
Draft for Discussion Only

Saudi Arabian Monetary Agency

**Rules on Stress Testing
for Banks**

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Rules on Stress Testing

1. General Requirements:

1.1. Introduction:

Stress testing has become a standard risk management tool for financial institutions. It is being increasingly used as a component of their risk identification and risk management processes. The recent global financial crisis and their impact on financial institutions in many jurisdictions have also highlighted the importance of rigorous stress testing .

SAMA's review of the Internal Capital Adequacy Assessment Plans(ICAAPs) of Saudi banks has indicated that they have started conducting stress tests but the choice of scenarios and their severity vary from bank to bank. The Agency expects banks to adopt robust techniques and scenarios in line with the best practices to further strengthen their stress testing programs. These Rules are being issued to guide banks in this direction.

1.2. Concept of Stress Testing:

Stress tests are conducted by using a set of quantitative techniques to assess the vulnerability of individual financial institutions as well as the financial systems to exceptional but plausible events. The exceptional but plausible events can be defined either against a specific historical scenario or against a hypothetical scenario based on the analysis of past volatility and correlations or by use of other methods. The impact of such events on the profitability and capital adequacy of a financial institution is estimated to assess its capacity to absorb potential losses. The ultimate objective of stress testing is to enable a bank or financial institution to adopt countermeasures that reduce either the probability or the impact of a plausible event to preserve its solvency.

1.3. Objective of the Rules:

The objective of these Rules is to require banks to adopt robust stress testing techniques and use stress tests as a tool of risk management. The results of stress tests should facilitate the management in making well-informed and timely decisions on strategic planning, risk management and capital planning.

1.4. Scope of Application:

The Rules shall be applicable to all locally incorporated banks licensed and operating in Saudi Arabia. Banks may include their subsidiaries and associates in the scope of stress testing if the risks faced by them are material and have bearing on their solvency. Furthermore, the branches of foreign banks operating in Saudi Arabia are also encouraged to adopt these Rules for conducting stress tests. However, they may apply these Rules with such modifications as may be considered expedient keeping in view the size and complexity of their business activities.

SAMA may extend the application of these Rules to any other institution or category of institutions, which are under its supervisory jurisdiction, as may be deemed fit by it from time to time.

These Rules sets out the minimum thresholds to be complied with by banks. However, banks can adopt more sophisticated techniques and scenarios beyond the minimum thresholds specified in these Rules. In addition, banks would continue to take into account the guidance on stress testing provided by SAMA through its circulars on Basel-II implementation.

1.5. Effective Date:

These Rules shall come into force with immediate effect. Banks are expected to create appropriate organizational structure and deploy required resources for designing and developing their stress testing frameworks in line with these Rules.

Banks are also required to put in place a robust stress testing framework, which fully meets the requirements of these Rules, by 31 December 2011. Furthermore, the information required under Section 10 of these Rules shall be submitted to the Agency starting from the half-year ending 31 December 2011 and for each calendar half-year thereafter, within two months of the end of each half-year.

1.6. BCBS Stress Testing Principles:

The Basel Committee on Banking Supervision (BCBS) has issued “Principles for Sound Stress Testing Practices and Supervision” in May 2009. SAMA has circulated these Principles to banks for compliance vide its Circular of 2nd August 2009. In addition to the requirements of these Rules, banks are also required to take into account the guidance provided in the aforesaid Principles and any other related documents of BCBS in designing, developing and implementing their stress testing programs. In case of any inconsistency in the requirements of these Rules and the BCBS Principles, they should approach SAMA for further guidance.

2. Conducting Stress Tests:

2.1. Types of Stress Tests:

The nature of stress tests would depend on the objective(s) of conducting such tests. For the purposes of these Rules, the stress tests would either be conducted by the banks themselves or by SAMA, and would fall in any of the following categories:

- i. *Regular Stress Tests:* Such stress tests would be conducted by the banks either at their own initiative as part of their risk management framework (in which case the nature and frequency of tests is determined by the banks themselves) or to meet the regulatory requirements of SAMA. Such Regular Stress Tests, to be conducted by banks on regular basis, are also called Bottom-up Stress Tests;
- ii. *Ad-hoc Stress Tests:* Such tests may be conducted by the banks at irregular intervals to assess the resilience of their overall portfolio or

exposure to a specific business area in the backdrop of adverse market developments or abrupt changes in the external operating environment. SAMA may also require banks to conduct ad-hoc tests from time to time and report the results thereof to the Agency in the prescribed manner;

- iii. *Reverse Stress Tests*: Such tests may be conducted by the banks to identify the vulnerabilities and assess the resilience of their business plan. The nature of such tests is further elaborated under Section 5.4 of these Rules;
- iv. *Macro Stress Tests*: Such tests may be conducted by SAMA from time to time to assess the resilience of the Saudi banking system to withstand adverse shocks. These tests are also called TopDown stress tests;

2.2. Stress Testing a Mandatory Requirement:

Stress Testing would henceforth be a mandatory regulatory requirement for all locally incorporated banks whereas the branches of foreign banks are also encouraged to conduct appropriate stress tests taking into account the size and composition of their portfolios. In order to meet this requirement, banks are required to conduct stress tests on regular basis. For this purpose, they should design, develop and implement their own stress testing programs in line with the nature, size and complexity of their businesses and risk profiles. The stress testing framework to be developed for this purpose should, inter alia, provide for the following:

- i. State objective(s) of the stress testing exercise;
- ii. Types of stress tests to be conducted;
- iii. Frequency of conducting stress tests;
- iv. Methodologies and techniques to be used including the defined scenarios and assumptions;
- v. Broad format for compiling the results of stress tests;
- vi. Strategy to deal with potential risks highlighted by the stress testing exercise;
- vii. Process for monitoring implementation of the remedial action plan.

2.3. Stress Testing Parameters:

The banks shall observe the following parameters in the context of doing stress testing:

- i. Stress tests should be designed in such a way that banks should be able to identify potential risks in their portfolios by application of exceptional but plausible shocks;
- ii. Stress tests should not be treated as substitutes of statistical models rather they complement them in identification and measurement of business risks. Thus the use of statistical models such as value-at-risk models may be continued to predict the maximum loss in normal business conditions;
- iii. The stress testing methodology should be comprehensive enough to cover all material risks faced by the bank. It should also provide flexibility to capture new risks emanating from diversification in business activities and changing operating environment;
- iv. The use of stress testing is also encouraged for assessing risks in portfolios that lack historical data. The lack of sufficient data may hinder the development of statistical models for such portfolios or the insufficient information / data may compromise the robustness of such models even if developed. Thus the stress testing of such portfolios may provide useful information to the management;
- v. Stress tests should enable the bank to better understand its risk profile, evaluate major risks (both internal and external) and take proactive measures to mitigate those risks. They should also enable the bank to assess the adequacy of its capital;

2.4. Frequency of Stress Tests:

The frequency of stress testing would generally depend on the nature and composition of the bank's portfolio and the risks associated therewith. It would

also depend on the nature of stress tests being conducted. The frequency of Regular or Ad-hoc stress tests conducted by banks at their own initiative may be determined by them in line with their stress testing frameworks and the objective(s) of conducting such tests. However, banks should take into account the latest market developments and their risk profiles in determining the frequency of such stress tests. The market sensitive portfolios e.g. equity investments and other marketable securities, foreign exchange exposures, etc. should be stressed more frequently as against the non-trading portfolios e.g. credit exposures which may be stressed at relatively longer intervals.

The frequency of stress tests to be conducted by banks to meet the requirements of SAMA under these Rules would be as under:

- i. Banks shall conduct stress testing of their portfolio on regular basis at the end of every calendar half-year and report the results thereof to SAMA in the specified manner as required under these Rules;
- ii. Banks shall conduct Ad-hoc stress tests for regulatory purposes on specific business areas or the overall portfolio on such frequency and within such timeline as may be specified by SAMA from time to time.

3. Role of Board and Management:

The board of directors and the senior management of the bank are required to play an important role in putting in place a robust stress testing framework. Specifically, they are expected to do, inter alia, the following:

3.1. Board of Directors:

- i. The board shall have the overall responsibility for the stress testing framework. For this purpose, it will provide the necessary oversight to ensure that the bank has a sound and robust stress testing program in place;

- ii. The board (or a relevant committee of the board) shall approve the stress testing policy of the bank. Such a policy should broadly define the approach, structure and roles for conducting stress tests. It should also appropriately articulate the stress testing framework adopted by the bank which should be in line with its size, complexity of operations, nature of business activities and risk appetite, and also fully captures its risk profile;
- iii. The board shall ensure that the management has devoted adequate resources and created necessary infrastructure for conducting stress tests in an effective manner;
- iv. The board shall also ensure that the management has adopted appropriate processes and procedures for making effective use of stress testing as a risk management tool;
- v. The Board shall review the major findings of the stress tests and ensure that appropriate remedial actions are being taken by the management to mitigate the identified risks;
- vi. The board shall require the management to apprise it from time to time on the effectiveness of the bank's stress testing framework. If deemed appropriate, the board may also require the management to get the stress testing program independently evaluated by the bank's internal audit function or by a third-party consultant to be engaged for this purpose.

3.2. Senior Management:

- i. Senior management shall have the responsibility for designing, developing and implementing an effective stress testing framework. In this regard, it will establish an appropriate organizational structure, deploy qualified human resources, and adopt well-defined processes and procedures for conducting stress tests;
- ii. Senior management should put in place necessary infrastructure and IT systems to support the conduct of stress tests. The infrastructure so provided should be adequate to support compilation and processing of data required for conducting stress tests in an effective manner;

- iii. Senior management should provide oversight in defining the relevant stress scenarios, selection of methodologies and conduct of the stress tests;
- iv. Senior management shall ensure that the results of the stress tests are compiled in a clear and concise manner, and communicated to the board, relevant board and management committees, relevant business areas and other stakeholders;
- v. Senior management shall prepare adequate action plans for dealing with the findings of the stress tests;
- vi. Senior management should periodically assess the effectiveness of the stress testing policy, procedures and framework, and make necessary adjustments therein in line with the market developments and changing business environment, and where-ever required seek approval of the board to the proposed changes. The ultimate objective should be to ensure the robustness and effectiveness of the bank's stress testing program;

4. Stress Testing Framework:

Banks are required to design, develop and implement a sound and robust stress testing frameworks. They are expected to ensure compliance of the following minimum requirements in this regard:

4.1. Approach to Stress Testing:

- i. Banks must adopt an holistic approach to stress testing, which means that all material risks (whether internal or external) to which the bank is or can be exposed to, should be covered in the stress testing process;
- ii. The magnitude of the shock should be large enough to stress exposure of the bank to various risks;
- iii. Banks should aim to capture all exceptional but plausible events in the scenario selection process;

- iv. The stress tests should take into account the recent developments in domestic, regional and global financial markets as well as all other relevant developments;
- v. The time horizon for capturing historical events for stress testing should be long enough to cover a period relevant to the portfolio of the bank;

4.2. Stress Testing Process:

Banks should document the entire process of stress testing for the guidance of the concerned staff. This may become part of the bank's policy on stress testing or included in its standard operating procedures. The process to be laid down by the banks should, inter alia, cover the following points:

- i. Assigning the responsibility for conducting stress tests. This responsibility may be assigned to the Chief Risk Officer who should be supported by a team (which may be an inter-departmental team or a dedicated unit created for this purpose);
- ii. Defining the responsibilities of the team members or individuals involved in stress testing;
- iii. Determining the frequency of regular stress tests in line with the regulatory requirements and also defining the parameters which should lead the bank to conduct ad-hoc stress tests;
- iv. Reviewing the composition and nature of the bank's portfolio as well as the external factors affecting the quality of this portfolio in order to identify the major risks to which the bank is exposed to and which should be tested under its stress testing program;
- v. Reviewing the historical data to identify the past events relevant to the bank's portfolio, which can be used in designing the appropriate stress tests. Banks are expected to compile a time series of relevant data covering at least one business cycle;
- vi. Determining the magnitude of shocks based on the identified historical events, future outlook and expert judgment;

- vii. Deciding on the type of stress tests to be conducted. This would involve a choice to either use a sensitivity analysis or a scenario analysis or a combination of both;
- viii. Listing the assumptions to be used in stress testing and articulating the basis of such assumptions;
- ix. Documenting the procedures for conducting stress tests and compiling the results thereof;
- x. Determining the procedure to be adopted for communicating results of stress tests to the board of directors, senior management, relevant business heads, and SAMA;
- xi. Determining the procedure to be adopted for taking remedial actions to mitigate the potential risks highlighted by the stress tests;
- xii. Laying down the criteria and factors which should lead the bank to review the effectiveness of its stress testing program. This may include, for instance, significant changes in bank's activities or portfolio characteristics or operating environment.

4.3. Designing Stress Tests:

Banks are expected to take into account the following factors in designing their stress testing programs:

- i. The overall stress testing process should be managed/coordinated by the Chief Risk Officer of the bank;
- ii. Stress testing process should identify and stress all relevant risks faced by the bank. This should cover all risks prevalent in the entire portfolio of the bank including both on-balance sheet and off-balance sheet positions;
- iii. The frequency of stress tests should be determined in line with the requirements set out under Section 2.4;
- iv. The stress scenarios should be developed by using both quantitative and qualitative factors and can be based on historical events and/or expert judgment;

- v. The adequacy of IT system and availability of required data for conducting robust stress tests. The IT system should be capable of producing aggregate data at portfolio level as well as granular data at the level of business units;
- vi. The effectiveness of the bank's stress testing framework. The stress testing program may be independently evaluated by the bank's internal audit function or by a third-party consultant engaged for this purpose.

4.4. Other Requirements:

As part of their stress testing frameworks, banks shall also specify the methodologies and techniques to be used, choice of scenarios, coverage of risks, procedures for compiling and communicating results, thresholds and options for taking remedial actions, and the process for compliance of regulatory reporting requirements. Detailed requirements in this regard are set out in the ensuing parts of these Rules.

5. Methodologies and Techniques:

Banks should use appropriate methodologies and techniques for conducting stress tests keeping in view the nature of business activities, size and complexity of operations, and their risk profiles. They may adopt a combination of methodologies and techniques in line with their stress testing frameworks. The methodologies generally employed in this regard are described hereunder:

5.1. Sensitivity Analysis:

Sensitivity Analysis measures the change in the value of portfolio for shocks of various degrees to a single risk factor or a small number of closely related risk factors while the underlying relationships among the risk factors are not evaluated. For example, the shock might be a parallel shift in the yield curve. In sensitivity

analysis, the impact of the shock on the dependent variable i.e. capital is generally estimated.

5.2. Scenario Analysis:

Scenario Analysis measures the change in value of portfolio due to simultaneous moves in a number of risk factors. Scenarios can be designed to encompass both movements in a group of risk factors and the changes in the underlying relationships between these variables (for example correlations and volatilities). Banks may use either the historical scenarios (a backward looking approach) or the hypothetical scenarios (a forward-looking approach) as part of their stress testing frameworks. However, they should be aware of the limitations of each of these scenarios. For example, the historical scenario may become less relevant over time due to the rapid changes in market conditions and external operating environment. On the other hand, the hypothetical scenario may be more relevant and flexible but involves more judgment and may not be backed by empirical evidence.

5.3. Financial Models:

Banks may also use financial models in analyzing the relationships between different risk factors. However, they should exercise due care in selection of the financial or statistical models. The choice of model should take into account, inter alia, the availability of data, nature and composition of the bank's portfolio, and its risk profile.

5.4. Reverse Stress Testing:

Reverse stress testing is used to identify and assess the stress scenarios most likely to cause a bank's current business plan to become unviable. A reverse stress test starts with a specified outcome that challenges the viability of the bank. The analysis would then work backward (reverse engineered) to identify a scenario or combination of scenarios that could bring about such a specified outcome. The

ultimate objective of reverse stress testing is to enable the banks to fully explore the vulnerabilities of their current business plan, take decisions that better integrate business and capital planning, and improve their contingency planning.

Banks are required to reverse stress test their business plan to failure i.e. the point at which the bank becomes unable to carry out its business activities due to the lack of market confidence. While doing this, they must identify a range of adverse circumstances which would cause their business plan to become unviable and assess the likelihood that such events could crystallize. In case the reverse stress testing reveal a risk of business failure that is inconsistent with the bank's risk appetite or tolerance, it must take effective remedial measures to prevent or mitigate that risk. Banks should also document the entire process of reverse stress testing as a part of their stress testing framework.

6. Selection of Scenarios:

Banks should use a range of scenarios for stress testing. The level and severity of scenarios may be varied to identify potential risks and their interactions. The decision of scenarios selection should be taken carefully after taking into account all the relevant factors. In this regard, the following broad parameters are being laid down to ensure consistency in stress testing practices across the banking industry:

6.1. Identification of Risk Factors:

As part of their stress testing process, banks should identify the potential risk factors that have implications for their business activities and can adversely affect the quality of their portfolios. After careful analysis and studying the inter-relationship of various risks to which their business is exposed to, banks are expected to draw a list of the major risk factors that need to be stressed. Few examples of the risk factors are listed below:

- i. Macro-economic factors such as changes in oil price, GDP growth, inflation rate, etc. which may adversely affect the bank's business and the quality of its portfolio;
- ii. Concentration risk which may be due to the concentration of a bank's exposure to few borrowers or a few groups of borrowers or to a particular industrial sector or to a geographic region or country, etc;
- iii. Counterparty credit risk which may be reflected in the relatively high Probability of Default(PD) or high Loss Given Default(LGD) of individual counterparties or of group of counterparties or at the overall bank level;
- iv. Equity price risk arising from volatility in stock market index or major movements in prices of shares to which the bank has significant exposure;
- v. Operational risk which may be due to the internal events such as the IT systems failure, internal frauds, disruption of services, etc. or due to the external events such as disruption of communication network, external frauds, etc;
- vi. Liquidity risk arising from narrow depositors base, adverse cash flows, negative market perceptions or major rating downgrades, etc.

The above examples are for illustration only and the banks are expected to develop their own list of risk factors taking into account the nature of their business activities, the characteristics of their portfolios and their overall risk profiles.

6.2. Levels of Shocks:

Banks may use the following levels of shocks to the individual risk factors taking into account the historical as well as hypothetical movement in the underlying risk factors:

- i. *Mild Level Shocks:* These represent small shocks to the risk factors, which may vary for different risk factors;
- ii. *Moderate Level Shocks:* These represent medium level shocks, the level of which may be defined for each risk factor separately;

- iii. *Severe Level Shocks:* These represent severe shocks to all the risk factors and their level may also be defined separately for each risk factor. Such scenarios may reflect an extreme economic downturn or severe market conditions;
- iv. *Extreme Level Shock:* This scenario measures the change in the risk factor in the worst-case scenario, i.e. the level of shock which entirely wipes out the capital.

Banks are required to invariably choose and apply the three levels of shocks listed at points (i) to (iii) above to each of the identified risk factors. Furthermore, they may apply the extreme level shock listed at point (iv) above if they can identify one or more extreme risk factors which may prove devastating for the bank and have the potential to wipe out its entire capital.

6.3. Magnitude of Shocks:

Banks are required to define the magnitude of the shock to be given to each of the identified risk factors separately for the above levels of shocks. They should take into account the following factors in defining the magnitude of the shock:

- i. While determining the magnitude of shock, banks should review the historical pattern of worst events at portfolio level or at the level of specific business segment but this should not be the sole determinant of shock. Other qualitative factors and expert judgment should also guide this process;
- ii. The time horizon for analyzing historical events should cover at-least one business cycle relevant to the underlying portfolio;
- iii. The magnitude of the shock could be more than the worst historical movement in market value of the relevant portfolio but should not be so large or so small to render the stress testing exercise a hypothetical one;
- iv. The magnitude of the shock should also take into account the prevailing market conditions, current operating environment and future perspectives;

- v. The magnitude of the shock should be adequately varied for different levels of shock to assess the vulnerability of the bank under different scenarios;
- vi. The magnitude of the shocks to be applied to the stress scenarios should be determined with reference to the “baseline” scenario and the magnitude for each level of shock should reflect an increasing level of stress when compared with the “baseline” position.

6.4. Scenario Assumptions:

The results of stress tests and their interpretation is influenced by the underlying assumptions of stress testing. Therefore, banks should clearly outline the assumption made in drawing-up the list of relevant risk factors, determining the magnitude of shocks and the development of scenarios.

6.5. Development of Scenarios:

Banks should develop a set of stress scenarios reflecting increasing levels of severity in line with the levels defined in Para 6.2 above. While developing the stress scenarios, banks should pay due regard to the following factors:

- i. The selected stress scenarios should fully reflect the business environment and risk profile of individual banks;
- ii. The scenarios may be based on historical events reflecting the actual experience of the bank or the banking industry in worst situations with appropriate adjustments, or non-historical/hypothetical ones based on a combination of factors including past experiences, prevailing market trends, future outlook and exercise of judgment;
- iii. All material and significant risk factors having the potential to adversely affect the assets quality and profitability of the bank should be taken into account in scenario development;
- iv. The scenarios should be comprehensive to cover the overall portfolio of the bank as well as its major business areas. Moreover, they should

cover both on-balance sheet and off-balance sheet/contingent exposures;

- v. Stress tests may include scenario(s) that could threaten the viability of the institution (reverse stress testing). Further guidance on selection of such scenario(s) has been provided in Section 5.4.

7. Risk Coverage and Scenarios:

Banks should cover all material and significant risks under their stress testing program. For this purpose, they should identify the major risk factors based on the assessment of their portfolios and its inherent vulnerabilities. The possible risk factors may include those related to credit, market, operational, liquidity and other risks.

Some possible stress scenarios for stressing various risk factors are described in the following paragraphs. The scenarios listed hereunder are only for the reference of banks and should not be construed as an exhaustive list. Banks are expected to develop their own risk factors taking into account the nature of their business activities and the risks associated therewith. They should also determine the methodologies and techniques to be used for stressing the identified risk factors in line with the requirements of these Rules and the prevailing best practices.

7.1. Credit Risk:

Credit risk is historically the most significant risk faced by the Saudi banking system. It is measured by estimating the actual or potential losses arising from the inability or unwillingness of the obligors to meet their credit obligations on time. Banks may choose to conduct stress tests either under Standardized Approach or Internal Rating Based (IRB) Approach of Basel-II. Furthermore, they may use a combination of risk parameters including Exposure at Default (EAD), Probability of Default (PD), Loss Given Default (LGD) and Maturity (M) to measure the credit risk.

Banks should conduct the stress tests on credit risk to estimate the impact of defined scenarios on their asset quality, profitability and capital. For this purpose, both on-balance sheet and off-balance sheet credit exposures should be covered. Some possible scenarios for conducting stress tests on credit risk are listed below:

- i. Decrease in Oil Prices:* Significant decrease in oil prices in the international market may affect the economic indicators of the country and possibly the credit portfolio of banks. The impact of significant reduction in oil prices on the asset quality, profitability and capital adequacy may be assessed;
- ii. Economic Downturn:* The adverse changes in major macro-economic variables may have implications for the quality of credit portfolio of banks. Banks may develop stress scenarios to assess the impact of adverse changes in economic variables like GDP, inflation, unemployment rate, etc. on their asset quality, profitability and capital adequacy. The unemployment rate and inflation may have direct impact on the quality of credit cards and personal loans.;
- iii. Changes in LGDs and other Risk Parameters:* Significant changes in LGDs, PDs, EAD, credit ratings, etc. of the obligors may heighten the credit risk of the bank. Banks may develop scenarios based on adverse changes in these credit risk parameters and assess the impact on their profitability and capital adequacy;
- iv. Significant Increase in NPLs:* Significant increase in non-performing loans (NPLs) due to multiple factors would adversely affect the asset quality and require additional provisioning. Such a scenario may involve increase in aggregate NPLs as well as downgrading all or part of the classified loans falling in various categories of classification by one notch. Banks may develop scenarios based on significant changes in the level of NPLs and their classification categories to assess the resultant impact on their provisioning requirements;
- v. Slowdown in Credit Growth:* Significant reduction in credit growth may adversely affect the income level and profitability. Banks may assess impact of marginal or negative growth in lending on their profitability and capital adequacy;

- vi. *Failure of Counterparties:* Banks may have significant exposure to few counterparties or groups of related counterparties. Furthermore, they might have significant exposure to few industrial sectors or geographic areas. Banks may develop scenarios to assess the impact of failure of their major counterparties or of increased default risk in a particular industry or geographic area on their profitability and capital adequacy.

Banks would develop their own scenarios taking into account the nature, size and mix of their credit portfolio. Furthermore, they should take into account the following factors while conducting stress tests on credit risk:

- i. Stress tests may be conducted to cover the entire credit portfolio or selected credit areas like corporate lending, retail lending, consumer lending, etc. or a combination of both;
- ii. Stress testing of corporate loans portfolio may involve the assessment of creditworthiness of individual borrowers and then aggregating the impact of risk factors on the portfolio level;
- iii. Banks may use financial models to calculate the revised PDs and LGDs based on the selected scenarios and assess the impact thereof on the profitability and capital adequacy of the bank;
- iv. Stress tests on consumer and retail loans may be conducted on portfolio level given the relatively large number and small value of such loans;
- v. Banks having established internal credit rating systems may develop scenarios involving downgrading of the credit ratings of borrowers to assess the impact of identified risk factors on the quality of credit portfolio;
- vi. The extreme but plausible events occurred over a business cycle may be taken into account in developing the relevant scenarios.

7.2. Market Risk:

Market risk arises when the value of on- and off-balance sheet positions of a bank is adversely affected by movements in market rates or prices such as interest rates,

foreign exchange rates, equity prices, credit spreads and/or commodity prices resulting in a loss to earnings and capital of the bank. Banks should conduct stress tests to test the resilience of their on- and off-balance sheet positions that are vulnerable to changes in market rates or prices in stressed situations. The stress tests for market risk may be conducted for the following risk factors:

7.2.1. Interest Rate Risk:

Interest rate risk arises when there is a mismatch between positions, which are subject to interest rate adjustment within a specified period. The vulnerability of an institution towards the adverse movements of the interest rate can be gauged by using duration GAP analysis or similar other interest rate risk models. Interest rate risk may arise due to (i) differences between the timing of rate changes and the timing of cash flows (**re-pricing risk**); (ii) changing rate relationships among different yield curves effecting bank's activities (**basis risk**); (iii) changing rate relationships across the range of maturities (**yield curve risk**); and (iv) interest-related options embedded in bank products (**options risk**). Banks should conduct stress tests for interest rate risk keeping in view the nature and composition of their portfolios. Some plausible scenarios relating to interest rate risk may include the following:

- i. Re-pricing Risk:* Banks may develop stress scenarios to assess the impact on their profitability of the timing differences in interest rate changes and cash flows in respect of fixed and floating rate positions on both assets and liabilities side including off-balance sheet exposures;
- ii. Basis Risk:* This scenario would involve assessing the impact on profitability due to unfavorable differential changes in key market rates;
- iii. Yield Curve Risk:* This scenario may assess the impact on profitability due to parallel shifts in the yield curve (both up and down shifts) and non-parallel shifts in the yield curve (steepening or flattening of the yield curve);

- iv. *Option Risk:* Banks may develop this scenario if they have significant exposure to option instruments. This would involve assessing the impact on profitability due to changes in the value of both stand-alone option instruments (e.g. bond options) and embedded options (e.g. bonds with call or put provisions and loans providing the right of prepayment to the borrowers) due to adverse interest rate movements.

7.2.2. Foreign Exchange Risk:

Foreign Exchange risk is the current or prospective risk to earnings and capital arising from adverse movements in foreign exchange rates. It refers to the impact of adverse movement in exchange rates on the value of open foreign exchange positions. The overall net open position is measured by aggregating the sum of net short positions or the sum of net long positions; whichever is greater regardless of sign.

The stress test for foreign exchange risk assesses the impact of change in exchange rates on the profitability. Such stress test may focus on the overall net open position of the bank including the on-balance sheet and off-balance sheet exposures. Some plausible scenarios relating to foreign exchange risk may include the following:

- i. *Appreciation in Exchange Rates:* Banks may develop stress scenarios to assess the impact of certain assumed levels of appreciation in the relevant exchange rates in case they have significant cross currency exposures;
- ii. *Depreciation in Exchange Rates:* Banks may develop stress scenarios to assess the impact of certain assumed levels of depreciation in the relevant exchange rates on their open foreign exchange positions;

Banks may develop such scenarios based on the significance and level of their open foreign exchange positions.

7.2.3. Equity Price Risk:

Equity price risk is the risk to the earnings or capital of the bank that results from adverse changes in the value of its equity related portfolios. The equity price risk may arise from changes in the value of a bank's equity investment portfolio either due to the adverse movements in the overall level of equity prices/stock markets indices or as a result of the price volatility in shares forming part of the bank's portfolio. Some plausible stress scenarios relating to equity price risk may include the following:

- i. Fall in stock market Indices:* Banks may develop stress scenarios to assess the impact of certain assumed levels of decline in the stock market indices on their earnings and capital;
- ii. Drop in value of portfolio:* If the bank holds an equity portfolio highly concentrated in few sectors or few companies, it may conduct stress tests based on the assumed changes in the related sectoral stock indices or prices of shares forming major part of its portfolio;
- iii. Drop in Collateral Coverage:* Banks active in margin lending may conduct stress tests to assess the impact of decline in stock prices/indices on the collateral coverage level of their margin loans and the resulting impact on their earnings and capital.

While conducting stress tests for equity price risk, banks should cover both the on-balance sheet as well as off-balance sheet equity portfolios.

7.2.4. Commodity Price Risk:

Commodity price risk is the risk to the earnings or capital of the banks, particularly those engaged in Sharia'h compliant banking, that results from the current and future volatility of market values of specific commodities. If a bank is exposed to commodity price fluctuations, it should develop appropriate scenarios to conduct

stress test for commodity price risk. The bank should assess the impact of changes in commodity prices on its profitability and capital adequacy.

7.3.Liquidity Risk:

Liquidity risk is the risk of potential loss to a bank due to either its inability to meet its obligations in a timely manner or its inability to fund increases in assets /conduct a transaction at the prevailing market prices. The liquidity risk may arise from various sources including the significant mismatches in maturity structure of assets and liabilities, changes in interest rates which may encourage depositors to withdraw their deposits to seek better returns elsewhere, downgrading of credit rating and adverse market reputation which may pose challenges in accessing fresh liquidity, etc. Banks should analyze their liquidity position to assess their resilience to cope with stress situations. Some plausible stress scenarios relating to liquidity risk may include the following:

- i. Deposits Withdrawals:* Banks may develop scenarios of significant deposits withdrawals or major shifts in different categories of deposits e.g. from current deposits to term deposits, and analyze their impact on their liquidity and funding costs. The banks may assume different levels of withdrawals for current, savings and term deposits, and for local and foreign currency deposits;
- ii. Tightening of Credit Lines:* The banks which are heavily reliant on inter-bank borrowing should develop scenarios involving tightening or withdrawal of available inter-bank credit lines, identify alternate sources of funding and estimate the impact of such changes on the funding cost and profitability of the bank;
- iii. Significant Maturity Mismatches:* Such scenarios may involve assumed widening of gaps in the overall and individual maturity buckets of total assets and liabilities as well as in the rate sensitive assets and liabilities, and assessing their implications for the liquidity management;
- iv. Repayment Behavior of Borrowers:* Banks may develop scenarios linking the level of projected cash flows with different assumed

patterns of loan repayments. For instance, a stress scenario may assume delayed payment or prepayment of loans by some large borrowers and assess the impact thereof on liquidity position and earnings of the bank.

Banks may assess the resilience of their liquidity position by calculating the ratio of “liquid assets to liquid liabilities” before and after the application of shocks. For this purpose, the liquid assets are the assets that can be easily and cheaply turned into cash and includes cash, balances with other banks and SAMA, inter-bank lending/placements, lending under repo and investment in government securities. The liquid liabilities includes the short-term deposits and borrowings. The ratio of liquid assets to liquid liabilities may be recalculated under each scenario to analyze the changes in liquidity position.

7.4. Operational Risk:

Operational risk is the risk of loss resulting from both internal and external operational events including e.g. technology failures, business disruption and system failures, breaches in internal controls, frauds, or other operational problems that may result in unexpected losses for the bank. The banks should systematically track and record frequency, severity and other information on operational loss events to provide a meaningful information for assessing the bank’s exposure to operational risk and developing a policy to mitigate / control that risk.

Banks should develop stress scenarios for operational risk stress tests based on the data of their past operational loss events and using professional judgment. The assumptions for operational risk stress tests would be different from those used in credit and market risk stress tests, and should be based on historical and plausible hypothetical operational loss events. A plausible stress scenario may assume a major business disruption or system failure (e.g. due to hardware or software failure or telecommunication problems) and assesses the effects of such disruptions /failures on the earnings and capital of the bank. Any additional capital requirements emanating from the outcome of operational risk stress tests should be taken into account in the capital planning process.

7.5. Other Risks:

The risks and scenarios mentioned above are for the guidance of banks and this list may not be exhaustive. Banks are encouraged to identify any other risks and vulnerabilities related to their business and develop appropriate scenarios to stress those risks. They should identify the sources of risks using the guidance provided in these Rules and their own experiences, and then narrow down the list to significant risks potentially having material impact on their business and financial condition. Focusing on the material risks would enable banks to conduct the stress testing exercise in a meaningful way.

8. Compilation and Communication of Results:

Banks should compile and communicate the stress testing results in a clear and concise manner. The stress testing exercise should provide an estimate of the expected losses under defined scenarios by using the appropriate methodologies and techniques. The impact of the stress tests should be measured on the following indicators of the bank:

- i. assets quality – increase/decrease in classified assets and the infection ratio;
- ii. profitability – increase/decrease in the accounting profit/loss;
- iii. capital adequacy – measured in terms of the changes in total amount of capital and the Basel-II Capital Adequacy Ratio (CAR);
- iv. liquidity position – measured in terms of changes in key liquidity indicators and any funding gaps.

Banks should communicate the results of stress tests to both internal stakeholders and SAMA. The internal stakeholders for this purpose should include, inter alia, the board of directors, senior management, chief risk officer and the relevant heads of business areas. The communication of results to SAMA will be made as part of

the regulatory reporting on stress testing as specified under Section 10 of these Rules.

While communicating the results of stress tests to the above internal stakeholders and SAMA, banks should clearly specify the following:

- i. The bank's approach to stress testing;
- ii. Scenarios used;
- iii. Underlying assumptions;
- iv. Methodologies and techniques used;
- v. Any limitations of the stress testing process.

Banks should also exercise due care in interpreting the results of stress tests. They should be fully aware of the limitations of the stress testing exercise. The stress testing involves a significant amount of judgment and its effectiveness would largely depend on the expertise of the conductors of stress tests, the quality of data, and choice of right scenarios. Therefore, the designing of remedial actions for redressing the issues highlighted by the stress tests should take into account these factors.

Banks would also suitably reflect the results of stress tests conducted under these Rules in their Internal Capital Adequacy Assessment Plan (ICAAP) document to be submitted to SAMA on annual basis.

9. Remedial Actions:

Banks are required to take appropriate remedial action(s) to address potential risks and vulnerabilities identified by the stress testing results. They should lay down well-defined procedures to determine the nature and timing of the possible remedial actions. Furthermore, they should take into account the following factors in devising their remedial action plans:

- i. The remedial actions identified to mitigate the adverse effects of stress tests should be realistic and implementable within the defined timeline. All relevant factors which may affect the usefulness of

- identified actions should be taken into account and, if needed, back-up plans are prepared to counter their adverse effects;
- ii. The adequacy of existing capital buffers and possible sources of raising capital, if needed, should be assessed. This should be compared with any additional capital requirements under stressed conditions;
 - iii. The practicality of remedial actions under stressed conditions should be evaluated. This should be done carefully as some of the actions available in normal situations may not be workable in a period of stress;
 - iv. The possible remedial actions to be taken may vary depending on the nature and significance of the identified risks/vulnerabilities. These may include, for example, tightening of credit policy to reduce credit risk, revisiting of business growth plans or growth plans in a particular business area, raising additional capital to absorb potential losses, identifying alternate funding sources to mitigate potential liquidity risk, etc.;
 - v. The decision to take or not to take a remedial action should be duly justified and the mechanism adopted to arrive at such decision be properly documented;
 - vi. Banks should estimate the impact of identified actions on their profitability and solvency as well as on the overall financial condition to understand the implications of such actions. In case of significant divergence from the planned results, they may resort to alternate options to achieve the desired results;
 - vii. The results of stress tests should be reflected in the policies and risk tolerance limits set by the management;
 - viii. Banks may also set out the minimum thresholds or triggers (e.g. the impact on profitability or capital) for initiating the identified remedial actions. The process to be adopted and the level of authority for taking such actions should also be clearly defined;

All the identified risks and vulnerabilities may not necessarily require a remedial action particularly if the impact thereof on the bank is not significant. If the bank decides not to take an immediate action to address a potential risk, it should closely

monitor the position and the post stress tests developments to ensure that the emerging position would not adversely affect its business. Furthermore, banks should have contingency plans in place to cope with any unexpected developments.

10. Regulatory Reporting:

Banks are required to submit the following information to SAMA:

- i. Statement providing Data for conducting Top-Down stress tests by the Agency as per the prescribed format (the format to be separately communicated electronically);
- ii. Statement providing results of the Bottom-up stress tests conducted by banks on the format attached as Annexure-I to these Rules;
- iii. Half-yearly / yearly financial statements prepared by banks on their standard formats.

The above information will be submitted to the Director, Banking Supervision Department on calendar half-yearly basis i.e. half-year ending 30th June / 31st December, within two months of the end of every half-year. The first such return for the half year ending 31st December 2011 shall be submitted by 28th February 2012.

11. Top-Down or Macro Stress Testing:

SAMA views stress testing as an important tool for not only strengthening the risk management frameworks in individual banks but also for assessing the resilience of the overall banking system under stressful conditions. Therefore, in addition to the bottom-up stress testing by banks, SAMA would also conduct Top-Down stress tests. For this purpose, it has adopted a holistic approach comprising of following three key components:

- i. *Use of Bottom-up Stress Testing Results:* Banks are required to submit their bottom-up stress testing results to SAMA which will be used by it in identifying and analyzing the potential vulnerabilities in the banking system and their systemic implications;

- ii. *Requiring Banks to Run Specified Scenarios:* SAMA may require banks to run the specified scenarios on their portfolios to assess the plausibility of certain events. In this regard, SAMA may require banks from time to time to conduct specified sensitivity tests for individual businesses/portfolio segments or scenario tests on the overall portfolio. Banks are required to submit the results of such tests to SAMA in the prescribed manner. These results may be used by the Agency to assess vulnerabilities in the banking system;
- iii. *System-wide Stress Testing:* SAMA may conduct its own stress tests based on the macro-economic data available with it and the banking data collected from banks.

Based on the findings of its Top-Down stress tests and supervisory reviews, SAMA may provide additional guidance to banks on their stress testing programs during bilateral meetings on their ICAAPs or through separate communications.

12. Implementation and Monitoring:

SAMA will assess the effectiveness of the banks' stress testing programs as part of its supervisory review process and during bilateral meetings on their ICAAP documents. The Agency may also review the stress testing frameworks of banks during their on-site examinations. In conducting such a review, the Agency shall assess the efforts made by banks in embedding the requirements of these Rules into their risk management frameworks. Furthermore, the review may also cover the following aspects of the banks' stress testing programs:

- i. The nature and complexity of business activities and the overall risk profile of the bank;
- ii. Evaluation of the organizational structure and resources deployed for conducting stress tests;
- iii. The adequacy of stress scenarios and methodologies adopted by the bank for its stress testing program;
- iv. The relevance and appropriateness of the assumptions made for stress testing;
- v. The adequacy of the frequency and timing of stress testing to support timely remedial actions;

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- vi. The effectiveness of the policy, procedures and processes for conducting stress tests, compiling results and making use of the findings thereof;
- vii. The level of involvement of the board and the senior management in the stress testing program;
- viii. Assessment of the degree of compliance with these Rules;
- ix. Any other matters related to stress testing program and risk management framework of the bank.

SAMA would determine the timing and frequency of conducting stress testing reviews for individual banks keeping in view the progress made in implementation of these Rules and the robustness of stress testing program of each bank.

Annexure-I

Name of the Bank:-----

**Stress Testing Results: Half-yearly Reporting to SAMA
As of 30 June / 31 December -----**

I. Stress testing Framework:

Salient features of the stress testing framework adopted by the bank should be described in this section. This would include, inter alia, a description of the organizational structure for conducting stress tests, composition of the stress testing team and their responsibilities, nature and frequency of stress tests, coverage of the portfolio, etc.

II. Stress Testing Methodologies:

A description of the methodologies and techniques used for conducting stress tests should be provided in this section. This should be done in the light of guidance provided under Section 5 of the Rules.

III. Scenarios and Assumptions:

A description of the stress testing scenarios and the underlying assumptions made by the bank for conducting stress tests should be provided in this section. This should be done, inter alia, in the light of guidance provided under Section 6 of the Rules.

IV. Risk Factors:

The major risk factors identified by the bank based on the assessment of its portfolio and the inherent vulnerabilities should be described in this section. It may also be elaborated as to why the identified risks are considered relevant for the bank and why the other significant risks generally faced by banks are not considered relevant by the bank. This should be done, inter alia, in the light of guidance provided under Section 6 & 7 of the Rules.

V. Stress Testing Results:

A summary of the results of stress tests should be provided in this section. This would include, inter alia, the following:

- i. Listing of the levels of shocks used and the magnitude of shock applied for each level. This should be provided separately for each of the stressed risk factored;
- ii. The estimated impact of the stress testing results on asset quality, liquidity, profitability and capital of the bank. The impact may be estimated based on the financial statements of the relevant reporting date i.e. as of 30th June or 31st December, based on which the half-yearly report would be submitted to SAMA;
- iii. The results should contain both absolute amounts and key financial ratios e.g. NPLs to loans, liquid assets to liabilities, statutory liquidity ratio, return on assets, capital to risk weighted assets, etc. The results should provide both pre-stressed as well as stressed positions. They should also be in line with the regulatory requirements of SAMA;
- iv. Listing of any violation of the SAMA's regulatory ratios or any other requirements based on the stressed positions;
- v. Any other information based on the stress testing results which the bank considers significant and would like to share with SAMA.

VI. Communication of Results:

A confirmation to the effect that the results of the stress tests have been communicated to the board of directors, key senior management members, and relevant business heads of the bank should be provided.

VII. Remedial Actions:

Remedial action(s), if any, already taken by the bank to address potential risks and vulnerabilities identified by the stress testing results may be described in this section. Any planned remedial action(s) along with the expected timeline for their completion may also be described.