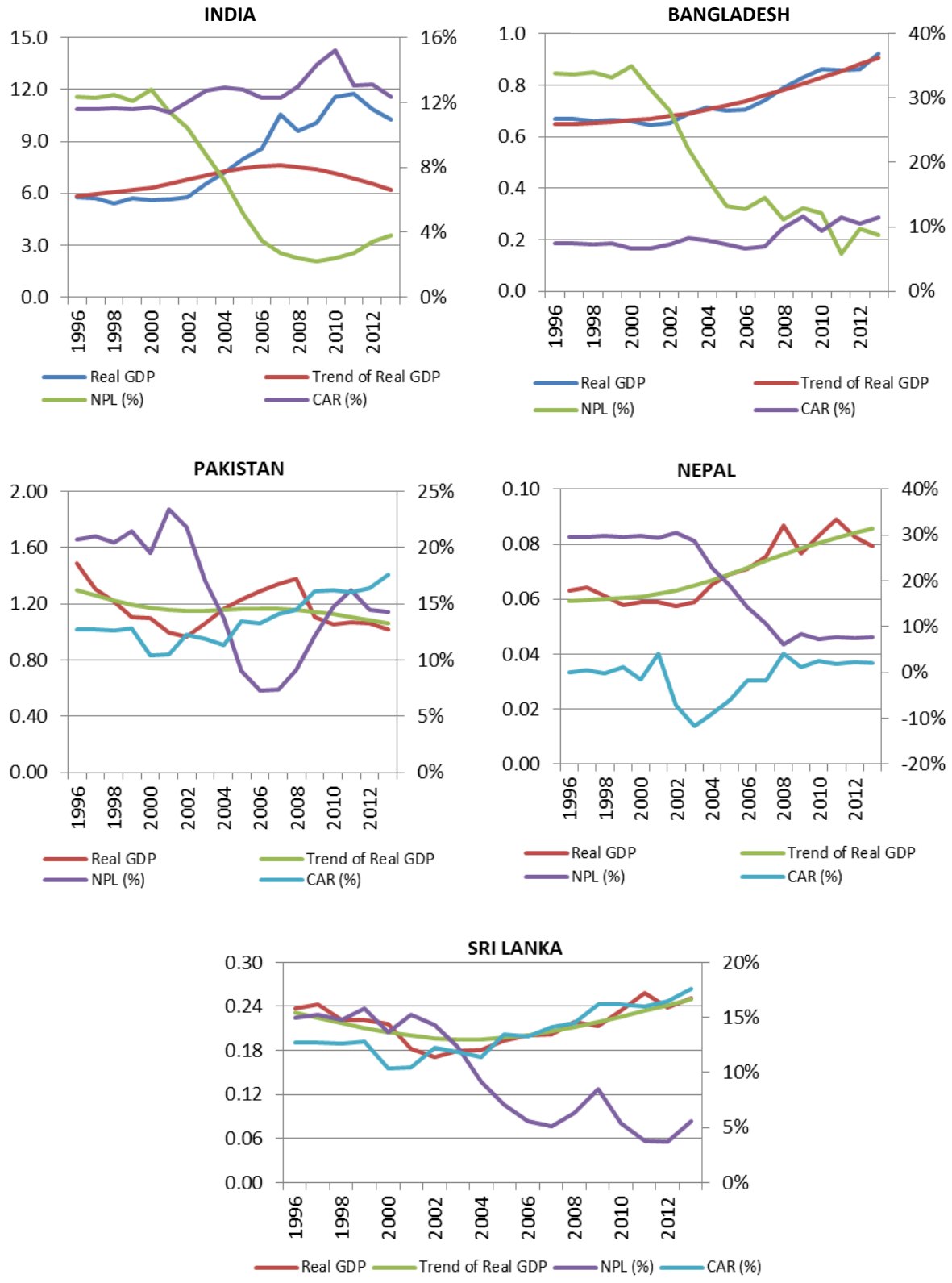
The banking industry of South Asia [3] generally proved its resilience during the Global Financial Crisis of 2007-2008. This development was achieved due to the implementation of stringent regulatory and supervisory standards within a stable, sounder and more flexible macroeconomic management framework over the past decade. Stringent capital ratios are expected to reduce the probability of systematic banking crises and smaller output volatility, thereby, leading to welfare gains. On the other hand, these tighter capital requirements are passed through an increased lending rate as the banks shift the burden to their customers. This in turn reduces consumption - investment and finally the growth rate of real economy through 'Bank Lending Channel'.

South Asian countries are making stronger efforts in line with BASEL reforms. Afghanistan, Bhutan, and Maldives have not yet implemented Basel II, but they are compliant with Basel I (Sophastienphong & Kulathunga, 2010; Financial Stabilty Institute, 2012). Bangladesh, India, Nepal, Pakistan, and Sri Lanka have already embraced various stages of Basel II. Some of these countries have even started working to implement BASEL III in coming years. These new macro and micro prudential regulations are helping these countries to address the issue of financial stability through improved management of risk and supervision. But the relevant costs of rising lending rate should also be taken under consideration in determining the net welfare gain of these accords. Therefore in spelling out a strategy to move with BASEL III, it is important to assess the implications of regulatory reforms on the economic performance of these countries.

We have showed the real GDP, trend of real GDP, capital adequacy ratio and nonperforming loans for India, Bangladesh, Pakistan, Nepal and Sri Lanka from 1996 to 2013 in Graph 1.

[3] Afghanistan, Bangladesh, Bhutan, India, *the* Maldives, Nepal, Pakistan and Sri Lanka

Graph 1: Real GDP and Trend (Billion, USD), Non Performing Loan (NPL) and Capital Adequacy Ratio (CAR)



Source: Compiled by authors from GFSR (2014); CBW; GFSA (2010) and WDI Database (2014)

The graphs for each country show strong negative association between capital adequacy ratio and nonperforming loans. The correlation coefficients between the two variables in Bangladesh, India, Nepal, Pakistan and Sri Lanka are - 0.68, - 0.75, - 0.40, - 0.42 and - 0.74 respectively while for the whole panel data set it becomes - 0.51. These results provide some evidence that tighter capital requirements might contribute to the resilience of South Asian banking industry through lowering the ratio of nonperforming loans.

Barrell et al. (2009) and Kato et al. (2010) build reduced form probit models for investigating the statistical relationship of probability of crisis occuring with bank capital and liquidity. Wong et al. (2010) used a cost-benfit analysis approach to assess the impact of tightened capital ratios for Hong Kong. By using a probit model for estimating banking crises and vector error correction models (VECM) for estimating long term output reduction, they concluded that regulatory reforms would bring a net long term gain for Hong Kong economy. Gambacorta (2011) also used a VECM approach to evaluate the new regulatory standards for the US economy over the period 1994 to 2008. They found that the estimated positive benefit of reforms through reducing the probability of banking crises and associated banking loss overrun the negative effects on the level of output.

There is no other study investigating the macroeconomic impacts of new regulatory capital accords for the South Asian countries as per the best of our knowledge. Our work on the issue, thus, will contribute to fill the gap. The estimation of the model is done using annual data over the period 1996-2013 for five South Asian countries which are Bangladesh, India, Nepal, Pakistan and Sri Lanka. The other three countries (Afghanistan, Bhutan and Maldives) are excluded for lack of sufficient data.

2. Estimating the Probability of Bank Crises

A multivariate panel logit model is used to estimate the impact of tighter capital requirements on bank crises. The model is widely used in the empirical literature on the causes of banking crises since its inception by Demirguc-Kunt & Detragiache (1998). In the model the probability of banking crisis is assumed to be a function of a set of potential explanatory variables. Given the hypothesized functional form, typically linear, the estimated logit gives the estimated probability of crisis. The dependent variable probability of banking crisis $(P_{i,t})$ is a binary variable which takes a value of 1 if country i is hit by a crisis at time t and 0 otherwise.

$$P_{i,t} = \phi\left(\beta_k Z_{k,t}\right) = \sum_{k=1}^{K} \beta_k Z_{k,t}$$

where $Z_{k,t}$ represents a set of macroeconomic variables including capital adequacy ratio, real interest rate, private sector credit to GDP as well as growth of GDP deflator, GDP, current account balance, terms of trade and credit. The set of the explanatory variables are chosen following other recent works in the subject, particularly Demirgüç-Kunt et al. (2006), Barrell et al. (2009), Wong et al. (2010) and Caggiano & Calice (2011). β be the vector of k parameters to be estimated and ϕ the cumulative probability density function which is assumed here to be logistic. The log-likelihood function of the model that must be maximized is:

$$\ln(L) = \sum_{i=1}^{n} \sum_{t=1}^{T} \{ P_{i,t} \ln[\phi(\Upsilon' Z_{kt})] + (1 - P_{i,t} \ln[1 - P_{i,t}]\}$$

We have followed the conventional and widely used definition of banking crises suggested by Demirguc-Kunt & Detragiache (1998), Davis & Karim (2008), Hosni (2014) and Wong et al. (2010). According to them banking crisis occurs when the banking sector's non perfoming loan ratio exceeds 10 percent. We

have taken a general-to-specific approach by progressively reducing the general model with including only those explanatory variables that are statistically significant at 1%, 5% and 10% level, as done by Caggiano & Calice (2011) and Yan et al. (2012).

Table 1: Banking Crisis Determinants [a]

Dependent Variable: Probability of Bank Crises					
	Model 5	**Model 4**	**Model 3**	**Model 2**	**Model 1**
Capital Adequacy Ratio	-0.798***	-0.759***	-0.948**	-1.153**	-1.168**
GDP Growth	-0.472*	-0.719**	-0.674*	-0.885*	-0.896*
Private Sector Credit to GDP	-0.365***	-0.394***	-0.469***	-0.538***	-0.541***
Real Interest Rate	0.386***	0.400***	0.569**	0.683**	0.717**
Private Sector Credit Growth		0.065	0.095*	0.165**	0.163*
GDP Deflator Growth			0.203	0.283	0.292
Current Account Balance Growth				0.001	0.001
Terms of Trade Growth					0.023
McFadden R-squared	0.720	0.734	0.747	0.767	0.768

[a] The regression includes a constant term, *Indicates statistical significance at the 10% level, **Indicates statistical significance at the 5% level, ***Indicates statistical significance at the 1% level

The estimated result shows that an increase in capital adequacy ratio, GDP growth, private sector credit to GDP reduces the probability of banking crises across all the five models in statistically significant way. We find that high real interest rate and private sector credit growth are positively associated with banking crises across Model 1-5 and Model 1-3 respectively in statistically significant way. Our coefficient of interest is the coefficient attached to capital adequacy ratio which is robustly significant across all the specifications at 5% level (at 1% level in Model 4-5). We can also observe that the origin of banking crisis in South Asia is mainly influenced by real economy indicators (real GDP growth and real

interest rate) and banking sector indicators (capital adequacy ratio, private sector credit to GDP and credit growth) while the external sector indicators (terms of trade and current account balance) do not have any statistically significant impact on banking crisis. This result implies that the external factors have limited role to play on the banking industry of South Asia. We can also compute the expected benefit from the estimated model through calculating the marginal effect of a change in the explanatory variable of our interest. To derive the marginal effect of capital adequacy ratio on the probability of crisis the following function is used:

$$\frac{\partial E\,(\text{Probability of Bank Crisis} \mid \text{Capital Adequacy Ratio}, \square)}{\partial\ \text{Capital Adequacy Ratio}} = f(-\ \text{Capital Adequacy Ratio}'\square)\square_{\text{Capital Adequacy Ratio}}$$

where E(Probability of Bank Crisis|.) is the conditional expected value of bank crisis, $\square$ is the vector of parameters and f(.) is the logistic function. By using the above function we have got a value of 0.18 as the marginal effect of capital adequacy ratio on the probability of banking crises from Model 5. This implies that the likelihood of a crisis would be reduced by 18 basis points if capital adequacy ratio is raised by 1 percentage point.

3. Conclusions

Implementation of new capital and liquidity requirements under BASEL III framework has emerged as a crucial issue for banking sector reforms in South Asia. The reforms are making the South Asian banking sector more resilient by reducing the probability of systematic banking crisis, thus, creating a welfare gain by eliminating negative output shock and reducing output volatility. But at the same time tightened capital requirements are passed from the banks to their customers through an increased lending rate which in turn inversely influences consumption-investment and finally GDP. By using a panel multivariate logit model and median output loss for a banking crisis, we have found that the likelihood

of a crisis would be reduced by 18 basis points if capital adequacy ratio is raised by 1 percentage point. Almost all the countries are maintaining a capital adequacy ratio much above 10 percent except Nepal. As mentioned earlier, we have not tried to derive the optimal level of capital requirement in our paper. Rather we have tried to assess how the South Asian countries should go with implementing BASEL accords.

We must mention some caveats that remain in the study. First, it was really difficult to get data for all of the variables of these countries over 1996-2013 from a single source. When the sources changed, some minor fluctuations were observed which might produce some bias in the results. This can be addressed in further research on this topic. Second, model limitations and particularly mapping capital ratios with relevant BASEL regulations inevitably influence the results. Finally, we have not incorporated liquidity in our model following Caggiano & Calice (2011), Kapp & Vega (2014) as well as not having sufficient data. However, Wong et al. (2010), Gambacorta (2011) and Yan et al. (2012) used loan to deposit ratio (LTD), liquidity to deposit ratio (LIQ) and net stable funding ratio (NSFR) respectively as liquidity terms in their models.

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5. Appendix

A.1. Definitions and Sources of Variables

Variables	Definitions	Sources
Capital Adequacy Ratio (CAR)	Bank Regulatory Capital to Risk-Weighted Assets (%)	Global Financial Stability Report (GFSR) Data, International Monetary Fund (IMF), 2014; Central Bank Websites (CBW)
Nonperforming Loans (NPL)	Bank nonperforming loans to total gross loans (%)	GFSR, IMF, 2014; CBW; Getting Finance to South Asia (GFSA), 2010
Return on Equity (ROE)	Bank return on equity (%)	GFSR, IMF, 2014; CBW; GFSA, 2010
GDP Deflator (GD)	GDP Deflator Growth	World Development Indicators (WDI) Database, 2014
GDP (Y)	Real GDP	WDI Database, 2014
GDP Growth (YG)	Real GDP Growth	WDI Database, 2014
Private Sector Credit (CREDIT)	Domestic credit to private sector (% of GDP)	WDI Database, 2014
Private Sector Credit Growth (CG)	Growth of domestic credit to private sector	WDI Database, 2014
Real Interest Rate (r)	Nominal interest rate adjusted for inflation as measured by the GDP deflator (%)	WDI Database, 2014
Terms of Trade (TOT)	Net barter terms of trade	WDI Database, 2014
Lending Rate (L)	Bank rate that usually meets the short and medium term financing needs of the private sector (%)	WDI Database, 2014
Current Account Balance (GCAB)	Current Account Balance Growth	WDI Database, 2013

A.2. Banking Crises Determinants (Logit Results – Model 5)

Dependent Variable: CRISES
Method: ML - Binary Logit (Quadratic hill climbing)
Date: 12/29/14 Time: 21:37
Sample: 1996 2013
Included observations: 90
Convergence achieved after 6 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	22.70130	6.321939	3.590875	0.0003
CAR	-0.798115	0.285930	-2.791293	0.0052
GY	-0.472510	0.261132	-1.809467	0.0704
CREDIT	-0.365827	0.105360	-3.472177	0.0005
R	0.386753	0.142696	2.710332	0.0067

McFadden R-squared	0.720238	Mean dependent var	0.622222
S.D. dependent var	0.487548	S.E. of regression	0.246734
Akaike info criterion	0.482057	Sum squared resid	5.174616
Schwarz criterion	0.620935	Log likelihood	-16.69256
Hannan-Quinn criter.	0.538061	Deviance	33.38512
Restr. deviance	119.3338	Restr. log likelihood	-59.66692
LR statistic	85.94871	Avg. log likelihood	-0.185473
Prob(LR statistic)	0.000000		

Obs with Dep=0	34	Total obs	90
Obs with Dep=1	56		