



भारतीय रिज़र्व बैंक

RESERVE BANK OF INDIA

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December 2, 2013

All Scheduled Commercial Banks  
(excluding RRBs)

Dear Sir,

### **Guidelines on Stress Testing**

Please refer to the guidelines on stress testing issued vide [circular DBOD.No.BP.BC.101/21.04.103/2006-07 dated June 26, 2007](#). Banks were required to operationalise their formal stress testing framework in accordance with these guidelines from March 31, 2008. It was expected that the stress testing framework being set up would help banks in building a sound and forward looking risk management framework.

2. The depth and duration of the recent global financial crisis has led many banks and supervisory authorities across the world to question whether the existing stress testing practices were sufficient and robust to cope with rapidly changing circumstances. In particular, the crisis was far more severe in many respects than was assumed by banks for their stress testing and consequently the weaknesses in stress testing practices impaired their resilience. Against this backdrop, the Basel Committee on Banking Supervision (BCBS) issued the Principles for Sound Stress Testing Practices and Supervision in May 2009. In tune with these principles, the extant guidelines on stress testing have been updated. Annex 1 contains guidelines on overall objectives, governance, design and implementation of stress testing programmes.

व्यक्तिग परिचालन और विकास विभाग, केन्द्रीय कार्यालय, 12वीं मंजिल, केन्द्रीय कार्यालय भवन, शाहीद भगतसिंह मार्ग, मुंबई-400001  
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बैंक हिन्दी में भी पत्राचार का स्वागत करता है। हिन्दी आसान है, इसका प्रयोग बढ़ाइये।

3. All banks are required to carry out the stress tests involving shocks prescribed in Annex 2, at a minimum. Though a bank should assess its resilience to withstand shocks of all levels of severity indicated therein, the bank should be able to survive, at least the baseline shocks.

4. Further, RBI would expect the degree of sophistication adopted by banks in their stress testing programmes to be commensurate with the nature, scope, scale and the degree of complexity in the bank's business operations and the risks associated with those operations. The broad approach which could be considered by banks in formulating their stress testing programmes is enumerated in Annex 3 which classifies banks into three groups based on the size.

5. Banks are expected to adopt these guidelines on stress testing from April 1, 2014.

Yours faithfully,

(Chandan Sinha)  
Principal Chief General Manager

Encl: a/a

### **Guidelines to Banks on Stress Testing**

The overall objectives, governance, design and implementation of stress testing programmes as well as issues relating to stress testing of individual risks and products are presented below:

#### **1. Introduction and Background**

##### **1.1. General**

**1.1.1** Stress testing is commonly described as the evaluation of a bank's financial position under a severe but plausible scenario to assist in decision making within the bank. It enables a bank in forward looking assessment of risks, which overcomes the limitations of statistical risk measures or models based mainly on historical data and assumptions. It also facilitates internal and external communication and helps senior management understand the condition of the bank in the stressed time. Moreover, stress testing outputs are used by a bank in decision making process in terms of potential actions like risk mitigation techniques, contingency plans, capital and liquidity management in stressed conditions, etc. It was, therefore, included as an important element of risk management framework and capital planning in the Basel Committee on Banking Supervision (BCBS) document titled 'An International Convergence of Capital Measurement and Capital Standards: A Revised Framework' known as Basel II'.

**1.1.2** The 2007-08 global financial crisis has brought into sharp focus the imperativeness of a rigorous and stringent stress testing programme for banks. The magnitude of the financial crisis has led many banks and supervisory authorities to question whether stress testing practices were sufficient prior to the crisis and whether they were adequate to cope with rapidly changing circumstances. A number of initiatives including G20's November 2008 action plan have strongly advocated raising the level and sophistication of stress testing programmes to make them realistic and meaningful.

**1.1.3** Stress testing should form an integral part of the internal capital adequacy assessment process (ICAAP), which requires banks to undertake rigorous, forward-looking stress testing that identifies severe events or changes in market conditions that could adversely impact the bank. The ICAAP should demonstrate that stress testing reports provide the senior management with a thorough understanding of the material risks to which the bank may be exposed. Stress testing should also be a central tool in identifying, measuring and controlling funding liquidity risks, in particular for assessing the bank's liquidity profile and the adequacy of liquidity buffers in case of both bank-specific and market-wide stress events.

**1.1.4** These guidelines, applicable both at solo as well as group level, would be considered by the Reserve Bank to review the suitability of stress testing programmes and resultant actions including the requirement of additional capital and liquidity buffers as part of Supervisory Review and Evaluation Process (SREP) under the Basel II framework. Banks may perform the stress tests in terms of these guidelines at least at half yearly intervals.

## **1.2 Objective**

**1.2.1** The development and implementation of a stress-testing programme would require defining the main objectives of stress-testing, which should cover, among other things, assisting in risk identification and control, complementing other risk management tools, improving capital and liquidity planning, and facilitating business decision-making.

**1.2.2** Stress testing which is based on forward looking approach should provide a complementary and independent risk perspective to other risk management tools such as value-at-risk (VaR) and economic capital. Stress tests should complement risk management approaches that are based on complex, quantitative models using backward looking data and estimated statistical relationships. It should be used to assess the robustness of models to possible changes in the economic and financial environment. In particular, appropriate stress tests should challenge the projected risk characteristics of new products where limited historical data are available. Banks should

also simulate stress scenarios in which the model-embedded statistical relationships break down as has been observed during the financial market crisis.

**1.2.3** Stress tests should play an important role in the communication of risk within the bank and external communication with supervisors to provide support for internal and regulatory capital adequacy assessments.

## **2. Governance**

### **2.1 Board and Senior Management Involvement**

**2.1.1** The ultimate responsibility for overall stress testing programme in a bank rests with the board of directors of the bank and with the Chief Executive Officer in the case of the foreign banks with branch presence in India. Senior management may be accountable for the programme's implementation, management and oversight. It is emphasised that the involvement of the Board and Senior management is critical for the success and effectiveness of stress testing programme.

**2.1.2** On practical considerations, some aspects of stress testing, such as design of methodologies, identification of risk factors, implementation, potential actions, etc., may be delegated. However, the board should actively participate in setting stress testing objectives, defining scenarios, discussing the results of stress tests in the context of bank's risk profile, assessing potential actions and decision making. The board/committees of board must therefore engage in the discussion of modelling assumptions and are expected to question assumptions underlying the stress tests from a common/business sense perspective e.g. whether assumptions about correlations in a stressed environment are reasonable. The Board should also take responsibility for identifying and agreeing credible management intervention and mitigating actions.

### **2.2 Integration of Stress Testing in Risk Governance and Risk Management Processes of a Bank**

**2.2.1** To promote risk identification and control, stress testing should be included in risk management activities of a bank at various levels of aggregation or complexity. This includes the use of stress testing for the risk management of individual or groups of

borrowers and transactions, for portfolio risk management, as well as for risk management of business lines or business strategy. In particular, it should be used to address existing or potential firm-wide risk exposures and concentrations.

**2.2.2** Stress tests should be used to support a range of decisions. Board and senior management should be made aware of the limitations of underlying assumptions of stress tests, the methodologies used and an evaluation of the impact of stress tests. It is thus important that senior management participates in the review and identification of potential stress scenarios and contributes to risk mitigating strategies. Stress tests should be used as an input for setting the risk appetite of the firm or setting exposure limits and to support the evaluation of strategic choices when undertaking and discussing longer term business planning. Importantly, stress tests should feed into the capital and liquidity planning process.

## **2.3 Internal Policies & Procedures and Documentation**

**2.3.1** The stress testing programme should be governed by internal policies and procedures that are appropriately documented.

**2.3.2** The following aspects should be detailed in policies and procedures governing the stress testing programme:

- (i) the type and specification of stress testing and scenarios and the main purpose / objective of each component of the programme;
- (ii) frequency of stress testing exercises which is likely to vary depending on type and purpose;
- (iii) the methodological details of each component, including the definition of relevant scenarios and the role of expert judgement; and
- (iv) the range of remedial actions envisaged, based on the purpose, type and result of the stress testing, including an assessment of the feasibility of corrective actions in stress situations.

**2.3.3** A bank should document the underlying assumptions and fundamental elements for each stress testing exercise. These include the reasoning and judgments underlying the chosen scenarios and the sensitivity of stress testing results to the range and severity of the scenarios. An evaluation of such fundamental assumptions should be performed regularly or in light of changes in the risk characteristics of the bank or its external conditions and documented.

## **2.4 An Appropriate and Flexible Infrastructure**

**2.4.1** Commensurate with the principle of proportionality, a bank should have suitably flexible infrastructure like IT system, qualified professionals, as well as data of appropriate quality and granularity. Banks should have adequate MIS in place to support the stress testing framework. Banks must ensure that they devote sufficient resources to developing and maintaining such infrastructures to enable the bank on a timely basis to modify methodologies to apply new scenarios as needed. The infrastructure should also be sufficiently flexible to allow for targeted or ad-hoc stress tests at the business line or firm-wide level to assess specific risks in times of stress.

## **3. Design**

**3.1.1** The identification of relevant stress events, the application of sound modelling approaches and the appropriate use of stress testing results require the collaboration of different senior experts within a bank. The unit with responsibility for implementing the stress testing programme should organise appropriate dialogue among these experts, challenge their opinions, check them for consistency (e.g. with other relevant stress tests) and decide on the design and the implementation of the stress tests, ensuring an adequate balance between usefulness, accuracy, comprehensiveness and tractability.

**3.1.2** There are broadly two categories of stress tests used in banks viz. **sensitivity tests** and **scenario tests**.

**3.1.3** Sensitivity analysis estimates the impact on a bank's financial position due to predefined movements in a single risk factor like interest rate, foreign exchange rate or equity prices, shift in probabilities of defaults (PDs), etc. In the sensitivity analysis,

generally, the source of the shock on risk factors is not identified and usually, the underlying relationship between different risk factors or correlation is not considered or ignored. For example, the impact of adverse movement in interest rate or foreign exchange rate on profitability is considered separately but the fact that movement in interest rate and foreign exchange rate is inter-related is ignored to keep stress test simple. These tests can be run relatively quickly and form an approximation of the impact on the bank of a move in a risk driver.

**3.1.4** Banks should identify relevant risk drivers in particular: macro-economic risk drivers (e.g. interest rates, foreign exchange rates), credit risk drivers (e.g. impact of monsoon or a shift in PDs), financial risk drivers (e.g. increased volatility in financial markets), operational risk drivers (e.g. natural disaster, terrorist attack, collapse of communication systems across the entire region / country, etc.), and external events other than operational risk events (e.g. sudden drying up of external funding, sovereign downgrade, market events, events affecting regional areas or industry, global events, etc).

**3.1.5** Banks should then stress the identified risk drivers using different degrees of severity. For example, a sensitivity test might explore the impact of varying declines in equity prices such as by 40%, 50%, 60% or a range of increases in interest rates such as by 100, 200, 300 basis points. The severity of single risk factor is likely to be influenced by long-term historical experience but banks are advised to supplement this with hypothetical assumptions of wide range of possibilities to test their vulnerability to specific risk factors.

**3.1.6** Banks can conduct sensitivity analyses at the level of individual exposures, portfolios or business units, as well as firm-wide, against specific risk areas as sensitivity analysis is likely to lend itself to risk-specific stress testing. It is likely to be influenced by purpose of stress testing.

**3.1.7** Single factor analysis can be supplemented by simple multi-factor sensitivity analyses, where a combined occurrence of some risk drivers is assumed, without



necessarily having a scenario in mind. While banks classified under Group C\* may use multi-factor sensitivity analysis as an option, banks classified under Group B and Group A should invariably use multi-factor sensitivity analysis as part of their stress testing.

**3.1.8** In utilising this technique, a bank must be mindful of the correlations between the various risk factors and ensure that these are taken into consideration when developing the underlying assumptions used in the stress scenarios.

**3.1.9** An effective stress testing programme should comprise scenarios along a spectrum of events and severity levels. It helps deepen management's understanding of vulnerabilities and the effect of non-linear loss profiles.

## **3.2 Review of Stress Testing**

**3.2.1** As the environment in which banks are operating is quite dynamic, the stress testing framework should be reviewed periodically, both qualitatively and quantitatively, to determine its efficacy and to consider the need for modifying any of the elements. The framework should be subjected to at least annual reviews which should cover, among others, the following aspects:

- (i) the effectiveness of the programme in meeting its intended purposes;
- (ii) integration of the stress testing in the risk management processes;
- (iii) realistic levels of stress applied;
- (iv) systems implementation;
- (v) management oversight;
- (vi) data quality and MIS;
- (vii) documentation;
- (viii) business and/or managerial assumptions used; and
- (ix) any other assumptions used.

**3.2.2** The quantitative processes should include benchmarking with other stress tests within and outside the bank.

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\* For grouping banks into A, B and C, please see Annex 3.

**3.2.3** Since the stress test development and maintenance processes often imply judgmental and expert decisions (e.g. assumptions to be tested, calibration of the stress, etc.), the independent control functions such as risk management and internal audit should also play a key role in the process.

**3.2.4** An important corollary of review and assessment of stress testing programmes involves updatation of the processes to keep them relevant and meaningful and suitable to the requirements of the bank.

## **4. Coverage**

### **4.1 Use of a Suite of Techniques & Methodologies**

**4.1.1** Banks in general should use multiple perspectives and a range of techniques and methodologies in order to achieve comprehensive coverage in their stress testing programme.

**4.1.2** The suite may include quantitative and qualitative techniques to support and complement the use of models and to extend stress testing to areas where effective risk management requires greater use of judgments. For example, it may contain a narrative scenario which should include various trigger events, such as monetary policy, financial sector developments, commodity prices, political events, global events, monsoon and natural disasters.

**4.1.3** Stress tests should range from simple sensitivity analysis to more complex stress tests like scenario analysis with system-wide interactions and feedback effects. Some stress tests should be run at regular intervals while the stress testing programme should also allow for the possibility of ad hoc stress testing. Stress testing should include various time horizons depending on the risk characteristics of the analysed exposures and purposes.

**4.1.4** Banks are expected to employ a combination of stress testing techniques that are most appropriate to the size and complexity of their business activities, as also the objectives in mind.

## **4.2 Forward Looking Scenario**

**4.2.1** The stress testing programme should cover forward-looking scenarios to incorporate different possibilities of multi-level stress tests, changes in portfolio composition, new information and emerging risk possibilities. These are generally not covered by relying on historical risk management or replicating previous stress episodes. However, historical scenarios (where a range of risk drivers are moved simultaneously) may provide useful information on the way risk drivers behave collectively in a crisis and they may therefore be useful to assess the assumptions of an internal capital model, and in particular correlation estimates.

**4.2.2** The compilation of forward-looking scenarios requires combining the knowledge and judgment of experts across the organisation. Further, as the statistical relationships used to derive the probability tend to break down in stressed conditions, giving appropriate weight to expert judgment in defining relevant scenarios with a forward looking perspective thus becomes critical.

**4.2.3** Forward looking scenarios of varying severity and for various purposes can be designed by calibrating historically observed macro-economic and financial variables, internal risk parameters, losses, etc. The formulation of realistic and imaginative scenarios requires at minimum the following two steps indicated in paragraphs 4.2.4 and 4.2.5 below:

**4.2.4** Banks should take into account both the systematic and institution-specific changes in the present and near future scenarios to be forward-looking. For this purpose, the following aspects are relevant:

- (i) All the material risk factors e.g. credit risk, market risk, operational risk, interest rate risk, liquidity risk, etc. that a bank may be exposed to should be stressed. In this regard, the results obtained from single factor analyses may be used to identify scenarios that include a set of highly plausible risk factors. No material risk factor should be left unstressed or unconsidered.
- (ii) Identified risk drivers should behave in ways which are consistent with the other risk drivers in a stress.

- (iii) All bank-specific vulnerabilities should be identified and analysed. These should take the regional and sectoral characteristics of a bank into account as well as consider specific product or business line exposures and funding policies.
- (iv) Banks should take into account developments in technology such as newly developed and sophisticated financial products and their interaction with the valuation of more traditional products.
- (v) The chosen scenario should be applied to all positions e.g. on- and off-balance sheet exposure of a bank.

**4.2.5** Banks should identify and develop appropriate and meaningful mechanisms to convert scenarios into relevant internal risk parameters and potential losses. It should also be tested regularly to check their reliability. For this purpose, the following aspects are relevant:

- (i) Banks should make realistic explicit estimates/assumptions about the correlation between underlying macro-economic and financial variables such as interest rates, exchange rate, global oil prices, GDP, monsoon, equity, consumer and asset prices, capital flows, etc.
- (ii) The transformation of external variables or institution-specific events into internal losses or increased risk measures on consistent basis is a challenging task. Banks should be aware of the possible dynamic interactions among risk drivers, the effects on earnings and on- and off-balance sheet position.
- (iii) The links between underlying economic factors and internal risk parameters are likely to be based primarily on institutional experience and analysis, which may be supplemented by external research. Benchmarks, such as those based on external research, may be quantitative or qualitative.
- (iv) Considering the complexity involved in modelling hypothetical and macro-economic based scenarios, banks should be aware of the model risk involved. A regular and conservative expert review of the model's assumptions and mechanics are important as well as a conservative modelling approach to account for model risk.

- (v) Where a wide variety of models, supporting formulas and varying assumptions are used, banks should consider ways to streamline their stress testing programmes to improve transparency and simplicity.

#### **4.3 System-wide Interactions and Feedback Effects**

**4.3.1** The strong links between the real economy and financial economy as well as the process of globalisation have amplified the need to look at system-wide interactions and feedback effects. The stress test should explicitly identify interdependences, e.g. among regions, among sectors and among markets. The overall scenario should take into account system-wide dynamics – such as leverage building up across the system, closure of certain markets, risk concentrations in a whole asset class such as mortgages, and adverse feedback dynamics, for example through interactions among valuations, losses, margining requirements and insurance relations.

**4.3.2** The above analysis can be very difficult to model quantitatively. Thus, banks may make qualitative assessments of the second order effects of stress. Such assumptions should be documented and reviewed by senior management.

#### **4.4 Levels of Severity in Scenarios**

**4.4.1** Stress testing should be based on exceptional but plausible events. However, their stress testing programme should cover a range of scenarios with different severities including scenarios calibrated against the most adverse movements in individual risk drivers experienced over a long historical period. Where appropriate, a bank might consider a scenario with a severe economic downturn and/or a system-wide shock to liquidity.

**4.4.2** In developing severe downturn scenarios banks should also consider plausibility. For example, as an economy enters recession banks should not necessarily always assume a further specific level of stress. There may be times when the stressed scenario is close to the base case scenario, but supplemented with specific shocks (e.g. interest rates, exchange rates), which should be reflected in the scenarios.

**4.4.3** Some of the scenarios that can be constructed from historical disturbances or events of significance may be the 1973 world oil crisis, 1973-74 stock market crisis, the secondary banking crisis of 1973-75 in UK, the default of Latin American countries on their debt in the early 1980s, the Japanese property bubble of the 1980s, the 1987 Market Crash, the Scandinavian banking crisis of 1990s, the 1991 external payments crisis in India, the securities scam of 1991-92 in India, the ERM crises of 1992 and 1993, the fall in bond markets in 1994, the 1994 economic crisis in Mexico, the 1997 Asian Crisis, the 1998 Russian Crisis, 26/11 2001 U.S. Crisis, the sub-prime mortgage crisis of 2007-2008 turning into severe recession, debt crisis of Greece in 2010, etc. Scenarios may also contain some risk factors or variables which were specially observed during financial crisis of 2007-08:

- (i) Scenarios to include significant strategic or reputational risk in particular for significant business lines;
- (ii) Scenarios to include, where relevant, an episode of financial market turbulence or a shock to market liquidity;
- (iii) Scenarios under which capital might not be freely transferable within banking groups in periods of severe downturn or extended market disruption;
- (iv) Scenarios under which a crisis impairs the ability of even very healthy banks to raise funds at reasonable cost;
- (v) Scenarios under which model-embedded statistical relationships break down;
- (vi) Scenarios under which risk characteristics of new products projected on the basis of limited historical data are challenged;
- (vii) Scenarios to include simultaneous pressures in funding and asset markets, and the impact of a reduction in market liquidity on exposure valuation, etc.

**4.4.4** Some of the scenarios can be designed from the specific observed/imaginative risk parameters or events like:

- domestic economic downturn, economic downturn of major economies to which the bank is directly exposed or to which the domestic economy is related;

- decline in the prospects of sectors to which the banks are having significant exposures, increase in level of NPAs and provisioning levels, rating downgrades, failure of major counterparties;
- timing difference in interest rate changes (repricing risk), unfavourable differential changes in key interest rates (basis risk), parallel / non parallel yield curve shifts (yield curve risk), changes in the values of standalone and embedded options (option risk), adverse changes in exchange rates of major currencies, decline in market liquidity for financial instruments, stock market declines, tightening of market liquidity;
- significant operational risk events viz. bank-specific or market-wide cyber attacks, increasing fraud risk in an economic downturn like increase in credit card frauds, internet banking frauds and litigation, rogue trader scenarios, damage to tangible assets due to a natural disaster say tsunami.

## **4.5 Reverse Stress Testing**

**4.5.1** Reverse stress testing is a technique that involves assuming worst stressed outcome and tracing the extreme event/shocks that bring the maximum impact. Reverse stress testing starts from an outcome of business failure and identifies circumstances where this might occur. It is seen as one of the risk management tools usefully complementing the “usual” stress testing, which examines outcomes of predetermined scenarios. Reverse stress testing is not expected to result in capital planning instead it is primarily designed as a risk management tool in identifying scenarios and underlying dynamism of risk drivers in those scenarios, that could cause an institution’s business model to fail.

**4.5.2** It is a useful tool in risk management as it helps understand potential vulnerabilities and fault lines in the business, including ‘tail risks’. It will also be useful in assessing assumptions made about the business model, business strategy and the capital plan. The results of reverse stress test may be used for monitoring and contingency planning.

**4.5.3** Reverse stress testing should be carried out regularly by large and complex banks i.e., Group A banks, to investigate the risk factors that wipe out their capital resources and also make their business unviable. As a starting point reverse stress testing is likely to be carried out in a more qualitative manner than other types of stress testing. As experience is developed this should then be mapped into more sophisticated qualitative and quantitative approaches developed for other stress testing.

## **4.6 Complex and Bespoke Products**

**4.6.1** Banks mistakenly assess the risk of some products by relying on external credit ratings or historically observed credit spreads related to (seemingly) similar products like corporate bonds with the same external rating. Such approaches cannot capture relevant risk characteristics of complex, structured products under severely stressed conditions.

**4.6.2** Stress tests for securitised assets should consider the underlying asset pools, their exposure to systematic market factors, relevant contractual arrangements and embedded triggers, and the impact of leverage, particularly as it relates to the subordination level of the specific tranches in the issue structure.

## **4.7 Pipeline and Warehousing Risk**

**4.7.1** The stress testing programme should cover pipeline and warehousing risks associated with securitization activities. A bank should include such exposures in its stress tests regardless of their probability of being securitised.

## **4.8 Reputational and Other Off-Balance Sheet Risks**

**4.8.1** To mitigate reputational spill-over effects and maintain market confidence, a bank should develop methodologies to measure the effect of reputational risk on other risk types, with a particular focus on credit, liquidity and market risks. For instance, a bank should include non-contractual off-balance sheet exposures in its stress tests to determine the effect on its credit, liquidity and market risk profiles.

**4.8.2** Banks should carefully assess the risks associated with commitments to off-balance sheet vehicles e.g. structured credit securities and the possibility that assets



will need to be taken on balance sheet for reputational reasons. Therefore, in its stress testing programme, a bank should include scenarios assessing the size and soundness of such vehicles relative to its own financial, liquidity and regulatory capital positions. This analysis should include structural, solvency, liquidity and other risk issues, including the effects of covenants and triggers.

#### **4.9 Risks from Leveraged Counterparties**

**4.9.1** A bank may have large gross exposures to leveraged counterparties including financial guarantors, investment banks and derivatives counterparties that may be particularly exposed to specific asset types and market movements. In case of severe market shocks, these exposures may increase abruptly and potential cross-correlation of the creditworthiness of such counterparties with the risks of assets being hedged may emerge (i.e. wrong-way risk). The bank should enhance its stress testing approaches related to these counterparties in order to capture adequately such correlated tail risks.

#### **4.10 Management Intervention Action**

**4.10.1** The performance of risk mitigating techniques like hedging, netting and the use of collateral should be challenged and assessed systematically under stressed conditions when markets may not be fully functioning and multiple institutions could simultaneously be pursuing similar risk mitigating strategies.

**Single Factor Stress Tests to be carried out by banks**

The stress testing framework and methodology in each bank should be tailored to suit the size, complexity, risk philosophy, risk perceptions and skills in each bank. However, banks have to necessarily apply the shocks indicated in this annex to their portfolios. These shocks are based on one or more of the following: (i) the aggregate experience of Indian banks since 2007 (ii) Stress tests carried out by IMF to assess Financial System Stability (iii) BCBS guidelines (iv) International best practices. The shocks have been simplified here considering the differences in types of banks in India, their business models and sophistication levels. Most of the shocks are indicated in three levels of severity - Baseline, Medium and Severe.

2. Banks may also endeavour to assess their resilience to the possibility of more than one shock materialising simultaneously. Banks which have already realised shocks more severe than the ones indicated here should have them built into their stress testing framework as baseline shocks and apply more stringent shocks to make the stress testing exercise meaningful. Banks with advanced capabilities may adopt more sophisticated methodologies for stress testing.

**3. Sensitivity Analysis - Shocks****3.1 Credit Risk**

The stress test for credit risk aims to assess the impact of macro-economic cycles as well as bank specific factors on bank's financial performance – be it capital adequacy or profitability. In an economic downturn, the major risk factors facing the banks are the credit downgrades of the counterparties, deterioration in the asset quality and erosion in the collateral value. On the other hand, in an economic upturn, there is likely to be a sense of exuberance on the backup of under-pricing of risk, leading to excessive credit growth in select sensitive sectors. To address this excessive sectoral credit growth, provisioning and/or risk weights on the exposure to these select sensitive sectors may be increased and

banks should be in a position to factor in such a rise during the economic upturn. Against this backdrop, banks may at the minimum carry out the following stress tests on their credit portfolio.

**Shock 1:** Increase in NPAs - Credit quality generally tends to deteriorate during economic downturn as debtors begin to experience cash flow problems which in turn affect smooth servicing of debt leading to a possible deterioration in asset quality.

Net NPA increase by 50 (**Baseline**), 100 (**Medium**), and 150 (**Severe**) percent, and simultaneous increase in provisioning to 1 percent for standard loans; 30 percent – for substandard loans; and 100 percent for doubtful loans over one-year period.

**Shock 2:** Increase in NPA in Top Five Industries – Some industries are more affected by economic downturn and experience problems in servicing of debt.

Additional 3 (**Baseline**) and 5 (**Medium**) percentage points increase in Net NPAs in top five industries.

**Shock 3:** Increase in NPA in Specific Sectors – Some sectors undergo stress due to idiosyncratic factors.

Additional 3 (**Baseline**) and 5 (**Medium**) percentage points increase in Net NPAs in specific sectors: Agriculture, Power, Real Estate, Telecom and Roads.

**Shock 4:** Slippage of Restructured Standard Assets – Assets which have undergone stress and are restructured are more prone to deterioration in asset quality.

Additional slippages in restructured standard assets – 20 per cent (**Baseline**), 30 per cent (**Medium**) and 40 per cent (**Severe**) of restructured standard assets.

**Shock 5:** Depletion in collateral

Depletion in collateral value by 10 per cent (**Baseline**), 15 per cent (**Medium**), 20 per cent (**Severe**)

**Shock 6:** Downgrade in counter-party rating - In a down turn, bank's counterparties may suffer credit downgrade awarded by an external CRA or internally.

Uniform downgrade of borrowers by one notch across all rating grades – 5 per cent (**Baseline**), 10 per cent (**Medium**), 20 per cent (**Severe**) of all borrowers.

**Shock 7:** Concentration Risk – Individual borrowers

Default by largest single borrowers – Default by top one (**Baseline**), top two (**Medium**), top three (**Severe**) borrower

**Shock 8:** Concentration Risk – Group

Default by largest group borrower – Default by top three company-member of the group (**Baseline**), top five company-members of the group (**Medium**), all company-members of the group (**Severe**)

**Shock 9:** Concentration Risk – Industries/Sectors

Default in all exposures to largest industries/sectors – Default by topmost industry/ sector (**Baseline**), top three industries/sectors (**Medium**), top five industries/sectors (**Severe**).

### **3.2 Market Risk**

The prime objective is to study the impact of stress test on Profit and Loss account.

#### **A. Foreign Exchange Risk**

Forex risk arises from exchange rate changes adversely impacting the local currency denominated bank's assets and liabilities. The Stress Test evaluates the impact of exchange rate variations on the bank's net open position and also on bank's profitability.

**Shock 1: Depreciation of Indian rupee**

- **Baseline:** 15 per cent depreciation in 30 days
- **Medium:** 20 per cent depreciation in 30 days
- **Severe:** 25 per cent depreciation in 30 days

**Shock 2: Appreciation of Indian rupee**

- **Baseline:** 15 per cent appreciation in 30 days
- **Medium:** 20 per cent appreciation in 30 days
- **Severe:** 25 per cent appreciation in 30 days

**Reverse Stress Testing**

How much depreciation would be necessary for Tier I capital to move down to 3 per cent over 60 days?

**B. Interest Rate Risk**

Interest rate risk is the risk where changes in market interest rates might adversely affect a bank's financial condition. The immediate impact of changes in interest rates is on bank's earnings through changes in its Net Interest Income (NII). A long-term impact of changes in interest rates is on bank's Market Value of Equity (MVE) or Net worth through changes in the economic value of its, liabilities and off-balance sheet positions. The interest rate risk, when viewed from these two perspectives, is known as 'earnings perspective' and 'economic value' perspective, respectively.

Banks should conduct sensitivity analysis using methods that reflect their specific interest rate risk characteristics using gap analyses or simulation techniques. Banks should at a minimum assess their resilience using the baseline factors given below:

## **Interest rate risk for both trading and banking book**

**Shock 1:** Parallel upward/downward shift of IND yield curve in bps

**Baseline** 250; **Medium:** 300; **Severe** 400

**Shock 2:** Steepening of IND yield curve

100 bps linearly spread between 15-day and over 25-year maturities

**Shock 3:** An Inversion of the yield curve

One -year rates up 250 bps and 10-year rates down 100 bps

### **C. Equity Price Risk**

**Shock:** Decline in equity prices across the board

**Baseline:** 40 per cent; **Medium:** 50 per cent; **Severe:** 60 per cent

## **3.3 Liquidity Risk**

Whether a bank can be regarded as having sufficient liquidity depends to a great extent on its ability to meet obligations under a funding crisis. Therefore, in addition to conducting cash-flow projections to monitor net funding requirements under normal business conditions, banks should perform stress tests regularly by conducting projections based on “what if” scenarios on their liquidity positions to

- identify sources of potential liquidity strain;
- ensure that current liquidity risk exposures remain in accordance with the established liquidity risk tolerance; and
- analyse any possible impact of future liquidity stresses on their cash flows, liquidity position, profitability and solvency.

### ***Institution-specific crisis scenarios***

An institution-specific crisis scenario should cover situations that could arise from a bank experiencing either real or perceived problems which affect public confidence in the bank and its firm-wide or group-wide operations. It should represent the bank’s view of the behaviour of its cash flows in a severe crisis. A

key assumption is that many of the bank's liabilities cannot be rolled over or replaced, resulting in the need to utilise its liquidity cushion.

For retail banks, this scenario will likely entail an acute deposit run. Such a scenario would typically include the following characteristics:

- significant daily run-off rates for deposits, with increasing requests from customers to redeem their time deposits before maturity;
- interbank deposits repaid at maturity;
- no new unsecured or secured funding obtainable from the market; and
- forced sale of marketable securities at discounted prices.

Foreign banks (including branches and subsidiaries of foreign banking groups) should, in particular, assess the effects of a group-wide crisis scenario on their liquidity positions. This scenario assumes that an institution-specific stress event is affecting the global operations of the banking group (i.e. with problems spilling over the whole banking group). In a group-wide crisis, a default position would be that no intragroup or head office funding support can be assumed to be available.

There are other institution-specific scenarios that are less severe in the short term but may subject a bank to longer-term liquidity pressures. These scenarios may be triggered by possible changes in the market and public perceptions of a bank that affect its access to funds or cause a gradual drain on its liquidity. Banks are encouraged to take account of different scenarios applicable to their own circumstances as part of the ongoing liquidity risk management process.

### ***General market crisis scenarios***

A general market crisis scenario is one where liquidity at a large number of financial institutions in one or more markets is affected. Characteristics of this scenario may include –

- a market-wide liquidity squeeze, with severe contraction in the availability of secured and unsecured funding sources, and a simultaneous drying up of market liquidity in some previously highly liquid markets;
- counterparty defaults;
- substantial discounts needed to sell or repo assets and wide differences in funding access among banks due to the occurrence of a severe tiering of their perceived credit quality (i.e. flight to quality);
- restrictions on currency convertibility; and
- severe operational or settlement disruptions affecting one or more payment or settlement systems.

Banks should be aware that the cash-flow patterns of certain assets and liabilities may behave quite differently in the case of a general market crisis scenario as compared with the institution-specific crisis scenario. For example, a bank may have less control over the level and timing of future cash flows from the sale of marketable debt securities under a general market crisis scenario. This could be due to the fact that only very few market participants would be willing or would have sufficient liquidity to purchase securities. Hence, banks should assign appropriate discount factors to such assets to reflect the price risk associated with different stress scenarios. Moreover, the impact of a general market crisis on individual banks may differ. For example, a bank with a strong market reputation may benefit from a flight to quality as depositors seek a safe haven for their funds.

### ***Combined scenarios***

Banks are expected to incorporate a third type of scenario into their stress tests which bears the characteristics of both an institution-specific crisis and a general market crisis. Although this combined scenario may reflect a set of very adverse circumstances that could plausibly happen to any bank in terms of liquidity impact, it will generally be inappropriate for banks to adopt an “additive approach” in designing the scenario, viz., simply by summing up the underlying assumptions and estimated impacts of an institution-specific scenario and a general market



risk scenario. Banks should consider making appropriate adjustments under the combined scenario to modulate the severity of assumptions used commonly for the institution-specific and the general market crisis scenarios, having regard to how the various stress circumstances may interact in the scenario.

The following are some relevant factors that could be considered:

- As a greater number of financial institutions in the market will be affected by the crisis, this may change the way in which some institution-specific stress elements are to be structured. For example, instead of a quick but severe bank run, there may be a less acute, but more persistent and protracted run-off of customer deposits.
- Even lower realisable values of assets may result as the bank concerned seeks to sell or repo large quantities of assets when the relevant asset markets become less liquid and market participants are generally in need of liquidity.

### ***Minimum stress period***

The ability of a bank to honour its immediate commitments at least for the initial period when the stress is likely to be most acute is crucial for its later survival. As such, it is expected that a bank should have sufficient funds (including those that can be generated from its available liquid assets and other funding sources) to cover its liquidity needs and to enable it to continue its business for a certain minimum stress period under each of the crisis scenarios, without resorting to emergency liquidity assistance from the RBI. A bank should assume the minimum stress period for an institution-specific crisis scenario to last for no less than five business days, and that for a general market crisis scenario and a combined scenario, no less than one calendar month. Banks should adopt longer minimum stress periods if their liquidity risk profile warrants this.

## Liquidity risk stress test

### A. Outflows

| 1. |   | Run-off factor                  |        |        |
|----|---|---------------------------------|--------|--------|
|    |   | Baseline                        | Medium | Severe |
|    | Partial loss of retail deposits <sup>1</sup>  |                                 |        |        |
|    | Stable <sup>2</sup>   | 5%                              | 10%    | 20%    |
|    | Unstable <sup>3</sup>   | 10%                             | 20%    | 40%    |
| 2. | Partial loss of wholesale deposits <sup>4</sup>   |                                 |        |        |
|    | Stable  | 5%                              | 10%    | 20%    |
|    | Unstable  | 10%                             | 20%    | 40%    |
| 3. | Partial loss of secured short term financing like Repo and CBLO   |                                 |        |        |
|    | Non-financial corporate bonds with any counterparty   | 15%                             | 30%    | 60%    |
|    | Non- Level 1 asset <sup>5</sup> or non-Level 2A asset <sup>6</sup> with domestic sovereigns, multilateral development banks or domestic PSEs as a counterparty. | 25%                             | 50%    | 100%   |
|    | Securitised instrument including RMBS   | 25%                             | 50%    | 100%   |
|    | Other level 2B asset <sup>7</sup>   | 50%                             | 75%    | 100%   |
|    | All other assets  | 100%                            | 100%   | 100%   |
| 4. | Market valuation changes on derivative transaction including change in collateral value posted for derivative transactions                                      | Look back approach <sup>8</sup> |        |        |
| 5. | Unscheduled draws on committed but unused credit and liquidity facilities   |                                 |        |        |
|    | Retail and small <sup>9</sup> business customers  | 5%                              | 10%    | 20%    |
|    | Credit facility to non-financial corporates, PSEs, and MDBs.  | 10%                             | 20%    | 40%    |
|    | Credit facilities to banks subject to prudential supervision  | 40%                             | 70%    | 100%   |
|    | Credit facilities to other financial institutions   | 40%                             | 80%    | 100%   |
|    | Liquidity facilities to other financial institutions  | 100%                            | 100%   | 100%   |
|    | Liquidity facility to non-financial corporates, PSEs and MDBs.  | 30%                             | 60%    | 100%   |
|    | Credit and liquidity facilities to other legal entities   | 100%                            | 100%   | 100%   |

## B. Inflows

|                           | Instruments   | Haircut  |        |        |
|---------------------------|---|----------|--------|--------|
| Securities held under HFT |   |          |        |        |
|                           |   | Baseline | Medium | Severe |
| 1.                        | Corporate bond with rating AA-or higher                                       | 15%      | 30%    | 60%    |
| 2.                        | Corporate bond with rating between A+ and BBB-                                | 50%      | 75%    | 100%   |
| 3.                        | Securitised instruments including RMBS  | 25%      | 50%    | 100%   |
| 4.                        | Equity shares   | 50%      | 100%   | 100%   |
| 5.                        | Securities/loans maturing within 30 days and held under AFS and HTM category. | As above |        |        |

<sup>1</sup>Retail deposits are defined as deposits placed with a bank by a natural person.

<sup>2</sup>Stable deposits are insured deposits in transactional accounts (eg. Accounts where salaries are automatically credited/deposits are in accounts where salaries are paid out from) or relationship based accounts (eg. The deposit customer has another relationship with the bank say a loan).

<sup>3</sup>All deposits other than stable deposits are unstable deposits.

<sup>4</sup>Unsecured wholesale funding is defined as funding/deposits from non-natural persons i.e. legal entities including sole proprietorship and partnerships.

<sup>5</sup>Level 1 asset include cash, Government securities and a portion (to be notified separately) of SLR deposits

<sup>6</sup>Level 2A assets includes marketable non-financial sector corporate bonds rated AA-or better and marketable securities assigned 20% risk weight under Basel II standardised approach.

<sup>7</sup>Level 2B assets includes securitised instrument including RMBS, corporate bond rated between A+ and BBB-, equity shares and commercial paper.

<sup>8</sup> Cash outflows arising out of margin and collateral requirements in the derivative exposures may be quite significant. Banks should identify the risk factors impacting the valuation of derivatives contracts in their portfolio (like interest rates, forex rates, volatilities, etc.) and generate the movements in these risk factors based on past distribution of movement of these risk factors. For base line scenario movements in the risk factors projections could be at 95% confidence interval, for medium scenarios movements in the risk factors projections could be based on 99% confidence interval and for severe scenarios, projections should be based on 99.9 % confidence interval. Collateral/Margin requirements based on these scenarios should then be calculated.

<sup>9</sup>Small business is one where the total average annual turnover is less than Rs.50 crore as defined in RBI Master Circular on New Capital Adequacy Framework (NCAF).

**Classification of banks for the purpose of stress testing**

Banks have been classified into three groups as given below:

Group A – Bank with Total Risk Weighted Assets of more than Rs.2000 billion

Group B – Bank with Total Risk Weighted Assets between Rs.500 billion and  
Rs.2000 billion

Group C – Bank with Total Risk Weighted Assets less than Rs.500 billion

2. A bank that falls under Group C should, at least, conduct simple sensitivity analyses of the specific risk types to which it is most exposed. This will allow such a bank to identify, assess and test its resilience to shocks relating to the material risks to which its portfolios are exposed. However, in developing its stress testing programmes, the bank should still consider interactions between risks, for example intra- or inter-risk concentrations, rather than focus on the analysis of risk factors in isolation. Even if the complexities of correlation among many of risk types are not clearly understood, an attempt should be made to qualitatively analyse the interactions among risk types and their impact on the portfolios. It is also expected that though the bank may not be able to perform complex firm-wide scenario based stress tests, it should at least, address firm-wide stress testing in a qualitative manner.

3. A bank that falls under Group B, in addition to what is described in paragraph 2 above, should conduct multifactor sensitivity analysis and simple scenario analyses of the portfolios with respect to simultaneous movements in multiple risk factors caused by an event. The bank should select a sufficiently realistic scenario which can impact its portfolios. Such a bank may also do qualitative analysis with respect to reverse stress testing as discussed in these guidelines. Moreover, the bank is expected to carry out both qualitative and quantitative analysis of correlations among risk types, feedback effects, etc. to get meaningful results from stress testing programmes.

4. A bank that falls under Group A should carry on stress testing programmes with all the complexities and severities required for programmes to be realistic and meaningful. These banks are expected to have an appropriate infrastructure in place to undertake a variety of stress testing approaches that are covered in these guidelines from simple portfolio based sensitivity analyses to complex macro scenario driven firm-wide exercises. Moreover, these institutions are expected to include in their stress testing programmes rigorous firm-wide stress tests covering all material risks and entities, as well as the interactions between different risk types. The banks are expected to conduct reverse stress testing on a regular basis. While those Group A banks which have been conducting such stress may continue doing so, those which have not yet commenced such stress tests are expected to start doing so from April 1, 2015.

5. There may be banks in any of the above categories, which may be part of the Group or/and operating internationally. Additional firm-wide stress testing programmes for such groups should be conducted at consolidated level to understand the risk at aggregate level and implications for the group. As other domestic and foreign regulators would be involved in such consolidated entities, they are expected to discuss the stress testing issues with the concerned regulators.