



The Vulnerability Trends of the Banking Sector of Bangladesh: A Stress Testing Approach

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ABSTRACT

The study investigates the stress test report of the banks to assess the vulnerability of the banking sector as a whole on extreme but plausible shock scenarios. The regulatory pressure and extreme market competition bound the banking sector to assess their risk and show the sensitivity based on hypothetical extreme scenarios. It refers to the stability of the bank in disaster situations so that the economy can withstand negative externality by protecting the preventive measures. It is found that the bank credit is vulnerable and volatile due to higher defaults and more concentration. The mandatory practice of stress test will give better information to the market about the sensitivity of banks that will automatically adjust to the market value of the share. This is one of the techniques by which market gambling can be reduced. The study is emphasized its importance and mandatory practice in the market.

Keywords: Bank Risk, Stress Test, Bangladesh

JEL Classifications: G2, G21

1. INTRODUCTION

Corruption and debt irregularities are going on like a tradition. There is a lot of credit fraud evidence in many banks. Especially due to the unprecedented aggressive banking of Farmers Bank, the entire banking sector is at risk. Besides, serious irregularities and corruption are being published in the media every day. Debt forgery has made the sector more troubling. As a result, the rebalancing of default money cannot be dragged in any way. It seems that there is no one to take strong action against the debt forgery and the defaulters. Of the existing 57 commercial banks, 18 banks are currently at financial risk. Of these, more than a dozen banks are very vulnerable. The rest of the “risk squares” are in and out. Thus, there has been a lot of unrest in the financial sector for a long time. Now, most of the depositors of banks have become more concerned about this situation. The whole chapter tried to explain the stress test scenarios especially focus on Bangladeshi banking sector.

The ability or persistence of the financial instruments or institution in the scenarios of an economic meltdown or financial crisis is evaluated by analysis is called test stress testing or simulation.

It is the best technique in describing situations rather than best estimation where it shows the robustness of the financial instruments under certain crashes. Within a very short period of time, it becomes popular and took keen attention to the government bodies, like Prudential Regulatory Authority (PRA), European Banking Authorities (EBA), International Monetary Fund (IMF), as a regulatory requirements in the case of testing capital adequacy levels whether it can cover the probable losses in the extreme, but plausible, events. Stress testing is not only used for individual stressors but also for a combination of events.

2. EVALUATION OF BANK STRESS TESTING

The bank stress testing is based upon the examination of the relevant bank's balance sheet. At the inception of the stress testing or simulation analysis is adopted as an internal control tool for the banks in the early 1990s (Quagliariello, 2009). However, the Basel capital accord amendment in the year of 1994 and emphasized on testing the ability of banks in adverse

Table 1: Historical scenarios used in stress testing anatomy

Scenario	Year	Description
Black monday	1987	The largest 1-day percentage drop in the stock market and shedding a huge value globally on 19 October 1987 (Monday). The Dow Jones Industrial Average (DJIA) fell exactly 508 points to 1738.74 (22.61%). It began in Hong Kong and spread quickly in the international arena and hitting the giant capital markets, the result is the major loss of value of the international stock markets by between 19% and 40% over the month
US interest rate shock	1994	The economic cycle was moving towards recession due to the slight rise of treasury yields compared to previous year although there were no signals of inflationary pressure in the economy. The result was the unexpected shock in the bond market creating so-called “convexity” ¹ problem. In fact, the shockwave hurt the US equity market and turn down the profitable pocket into the bare shirt of the investors
Mexican Peso crisis	1994	The sudden devaluation of Mexican currency (peso) by the government break down the theoretical justification to fall naturally into “true” value. The prediction was substantially injured by the actual devaluation of 300% which is 15 times more than the estimated. However, it was assumed that lack of investors’ confidence due to negative trade balance drove the collapse and link up the currency into massive devaluation and hyperinflation
Asian crisis	1997	The crisis emerges in Thailand due to the devaluation of Thai baht by the government to supports its currency peg to the US dollar. However, the country was overwhelming by the burden of foreign debt and waiting for bankrupt before the collapse of its currency. The crisis spread quickly in Japan and most of the Southeast Asia by the devaluation of the currency, fall of the value of share market and undervalued the assets price, especially impulsive rise in private debt
Russian crisis	1998	The crisis also termed as Ruble crisis or Russian Flu. It was found that the Russian government and central bank decided to devalue the currency (Ruble) due to an enormous debt default. The lesson of the crisis was pointed out the diversification of assets that were the remedy of the sudden crush

market effect through stress testing. This was the remarkable initiative taken by the Basel committee. Banks continued this practice for the judgment of internal evaluation or self-assessment till 2007. In early 2007, the government regulators are very much interested in adopting stress testing mechanism in their own entities to check the performance and operations of financial institutes. Later on, the urgency of practicing stress testing become implemented in different countries of the world as a form of regulatory requirements which emerge to avoid the negative externality of the economy.

It is used as a prominent regulatory toolkit after the incurrence of the financial crisis in the global economy.

It is found that scenario based stress testing initiated within the banks as a regulatory discipline in the early 1990s acting as a complementary statistical analysis in the diagnosis and identification of risky banks (Blaschke et al., 2001; McGee and Khaykin, 2013). Generally, historical and hypothetical scenarios were envisaged by the trading manager against their portfolios investment with the analysis and took precautions (Araten, 2013). In fact, historical scenarios were evaluated to determine the impact based on past extreme events whether the repetition of such cases incurred in the current portfolios. Some of the adverse situations in the economy were remarked as a milestone in the historical scenario analysis took consideration for the early stress testing practitioners (Table 1).

¹ The way of measuring the curvature relationship between the bond price and bond yield that states the duration of bond changes due to changes in interest rates. It is a risk management tool by which it measure and manage the market risk in the bond portfolios

The severity of past events can be a pathfinder of taking remedies for the upcoming bad consequences but the fact is that future events may not be repeated as the replica of past events. Definitely, the measures will be taken differently based on scenarios and the nature of consequences. Then the future risk is determined by the benchmark events visualizing the scenarios based on severe but plausible hypothetical events. The changes of economic growth prospects is considered as the key points in hypothetical scenarios especially in the case of developed countries while the rate of government debt obligation as an economic disruption is often used in emerging market scenarios.

The manner of the initial stress testing application varied according to bank to bank and country to country. Committee on the Global Financial System (CGFS) (2000) found that banks showed its limit of maximum loss incurred from the portfolio while others are determined the appropriate amount of capital fund that kept for the portfolio loss.

In 1996, the strategic amendment of international capital regime was formalized based upon the market risk² consequences used in evaluating portfolios under stress testing. After the changes, banks tried to apply their own model in quantifying the market risk in existing capital regulation. However, the calculated market risk of each bank was required to evaluate the market based stress testing in the economy. While there was a high frequency of practicing market risk measurement in the international arena, then the idea moved toward credit risk (counter party risk or default of borrowers) for stress testing approach.

² Amendment in Basel capital accord

Table 2: Stress testing practices in the globe before and after the financial crisis

Stress testing practice before financial crises	Subjects	Stress testing practice after financial crises
The policymakers tried to capture the impact of severe, but plausible, shocks on the financial system as a whole or in the aggregate level	Level	After the financial crisis, the actual deviation came to the mind of the policymaker in the case of risk management and took keen attention (BCBS, 2009)
The impact of adverse events came on the screen in the late 1990 and practiced with fewer scopes	Scope	The scope of the practice of stress test uses explored with a broader range within the regulatory sphere. Regulatory stress test moved to comprehensive and large-scale risk assessment program
In fact, the financial sector assessment program (FSAP) ³ finds out the volatility of financial and economic growth and significant adverse effect on financial markets from the crisis period of the 1980s and 1990s. The demands for adopting stress testing emerge in that period	Time	In early 2009, the US supervisory capital assessment program (SCAP) assessed the large banks capital adequacy whether it could absorb the losses and can perform well in the stress scenarios. The scenarios designed for the expected trajectory was more severe than actual events in the economy (Bernanke, 2010)
Every participating country in FSAP, perform the stress testing as a key component of the analysis. The purpose was to measure the quantitative vulnerability of country's financial system to diverse macro-financial scenarios	Purpose	Moving from the past, SCAP tried to publish the disclosures in the market on the bank by bank basis. As a result, all the banks raised their capital privately in a position so that they should not depend on treasury support
Every central bank performs the stress test considering the whole banks as a single entity and develops their model	Entity	SCAP had a significant contribution in encouraging banks to hold adequate capital for stabilizing the market and restoring public confidence (Krugman, 2014; Schuermann, 2013; Zhang, 2013)
The stress test technique overcame its limit and used concurrent stress-testing framework for wider range	Limit	The concurrent stress testing was introduced firstly in European Union (EU) in late 2009 under the direction of the Committee of European Banking Supervisors (CEBS). Initially, concurrent stress testing used as a complement to non-concurrent basis technique
There was a very negligible effect of concurrent stress tests on regulatory or policy development before the global financial crisis	Effect	The regulatory focus on the improvement of bank's stress testing technique in risk management practice moved financial resilience into more rigid framework capitalizing the benefits increasing regulatory capital

In 1999, the Basel committee of banking supervision (BCBS) made a little progress in developing credit risk stress testing technique. In fact, credit risk holds the major portion of the risk in bank risk category.³ CGFS (2005) highlighted that stress testing should not only improved for credit risk but also applied for all types of risk faced by the banking sector as a whole. Initially, the BCBS updated the techniques for market risk and credit risk with their revised international regulatory capital accord in 2004 termed as Basel II⁴.

After the financial crisis of 2008, it was proven that Basel II failed due to the lack of public confidence and inadequate disclosures. In 2010, Basel committee of BCBS issued "Basel II: A global regulatory framework for more resilient banks and banking systems" for strengthening the banking stability and growing public confidence (Table 2).

Cardarelli, Elekdag and Lall (2008) constitute a financial stress index in the consequences of the global financial crises based on the average value of 7 equal variables associated with the

stock market return, fluctuations of stock returns, foreign trade, liquidity, sovereign debt spreads, international reserves, and risk and profitability of banking system. Each variable is standard, i.e., demeaned (using arithmetic means) and its value is divided by standard deviations. The unit material is aggregated using the weighted average to produce aggregate financial stress index. Swiss National Bank constitutes a joint stress index for the Swiss banking system and publishes its annual Financial Stability Report regularly. The index measures the level of stress experienced by the banking sector in a specific date, consisting of different variables representing the possible risk factors in the capital market.

Following Illing and Liu (2003) and Van den End (2006) respectively the Bank of Canada and the Netherlands created a measure of financial stability but that were not published in their FSRs. It is advisable that a single measure is capable of flagging crises generally compared to the method used in partial literature. Financial Terms Index of The Netherlandsche Bank's guidelines makes an important contribution towards understanding the financial vulnerabilities. The Bank of England approaches their viewpoint about the stability of the financial system in qualitative terms, which is supported by the quantitative modeling of the key by the cumulative modeling of fundamental weaknesses and

³ CRAR is the capital to risk weighted assets ratio.

⁴ Basel II was published in June, 2004, by the major revision of Basel I for the purpose of safeguarding the credit and operational risk with regard to capital adequacy of banks.

the combined market liquidity index of the financial system. The Federal Reserve System has an index of financial vulnerabilities.

Geršl and Hermánek (2006) recommend in The National Bank's Financial Stability Report in Czech a collective financial stability index based on the IMF's original financial soundness index value. Similarly, the central bank of the Republic of Turkey (2006) creates a financial power index using six sub-indicators spread over asset quality, liquidity, foreign exchange risk, interest rate risk, profitability and capital adequacy. It is seen that the IMF's financial stress index for emerging economy (2009) is quite strong to identify major financial stress-related events in.

1. 1997 (Quarter 4): Asian financial crisis;
2. 1998 (Quarter 2): Russian outer obligation and the collapse of LTCM;
3. 2000: Dot-com crash;
4. 2008 (Quarter 3): Global Financial Tsunami.

3. LIMITATIONS OF STRESS TESTING

Under the larger regulatory capital structure, stress tests are paying attention to banks' capital status - otherwise known as solvent-based testing - are simply a structured tool that is used to evaluate banks against the requirements of this framework. For example, stress tests are not a substitute for a robust capital structure, but a complement to it. Similarly, stress tests cannot replace a strong supervisory regime that ensures banks have adequate risk management and governance processes. Also, stress test results are robust as only used in data and methodologies, and are estimated, in their production. Although the significant progress in the development of these methods in recent years, the theoretical results of the stress test are in line with the high degree of uncertainty. The reason is that the use of the Stress-test result as an input in the process of policy formulation process, in determining the appropriate level of capital of the bank.

In this section, three major areas are considered which policymakers can focus their efforts on developing more developing stress tests to increase the effectiveness of informing micro and macro-prudential policy.

1. Improve stress test ability to determine the elasticity of different banks by various types of, and an extensive range of risks.
2. Convenience and feedback process involves behavioral response in coordination into stress testing.
3. Expand stress test opportunities beyond core banking sector.

4. THE FUTURE OF STRESS TESTING

In the world for the last 25 years to become a key part of the global regulatory toolkit, the stress tests have stimulated from being an isolated risk management tool used by banks to evaluate the elasticity of their business portfolios. But today's stress

tests are not without restrictions, and there are many areas in which for further development can improve their usefulness for policymakers.

5. THE TRENDS OF BANK STRESS TEST: EVIDENCE FROM BANGLADESH

Bangladesh Bank, the central bank of Bangladesh, test the resilience of the banking sector based on extreme but plausible shock scenarios. The regulatory pressure and extreme market competition bound the banking sector to assess their risk and show the sensitivity based on hypothetical extreme scenarios. It counts the stability of banks in catastrophic circumstances so that the economy can tolerate the negative externality by the protection of preventive measures. The risk categories, credit risk, market risk and liquidity risk are tested by some single factor sensitivity stress tests to assess the resilience of the banks. In each scenario, capital to risk-weighted assets ratio (CRAR)⁵⁵ is determined to adjust the presumed shocks and compared with the required amount specified in the regulation. In fact, the regulatory authority and concerned groups paid their attention specifically on credit risk because of its enormous extension, exploration, and existence of risk exposure.

In Bangladesh, there are 57 schedule banks operating their activities including Shimanto Bank Limited which commences on 9 October 2016. As Shimanto Bank Ltd., has not submitted their stress test report yet, they are excluded from the reporting groups. However, it is found that among 56 scheduled banks only 49 banks have been able to meet the regulatory criteria of minimum capital requirements of CRAR, 10%, but remaining 7 banks had a CRAR less than the regulatory limit as at December, 2016 (Financial Stability Report, 2016). It is a matter of sorrow that 12.50% banks were under-capitalized and also 4 banks had negative CRAR because of their cumulative loss and provision shortfall (Chart 1).

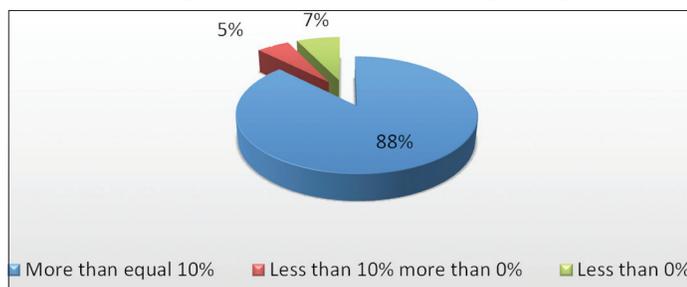
5.1. Credit Risk

Credit risk arising from the default of borrowers in part or full loss of the principal along with potential return in the violation of the contract. This violation of contract can be settled in the court by the judicial interference. So, strong governance mechanism should prevail in the state, and effective enforcement of law and order should be maintained. In fact, proper monitoring and supervision discard the malfunctioning behavior of banks in the financial market and protect the rational investors from speculation. Recent market-based research affirm that credit risk belongs to the highest portion among all sought of risk and affect the economy adversely.

Credit risk affects the banking performance and position in a reversal way to:

1. Statement of comprehensive income/income statement
2. Statement of financial position/balance sheet.

5 This is called the Minor Level Shocks that showed small shock on different risk factor.

Chart 1: Compliance with bank regulatory capital requirement

Source: Author's construction

The income statement is affected by the loss of interest income due to the default of the borrowers. On the other hand, loss of principal amount from the borrowers has lessened the value assets off balance sheet. Therefore, the negligence in credit management process accelerates the financial vulnerability and economic havoc. Every bank developed their own independent credit risk management mechanism to assess their ongoing performance. The risk review process is performed at least twice in a year. The more frequent evaluation or review is needed for the new accounts or the grounds where the borrowers are not well rewound or famous, or there is a chance of higher default.

The study performed the different shocks on bank's capital to assess the vulnerability or severity of financial strength based on a number of credit risk tests.

The Chart 2 showed the status of CRAR and gross non-performing loan (NPL) ratio over the period 2010-2016. It was found that the minimum regulatory capital required for the banking sector as a whole was 9% and increased in the year of 2011 to 10%. It also revealed that the maintained CRAR was sharply decreased in 2012 compared with 2011. In case of gross NPL ratio, there was a positive improvement in 2011 compared to 2010. The amount of NPLs adjusted for provisions and interest play a vital role in estimating the probable risk of banks mentioning the solvency positions. The net NPLs of the banking sector sharply decreased to Tk. 24.59 billion in the year 2011 in comparison with the previous year of Tk. 31.58 billion, indicated a decrease of 22% on year on year basis (Financial Stability Report, 2011). However, the gross NPL ratio moved in a zigzag (volatile) way from 2012 to 2016. The reason was the undue influence, ignoring credit quality and stiff market competition.

Chart 3 showed the probable NPL ratio after minor shock of 4 quarters from the year 2012 to 2016. The historical time trends showed an increasing slope up to mid of 2013 and the green line of the last 2 quarters of 2013 highlighted a tremendously fall of the stressed NPL ratio. Moreover, the current year situation of the calendar year 2016, the gross NPL ratio of the banking sector as a whole was like to rise to 9.50% from the 9.23% under minor shock situation. Therefore, the capital to risk-weighted asset ratio of the banking sector would have declined to 9.94%.

The Chart 4 showed the maintained CRAR⁶ after Shock from the year 2010 to 2016. It is found that the required CRAR in 2010 was 9% whereas from the year 2011 to 2016, the rate was constantly fixed at 10%. In the case of Shock 1, it is found that there was a sharply increasing trend from the year 2010 to 2011 which was 7.9% to 10.07% because of the higher NPL risk. From the year 2012 to 2016, the rate was 9.45%, 10.12%, 10.6%, 10.1%, and 9.94% successively. In the case of Shock 2, there was a gradual increase of CRAR from the year 2010 to 2012 which was 6.4% to 8.38%, but from the year 2013 to 2016 the rate was less volatile. Again, the situation of Shock 3, the CRAR rate was sharply decreased from the year 2010 to 2011 which was 4.7% to 2.69% and then in the year 2012, it became increased to 5.28%. However, the rate was less volatile from the year 2013 to 2016. The shock was not uniformly determined because of the stress rate changes in the year 2012. In the Chart 5, consider the situations where: Shock 1 (NPL increase 5% for the year 2010 and 2011 but 3% for the year 2012 to 2015) Shock 2 (NPL increase by 10% for the year 2010 and 2011 but 9% for the year 2012 to 2015); and Shock 3 (NPL increase by 15%) performed under pressure in the banking system of Bangladesh.

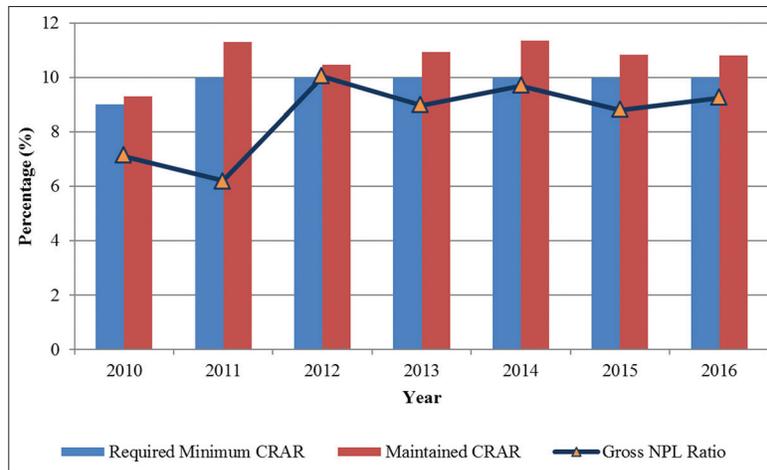
*NPL increases 5% for the year 2010 and 2011 but 3% for the year 2012 to 2015; **NPL increase by 10% for the year 2010 and 2011 but 9% for the year 2012 to 2015; ***NPL increase by 15%.

The trends of the aftershock gross NPL ratio showed the increasing trends over the period of 2010 to 2016. The study revealed that the gross NPL ratio was 7.46% in 2010; 6.51% in 2011; 10.33% in 2012; 9.24% in 2013; 9.98% in 2014; 9.05 in 2015; and 9.5% in 2016 for Shock 1 case; 7.81% in 2010, 6.82% in 2011, 10.93% in 2012, 9.78% in 2013, 10.56% in 2014, 9.58% in 2015, and 10.6% in 2016 for Shock 2 case, and 8.17% in 2010, 7.13% in 2011, 11.53% in 2012, 10.34 in 2013, 11.14% in 2014, 10.11% in 2015, and 10.61% in 2016 for Shock 3 case. It is also found that the diffusion among the Shocks is not greater on gross NPL ratio. In fact, stress test showed the calibration of capital concerning the change in NPLs based on extreme situations. These shocks are deal with the following aspects:

- Firstly, the increase of NPL that also change the provision requirement. It is stated that the extreme three scenarios describe the position where 1%, 2% and 3% on total performing loan directly impact on bad/loss classes with 100% provision.
- Secondly, the negative shift in NPLs classes that also increase the provision. The guideline for this case remarks that the three extreme scenarios will be expressed by the impact of 50%, 80%, and 100% downward shift in NPLs classes.
- Thirdly, the fall of forced sale value (FSV) of mortgage collateral that has a negative effect. The forced sale value is imperatively declined at a shock of 10%, 20%, and 40% of the value of mortgage collateral under all scenarios.
- Fourthly, the increase of NPLs in the area of garments and Textiles concerning provision. It explained the situations

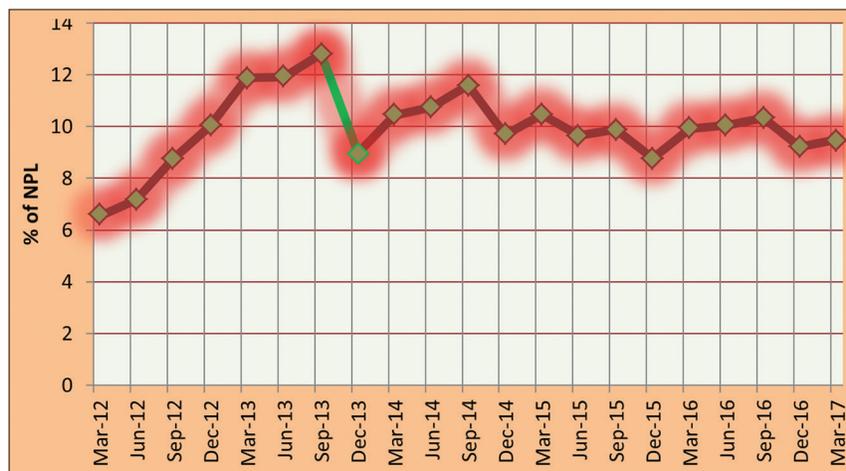
6 The Moderate Level of Shocks that are determined in each risk factor separately.

Chart 2: Capital to risk-weighted assets ratio and non-performing loan ratio: Banking sector as a whole



Source: Financial Stability Report (2010-2016), Bangladesh bank

Chart 3: Probable non-performing loan Ratio After-Minor-Shock



Source: Financial Stability Report (2016), Bangladesh Bank

Chart 4: Maintained capital to risk-weighted assets ratio after shock

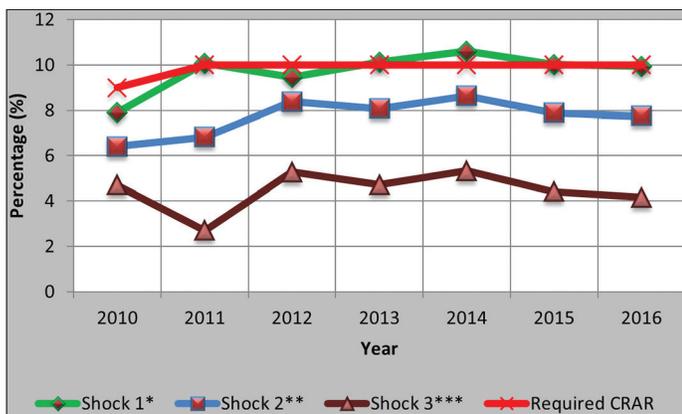
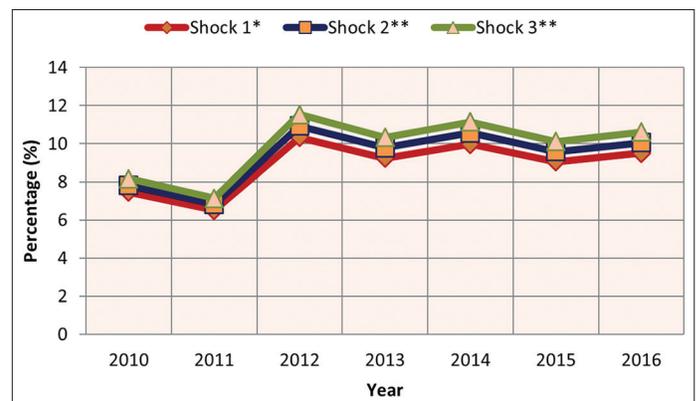


Chart 5: After Shock gross non-performing loan ratio



where 5% 7.5% and 10% of performing loans are downgraded with 100% provisioning.

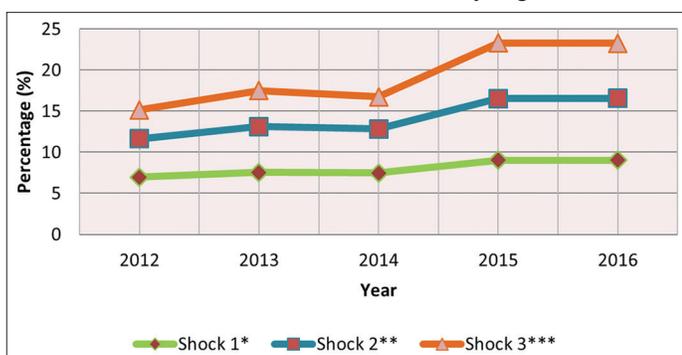
- Fifthly, the increase of NPLs in the position of the default of top

10 borrowers with 100% provision. The provisions are taken under the situations of 5%, 7.5%, and 10% of performing loans that have a negative impact and also considered as bad and loss.

Table 3: Market risk stress test: Interest rate risk

Year	Banking System	Required minimum CRAR	Maintained CRAR	After-Shock CRAR
2016	Before stress scenario	10	10.8	-
	Stress scenarios:	-	-	-
	Shock-1: 1% increase in interest rate	10	10.8	10.45
	Shock-2: 2% increase in interest rate	10	10.8	10.1
2015	Shock-3: 3% increase in interest rate	10	10.84	9.75
	Before stress scenario	10	10.84	-
	Stress scenarios:	-	-	-
	Shock-1: 1% increase in interest rate	10	10.84	10.41
2014	Shock-2: 2% increase in interest rate	10	10.84	9.98
	Shock-3: 3% increase in interest rate	10	10.84	9.54
	Before stress scenario	10	11.35	-
	Stress scenarios:	-	-	-
2013	Shock-1: 1% increase in interest rate	10	11.35	11.3
	Shock-2: 2% increase in interest rate	10	11.35	11.25
	Shock-3: 3% increase in interest rate	10	11.35	11.2
	Before stress scenario	10	10.93	-
2012	Stress scenarios:	-	-	-
	Shock-1: 1% increase in interest rate	10	10.93	-
	Shock-2: 2% increase in interest rate	10	10.46	10.88
	Shock-3: 3% increase in interest rate	10	10.46	10.82
2011	Before stress scenario	10	10.46	10.77
	Stress scenarios:	-	-	-
	Shock-1: 1% increase in interest rate	10	10.46	10.47
	Shock-2: 2% increase in interest rate	10	10.46	10.48
2010	Shock-3: 3% increase in interest rate	10	10.46	10.49
	Before stress scenario	10	11.35	-
	Stress scenarios:	-	-	-
	Shock-1: 1% increase in interest rate	10	11.35	11.32
2010	Shock-2: 2% increase in interest rate	10	11.35	11.29
	Shock-3: 3% increase in interest rate	10	11.35	11.26
	Before stress scenario	10	10.3	-
	Stress scenarios:	-	-	-
2010	Shock-1: 1% increase in interest rate	10	10.3	9.7
	Shock-2: 2% increase in interest rate	10	10.3	9.1
	Shock-3: 3% increase in interest rate	10	10.3	8.5

Source: Financial Stability Report (2010-2016), Financial Stability Department, Bangladesh Bank, CRAR: Capital to risk-weighted assets ratio

Chart 6: Stress tests for credit risk: Default by largest borrowers

- Lastly, the increase of NPLs under extreme situations that have negative effect on capital. In this position, bank capital is used to offset the losses by keeping provisions.

*NPL increase 5% for the year 2010 and 2011 but 3% for the year 2012 to 2015; **NPL increase by 10% for the year 2010 and 2011 but 9% for the year 2012 to 2015; ***NPL increase by 15%.

5.1.1. Stress tests for credit risk: Default by largest borrowers

The Chart 6 showed the extreme three situations, e.g., Shock 1⁷, Shock 2⁸, and Shock 3, where the default of large borrowers are negatively affected the CRAR. In this situation, Shock 1 indicates the effect of the default of top 3 borrowers; Shock 2 is the impact of CRAR of the default of to 7 borrowers and Shock 3 showed the impact of the default of top 10 borrowers. It is showed that from 2012 to 2016, the trend of Shock 1 is gradually increased over time. However, in all the three cases, the trends rapidly increased from the year 2014 to 2015. It also noticeable that the distance between Shock 1 and Shock 2 is higher than the distance between Shock 2 and Shock 3 from the year 2012 to 2016. It revealed that the credit concentration is very high where few numbers of borrowers can affect the entire financial market and banks have very lower bargain power. Most of the banks in the country hide information about the loan fraud. There is also evidence that banks have more than 20% of the actual defaulting

7 This is called the Minor Level Shocks that showed small shock on different risk factor.

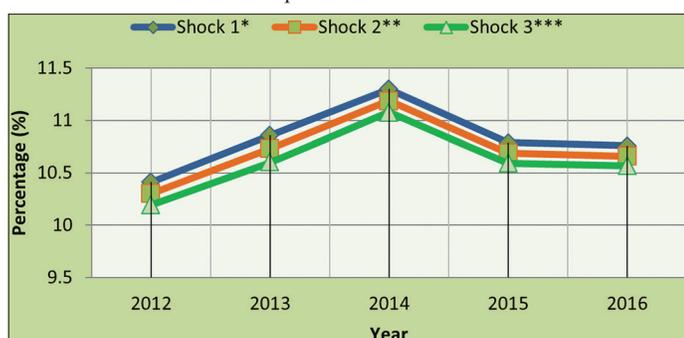
8 The Moderate Level of Shocks that are determined in each risk factor separately.

Table 4: Stress test: Exchange rate risk

Year	Banking system	Required minimum CRAR	Maintained CRAR	After-shock CRAR
2016	Banking system	10	10.8	-
	Stress scenarios:	-	-	-
	Shock-1: Currency appreciation/depreciation by 5%	-	-	10.76
	Shock-2: Currency appreciation/depreciation by 10%	10	10.8	10.71
2015	Shock-3: Currency appreciation/depreciation by 15%	-	-	10.66
	Banking system	10	10.84	-
	Stress scenarios:	-	-	-
	Shock-1: Currency appreciation/depreciation by 5%	-	-	10.8
2014	Shock-2: Currency appreciation/depreciation by 10%	10	10.84	10.75
	Shock-3: Currency appreciation/depreciation by 15%	-	-	10.7
	Banking System	10	11.35	-
	Stress Scenarios:	-	-	-
2013	Shock-1: Currency appreciation/depreciation by 5%	-	-	11.33
	Shock-2: Currency appreciation/depreciation by 10%	10	11.35	11.3
	Shock-3: Currency appreciation/depreciation by 15%	-	-	11.28
	Banking System (47 banks)	10	10.93	-
2012	Stress scenarios:	-	-	-
	Shock-1: Currency appreciation/depreciation by 5%	-	-	10.91
	Shock-2: Currency appreciation/depreciation by 10%	10	10.46	10.88
	Shock-3: Currency appreciation/depreciation by 15%	-	-	10.86
2011	Banking System	10	10.46	-
	Stress scenarios:	-	-	-
	Shock-1: 1% increase in interest rate	-	-	10.44
	Shock-2: 2% increase in interest rate	10	10.46	10.41
2010	Shock-3: 3% increase in interest rate	-	-	10.39
	Banking System	10	11.35	-
	Stress scenarios:	-	-	-
	Shock-1: 1% increase in interest rate	-	-	11.33
2010	Shock-2: 2% increase in interest rate	10	11.35	11.31
	Shock-3: 3% increase in interest rate	-	-	11.3
	Banking System	10	10.3	-
	Stress scenarios:	-	-	-
2010	Shock-1: 1% increase in interest rate	-	-	10.3
	Shock-2: 2% increase in interest rate	10	10.3	10.2
	Shock-3: 3% increase in interest rate	-	-	10.2

Source: Financial Stability Report (2010-2016), Financial Stability Department, Bangladesh Bank. CRAR: Capital to risk-weighted assets ratio

Chart 7: Stress tests for credit risk: Increase in non-performing loan s in particular sector



5.1.2. Stress tests for credit risk: Increase in NPLs in particular sector

The stress test for credit risk is measured by the increase in NPLs in particular sector (garments and textiles). The scenario is depicted aftershock CRAR of the three extreme situations. It is found that from the year 2012 to 2014, there was a sharp increase of CRAR in the three Shock scenarios. However, from the year 2014 to 2016, the trend was downward. It indicates that the garments and textiles sector was highly risky in 2014 and there was a need for CRAR at highest rate. This is the emerging sector in Bangladesh. The reason is that 12.36% of GDP comes from this sector in 2016-2017. So, there is no chance to reduce the loan distribution in the garments and textiles sector as they are the major player in financial growth (Chart 7).

loan rate. However, the rate of failure is only 12%. Finding the reason for not increasing the default credit, the risk of default in the banking sector is increasing due to hiding information. And it has become difficult to resist.

*3 largest borrowers; ** 7 largest borrowers; *** 10 largest borrowers

*3% of performing loans directly downgraded to bad/loss; **9% of performing loans directly downgraded to bad/loss; ***15% of performing loans directly downgraded to bad/loss.

5.2. Market Risk

Market risk is exposed to the interest rate risk (IRR), exchange rate risk (ERR), and equity price risk (EPR). Interest rate risk arises

Table 5: Stress test: Equity price risk

Year	Banking system	Required minimum CRAR	Maintained CRAR	After-Shock CRAR
2016	Banking System	10	10.8	-
	Stress scenarios:	-	-	-
	Shock-1: Fall in the equity prices by 10%			10.52
	Shock-2: Fall in the equity prices by 20%	10	10.8	10.24
2015	Shock-3: Fall in the equity prices by 40%			9.68
	Banking system	10	10.84	-
	Stress scenarios:	-	-	-
	Shock-1: Fall in the equity prices by 10%			10.58
2014	Shock-2: Fall in the equity prices by 20%	10	10.84	10.32
	Shock-3: Fall in the equity prices by 40%			9.79
	Banking System	10	11.35	-
	Stress scenarios:	-	-	-
2013	Shock-1: Fall in the equity prices by 10%			10.92
	Shock-2: Fall in the equity prices by 20%	10	11.35	10.49
	Shock-3: Fall in the equity prices by 40%			9.62
	Banking System (47 banks)	10	10.93	-
2012	Stress scenarios:	-	-	-
	Shock-1: 1% increase in interest rate			10.56
	Shock-2: 2% increase in interest rate	10	10.93	10.18
	Shock-3: 3% increase in interest rate			9.41
2011	Banking System	10	10.46	-
	Stress scenarios:	-	-	-
	Shock-1: 1% increase in interest rate			10.25
	Shock-2: 2% increase in interest rate	10	10.46	10.04
2010	Shock-3: 3% increase in interest rate			9.61
	Banking System	10	11.35	-
	Stress scenarios:	-	-	-
	Shock-1: 1% increase in interest rate			11.13
2010	Shock-2: 2% increase in interest rate	10	11.35	10.9
	Shock-3: 3% increase in interest rate			10.45
	Banking System	10	10.3	-
	Stress scenarios:	-	-	-
2010	Shock-1: 1% increase in interest rate			10.1
	Shock-2: 2% increase in interest rate	10	10.3	10
	Shock-3: 3% increase in interest rate			9.9

Source: Financial Stability Report (2010-2016), Financial Stability Department, Bangladesh Bank. CRAR: Capital to risk-weighted assets ratio

when the value of on-balance sheet and off-balance sheet activities are negatively affected with respect to the change of interest rate. Duration⁹ GAP analysis predicts the vulnerability of banks through the adverse movements of interest rate. The Table 3 showed the market stress test focusing on interest rate risk. It is found that the trend of the interest rate risk was fully backed by the CRAR in all the situations. The noticeable figure was in 2015 where the Shock 2 and Shock 3 CRAR was below the required CRAR, but the overall maintain CRAR was good. In this situation, only 2 or 3 banks are found to be under capitalized.

In exchange rate risk, the impact of change in exchange rate is assessed by the value of bank equity. The net worth of banks including on-

$$9 \quad \text{Duration (D)} = \frac{\sum_{t=1}^n \frac{t * CF_t}{(1 + YTM)^t}}{\sum_{t=1}^n \frac{CF_t}{(1 + YTM)^t}} = \frac{\sum_{t=1}^n \frac{t * CF_t}{(1 + YTM)^t}}{Pv (\text{Security})}; \quad \text{Where,}$$

CF_t = Cash flow at time t; t = the number of periods of time until the cash

flow payment, YTM = the yield to maturity 1 of the security generating the cash flow, and n = the number of cash flows.

balance sheet and off-balance sheet exposure is charged by 5%, 10%, and 15% for minor, moderate and major levels to assess exchange rate risk. It is found that in all soughs of activities exchange rate risk is not severe over the time trends. The maintained CRAR is higher than required and in no respects below the threshold point (Table 4).

The equity price risk is another form of market risk. This form of market risk assessed the impact of fall in stock market index which is crucial for the market stability. The consequences of the outcome have long negative effect on the economy. The loss incurred by the equity price risk is calibrated in CRAR. The Table 5 found that from the year 2010 to 2016, the average maintained CRAR is greater than the average required CRAR which ensures that the risk is not severe enough that can significantly affect the equity position and they are sufficiently backed by regulatory capital.

5.3. Liquidity Risk

In Bangladesh, the liquidity concept of stress test assesses the resilience of banks in the reduction of liquid liabilities. The scenario showed the “liquid assets to liquid liabilities” ratio for both before and after the shock. From the Table 6, it is found that the trend of liquidity risk is in a good position except in the year 2010. To test the resilience of banks, it is assumed that

Table 6: Stress tests: Liquidity risk

Year	Liquidity stress consecutive 5 working days	Stress scenarios		
		Shock 1	Shock 2	Shock 3
2010	Day: 1	1	0	0
	Day: 2	1	0	0
	Day: 3	1	0	0
	Day: 4	1	0	0
	Day: 5	1	0	0
2011	Day: 1	1	1	1
	Day: 2	1	1	1
	Day: 3	1	1	1
	Day: 4	1	1	1
	Day: 5	1	1	1
2012	Day: 1	1	1	1
	Day: 2	1	1	1
	Day: 3	1	1	1
	Day: 4	1	1	1
	Day: 5	1	1	1
2013	Day: 1	1	1	1
	Day: 2	1	1	1
	Day: 3	1	1	1
	Day: 4	1	1	1
	Day: 5	1	1	1
2014	Day: 1	1	1	1
	Day: 2	1	1	1
	Day: 3	1	1	1
	Day: 4	1	1	1
	Day: 5	1	1	1
2015	Day: 1	1	1	1
	Day: 2	1	1	1
	Day: 3	1	1	1
	Day: 4	1	1	1
	Day: 5	1	1	1
2016	Day: 1	1	1	1
	Day: 2	1	1	1
	Day: 3	1	1	1
	Day: 4	1	1	1
	Day: 5	1	1	1

Source: Financial Stability Report (2010-2016), Bangladesh Bank

10%, 20%, 30% deposit has been a withdrawal to check the shock scenarios under three positions. The withdrawal has a significant impact on the banking sector. Only in the year 2010, the resilience of the banks' liquidity ratio was good in the situation where 10% deposit withdrawals but for the situation of Shock 2 (20% of Deposit Withdrawals) or Shock 3 (50% of Deposit Withdrawals) was vulnerable in position. It indicates that in extreme situation, banks will fall in the liquidity crisis. However, from the year 2011 to 2016, the situations were very good, and the banks' have enough liquid assets that could meet the unwanted crisis.

6. CONCLUSIONS

In the evolution of time, the banking sector of Bangladesh lasted 45 years. The number increased, the competition increased, the new banking products came to the market. But with the increase in the field and the extent of such new possibilities as well, there have been numerous new types of risks created. During this time, maintaining stability in the banking sector and increasing efficiency through effective risk management is the common goal of all partner parties.

The financial sector of Bangladesh is basically the banking sector. At present, the banking sector provides financial services through 57 commercial banks. In order to increase banking stability and efficiency, the Bangladesh Bank, the Governing Council, the Board of Directors of the banks and the Bank's Management Authority formulate various strategies and policies, formulate strategies and implement and implement banking services. But in this case, all stakeholders have to think again for the time being required. Especially after the 2008-2009 global financial crises, major changes were made in the face of banking risk management. Besides, the expansion of financial corruption, money laundering concerns and digital security risks are being compounded by the banking system's policy makers and management.

As a regulatory body, the Bangladesh Bank formulated policies and strategies to bring stability to the financial sector, with the formation of monetary policy. Considering the overall risks of the banking sector of Bangladesh, Bangladesh Bank has taken several steps to strengthen the credit sector in the last few years. In order to manage credit risk, many effective measures have been taken in implementing Basel-II and Basel-III and good

governance in debt management. Issues such as money laundering and militant financing, transparent banking, etc. have been given special importance in solving the various problems and risks of the international banking sector. Besides, the use of information technology brought qualitative changes in monitoring and supervision of banking activities. The exchange rate in foreign sector management and foreign exchange rate stability is an important aspect of this time. Besides, a visible change in foreign exchange sector is the continuous increase in the foreign reserves, which is currently equivalent to the import expenditure of about 9 months of Bangladesh.

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