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Madam / Sir,

Governance, measurement and management of Interest Rate Risk in Banking Book

Interest Rate Risk in Banking Book (IRRBB) refers to the current or prospective risk to banks' capital and earnings arising from adverse movements in interest rates that affect its banking book positions. Excessive IRRBB can pose a significant risk to banks' current capital base and/or future earnings. These guidelines, accordingly, require banks to measure, monitor, and disclose their exposure to IRRBB.

2. The final guidelines on Interest Rate Risk in Banking Book (IRRBB), in alignment with the revised framework issued by the Basel Committee on Banking Supervision (BCBS), are enclosed in Annex.

3. **Commencement**

(a) The date for implementation will be communicated in due course. Banks are advised to be in preparedness for measuring, monitoring, and disclosing their exposure to interest rate risk in the banking book in terms of this circular.

(b) Ahead of the implementation, banks shall submit the disclosures stipulated in Table B of Appendix-3 to the Department of Regulation, Reserve Bank of India (by e-mail: mrgdor@rbi.org.in) within two months from the end of the respective quarter, as per following schedule:

Entities	Frequency	Return to be submitted from the quarter ended
D-SIBs	Quarterly	March 2023
Other Banks	Quarterly	June 2023

4. It may be noted that the extant instructions on interest rate risk management issued vide circular DBOD.No.BP.BC.8/21.04.098/99 dated February 10, 1999 on 'Asset Liability Management (ALM) system' which require banks to undertake Traditional Gap Analysis and circular DBOD.No.BP.BC.59/21.04.098/2010-11 dated November 04, 2010 on 'Guidelines on Banks' Asset Liability Management Framework - Interest Rate Risk' which require banks to undertake Duration Gap Analysis, shall be phased out post implementation of these guidelines, the details of which shall be advised in due course.

Applicability

5. This circular is applicable to all commercial banks (other than Regional Rural Banks, Small Finance Banks, Payments Banks and Local Area Banks).

(Usha Janakiraman)
Chief General Manager

Annex

Governance, measurement and management of Interest Rate Risk in Banking Book

1. Introduction

1.1 Interest Rate Risk in Banking Book (IRRBB) refers to the current or prospective risk to banks' capital and earnings arising from adverse movements in interest rates that affect its banking book positions. When interest rates change, the present value and timing of future cash flows change. These changes in turn affect the underlying value of banks' rate sensitive assets, liabilities, and off-balance sheet items and, hence, their economic value (EV). Changes in interest rates also affect banks' earnings by altering interest rate-sensitive income and expenses, affecting their net interest income (NII). Excessive IRRBB can pose a significant risk to banks' current capital base and/or future earnings if not managed appropriately. These guidelines, accordingly, require banks to measure, monitor, and disclose their exposure to IRRBB in terms of potential change in Economic Value of Equity (ΔEVE) and Net Interest Income (ΔNII), computed based on a set of prescribed interest rate shock scenarios.

1.2 IRRBB arises from banking activities and is encountered by all banks. It arises because interest rates can vary significantly over time, while the business of banking typically involves intermediation activity that produces exposures to both maturity mismatch (eg. long-maturity assets funded by short-maturity liabilities) and rate mismatch (eg. variable rate loans funded by fixed rate deposits). In addition, there are optionalities embedded in many of the common banking products (eg. non-maturity deposits, term deposits, fixed rate loans) that are triggered in accordance with changes in interest rates. Banks must be familiar with all elements of IRRBB, actively identify their IRRBB exposures and take appropriate steps to identify, measure, monitor and control it.

2. Definitions

(a) In this Circular, unless the context states otherwise, the terms herein shall bear the meanings assigned to them below:

i. **Amenable to standardisation –** Positions with certain cash flow till maturity / repricing date.

ii. **Banking Book** - All items which are not included under trading book as defined in paragraph 8.2.1 of the circular DOR.CAP.REC.3/21.06.201/2022-23 dated April 1, 2022 on Basel III Capital Regulations, as amended from time to time, shall be considered as part of banking book.

iii. **Basis risk -** Describes the relative impact of changes in interest rates for financial instruments that have similar tenors but are priced using different interest rate indices.

iv. **Commercial Margins or credit margin** - A specific add-on to internal benchmark rate.

v. **Constant balance sheet** - Total balance sheet size maintained by assuming like-for-like replacement of assets and liabilities as they run off.

vi. **Embedded loss** – Loss embedded in the instruments that are not marked to market, which may be reflected over time in the bank's earnings. For example, a long-term fixed rate loan entered into when interest rates were low and refunded more recently with liabilities bearing a higher rate of interest will, over its remaining life, represent a drain on the bank's resources.

vii. **Gap risk-** Risk arising from the term structure of instruments in banking book that arises from differences in the timing of their rate changes. The extent of gap risk depends on whether the changes to the term structure of interest rates occur consistently across the yield curve (parallel risk) or differentially by period (non-parallel risk).

viii. **Less amenable to standardisation -** Positions with optionality that makes the timing of notional repricing of cash flows uncertain by introducing a non-linearity, which suggests that delta-equivalent approximations are imprecise for large interest rate shock scenarios.

ix. **Non-maturity deposits (NMD)** - Deposits which can be withdrawn, with or without penalty, at the discretion of the depositor.

x. **Not amenable to standardization** – Positions not amenable to standardisation include: Non-maturity deposits (NMDs), fixed rate loans subject to prepayment risk and term deposits subject to early redemption risk.

xi. **Notional Repricing Cash Flow (CF)**

a. any repayment of principal (e.g., at contractual maturity);

b. any repricing of principal; repricing is said to occur at the earliest date at which either the bank or its counterparty is entitled to unilaterally change the interest rate, or at which the rate on a floating rate instrument changes automatically in response to a change in an external benchmark; or

c. any interest payment on a tranche of principal that has not yet been repaid or repriced; spread components of interest payments on a tranche of principal that has not yet been repaid and which do not reprice must be slotted at their contractual maturity irrespective of whether the non-amortised principal has been repriced or not.

xii. **Option risk –** Risk arising from options (embedded or explicit) in a bank's assets, liabilities and/or off-balance sheet items where the bank or its customer can alter the level and timing of their cash flows. Option risk can be further characterized into automatic option risk and behavioural option risk.

a. **Embedded or explicit automatic option risk** - Risk arising from standalone instruments, such as exchange-traded and over-the-counter option contracts, or explicitly embedded within the contractual terms of an otherwise standard financial instrument (e.g., floating rate mortgage loan with embedded caps and / or floors) and where the holder will almost certainly exercise the option if it is in their financial interest to do so.

b. **Embedded behavioural option risk** – Risk arising from flexibility embedded implicitly or within the terms of financial contracts, such that changes in interest rates may effect a change in the behaviour of the client (e.g., Rights of a borrower to prepay a loan, with or without penalty, or the right of a depositor to withdraw their balance in search of higher yield).

xiii. **Repricing Date:** The date of each repayment, repricing or interest payment.

xiv. **Risk- appetite statement** - Written articulation of the aggregated level and types of IRRBB exposures that a bank will accept, or avoid, in order to achieve its business objectives.

xv. **Risk-free rate** – The theoretical rate of interest an investor would expect from a risk-free investment for a given maturity.

xvi. **Run-off balance sheet** - Existing assets and liabilities are not replaced as they mature, except to the extent necessary to fund the remaining balance sheet.

(b) All other expressions unless defined herein shall have the same meaning as have been assigned to them under the Banking Regulation Act, 1949 or the Reserve Bank of India Act, 1934 and rules/regulations made thereunder, or any statutory modification or re-enactment thereto or as used in commercial parlance, as the case may be.

3. Governance and Control

3.1 The Board of the banks has the responsibility for understanding the nature and the level of the bank's IRRBB exposure. The Board shall approve broad business strategies as well as overall policies with respect to IRRBB. Accordingly, the Board is responsible for ensuring that steps are taken by the bank to identify, measure, monitor and control IRRBB consistent with the approved strategies and policies. Monitoring and management of IRRBB can be delegated by the Board to ALCO, which should regularly monitor the nature and the level of the bank's IRRBB exposure. The management of banks' IRRBB should be integrated within its broader risk management framework and aligned with its business planning and budgeting activities. More specifically, the Board/ALCO is responsible for setting:

a) appropriate limits on IRRBB, including the definition of specific procedures and approvals necessary for exceptions, and ensuring compliance with those limits;
b) adequate systems and standards for measuring IRRBB;
c) valuing positions and assessing performance, including procedures for updating interest rate shock and stress scenarios and key underlying assumptions driving the institution's IRRBB analysis;
d) a comprehensive IRRBB reporting and review process; and
e) effective internal controls and management information systems (MIS).

3.2 Banks should have a clearly defined Board approved risk appetite statement which lays down policies and procedures for limiting and controlling IRRBB. The risk appetite statement should be articulated in terms of the risk to both economic value and earnings. It should lay down Board approved aggregate IRRBB limit given the bank's business strategies at the consolidated bank level as also at the level of individual entities as appropriate. These limits shall be associated with specific scenarios of changes in interest rates and/or term structures, such as an increase or decrease of a particular size or a change in shape. The interest rate movements used in developing these limits should represent meaningful shock and stress situations, taking into account historical interest rate volatility and the time required by management to mitigate those risk exposures. Depending on the nature of a bank's activities and business model, sub-limits may also be identified for individual business units, portfolios, instrument types or specific instruments. The risk appetite framework should delineate delegated powers, lines of responsibility and accountability over IRRBB management decisions and should clearly define authorised instruments, hedging strategies and risk-taking opportunities.

3.3 Banks must identify the IRRBB inherent in products and activities and ensure that these are subject to adequate procedures and controls. Significant hedging or risk management initiatives must be approved before being implemented. Products and activities that are new to a bank must undergo a careful pre-acquisition review to ensure that the IRRBB characteristics are well understood and subject to a predetermined test phase before being fully rolled out. Prior to introducing a new product, hedging or risk-taking strategy, adequate operational procedures and risk control systems must be in place. Procedures should be clearly laid out to approve major hedging or risk-taking initiatives prior to implementation. A dedicated set of risk limits should be developed to monitor the evolution of hedging strategies that rely on instruments such as derivatives, and to control mark-to-market risks in instruments that are accounted for at market value. The proposals to use new instrument types or new strategies (including hedging) should be assessed to ensure that (a) the resources required to establish sound and effective IRRBB management of the product or activity have been identified, (b) the proposed activities are in line with banks' overall risk appetite, and (c) the procedures to identify, measure, monitor and control the risks of the proposed product or activity have been established.

3.4 Systems should be in place to ensure that positions which exceed or are likely to exceed limits defined by the Board should receive prompt management attention and be escalated without delay. There should be a clear policy on who will be informed, how the communication will take place and the actions which will be taken in response to such exceptions.

3.5 Banks should have adequate internal controls to ensure the integrity of their IRRBB management process. In addition, banks should have in place regular evaluations and reviews of their internal control system and risk management processes. Banks should have their IRRBB identification, measurement, monitoring and control processes reviewed by an independent auditing function (such as an internal or external auditor) on a regular basis. In such cases, reports written by internal/external auditors or other equivalent external parties should be made available to the concerned SSM team of RBI. All IRRBB policies should be reviewed periodically (at least annually) and revised as needed.

4. IRRBB Measurement

4.1 Banks' systems for IRRBB should be able to compute the impact on the economic value and earnings in various scenarios, based on:

a) internally selected interest rate shock scenarios addressing the bank's risk profile, according to its Internal Capital Adequacy Assessment Process (ICAAP);
b) historical and hypothetical interest rate stress scenarios, which tend to be more severe than shock scenarios;
c) the six prescribed interest rate shock scenarios as given in **Appendix 1**; and
d) any additional interest rate shock scenarios required by the Reserve Bank of India.

4.2 An indicative standardised methodology for computing IRRBB from the perspective of change in EVE is given in **Appendix 2**.

Assumptions required for computation of IRRBB

4.3 Both economic value and earnings-based measures of IRRBB are significantly impacted by the assumptions made for the purposes of risk quantification, namely

a) expectations for the exercise of interest rate options by both the bank and its customers under specific interest rate shock and stress scenarios;

b) treatment of balances and interest flows arising from non-maturity deposits (NMDs);

c) treatment of own equity in economic value measures; and

d) implication of accounting practices for IRRBB.

4.4 Hence, when assessing its IRRBB exposures, banks should *inter-alia* make judgments and assumptions about how an instrument's actual maturity or repricing behaviour may vary from the instrument's contractual terms because of behavioural optionalities. Accordingly, all modelling assumptions should be conceptually sound and reasonable, and consistent with historical experience. Banks must carefully consider how the exercise of the behavioral optionality will vary not only under the interest rate shock and stress scenario but also across other dimensions. For instance, considerations may include:

Table 1

Product	**Dimensions influencing the exercise of the embedded behavioral options**
Fixed rate loans subject to prepayment risk	Loan size, loan-to-value (LTV) ratio, borrower characteristics, contractual interest rates, seasoning, geographical location, original and remaining maturity, and other historical factors. Other macroeconomic variables, such as stock indices, unemployment rates, GDP, inflation and housing price indices should be considered in modelling prepayment behaviour.
Fixed rate loan commitments	Borrower characteristics, geographical location (including competitive environment and local premium conventions), customer relationship with bank as evidenced by cross-products, remaining maturity of the commitment, seasoning and remaining term of the mortgage
Term deposits subject to early redemption risk	Deposit size, depositor characteristics, funding channel (e.g. direct or brokered deposit), contractual interest rates,

Product	Dimensions influencing the exercise of the embedded behavioral options
	seasonal factors, geographical location and competitive environment, remaining maturity and other historical factors. Other macroeconomic variables such as stock indices, unemployment rates, GDP, inflation and housing price indices should be considered in modelling deposit redemption behavior.
NMDs	Responsiveness of product rates to changes in market interest rates, current level of interest rates, spread between a bank's offer rate and market rate, competition from other firms, the bank's geographical location and demographic and other relevant characteristics of its customer base.

4.5 In addition, banks with positions denominated in different currencies can expose themselves to IRRBB in each of those currencies. Since yield curves vary from currency to currency, banks should assess exposures in each currency. Further, banks should consider the materiality of the impact of behavioural optionalities within floating rate loans. For instance, the behaviour of prepayments arising from embedded caps and floors could impact banks' EVE.

4.6 Banks should be able to test the appropriateness of key behavioural assumptions and should also document all changes to the assumptions of key parameters (e.g. by comparing the EVE measured under their internal systems with the indicative standardized framework given in **Appendix 2**). Banks should periodically perform sensitivity analyses for key assumptions to monitor their impact on measured IRRBB. Sensitivity analyses should be performed with reference to both economic value and earnings-based measures.

4.7 The most significant assumptions underlying the system should be documented and clearly understood by the Board or its Committee. Documentation should also include description on how those assumptions could potentially affect bank's hedging strategies.

4.8 As market conditions, competitive environments and strategies change over time, banks should review significant measurement assumptions at least annually and more

frequently during rapidly changing market conditions. For example, if the competitive market has changed such that consumers now have lower transaction costs available to them for refinancing their residential mortgages, prepayments may become more sensitive to smaller reductions in interest rates.

5. Stress testing framework

5.1 Banks should also develop and implement an effective stress testing framework for IRRBB as part of their broader risk management and governance processes, which should be commensurate with their nature, size and complexity as well as business activities and overall risk profile. It should include clearly defined objectives, scenarios tailored to the bank's businesses and risks, well documented assumptions and sound methodologies. This framework should be used to assess the potential impact of the scenarios on the bank's financial condition, enable ongoing and effective review of stress tests and recommend actions based on the stress test results.

5.2 The stress testing framework should feed into the decision-making process at the appropriate management level, including strategic decisions (e.g. business and capital planning decisions) of the Board or its Committee. In particular, IRRBB stress testing should be considered in the ICAAP, requiring banks to undertake rigorous, forward-looking stress testing that identifies events of severe changes in market conditions which could adversely impact the bank's capital or earnings, possibly also through changes in the behavior of its customer base. IRRBB stress tests should play an important role in the communication of risks, both within the bank and externally.

5.3 The identification of relevant shock and stress scenarios for IRRBB, the application of sound modelling approaches and the appropriate use of the stress testing results require the collaboration of different experts within a bank (e.g., traders, the treasury department, the finance department, the ALCO, the risk management and risk control departments and/or the bank's economists). A stress-testing programme for IRRBB should ensure that the opinions of the experts are taken into account.

5.4 The banks should determine a range of potential interest rate movement scenarios currency-wise, against which they will measure their IRRBB exposures. When developing interest rate shock and stress scenarios, bank should consider the following:

a) Scenarios should be sufficiently wide-ranging to identify parallel and non-parallel gap risk, basis risk, and option risk. Scenarios should be both severe and plausible, in light of the existing level of interest rates and the interest rate cycle;

b) Special consideration should be given to instruments or markets where concentration exists;

c) Possible interaction of IRRBB with related risks as well as other risks (eg. credit risk, liquidity risk);

d) Banks should assess the effect of adverse changes in the spreads of new assets or liabilities replacing those positions maturing over the horizon of the forecast on their NII;

e) Banks with significant option risk should include scenarios that capture the exercise of such options. For example, banks that have products with sold caps or floors should include scenarios that assess how the risk positions would change should those caps or floors move into the money. Banks should also develop interest rate assumptions to measure their IRRBB exposures given changes in interest rate volatilities;

f) Banks should specify the term structure of interest rates that will be incorporated (including shape, level), historical and implied volatility of interest rates, and the basis relationship between yield curves when building interest rate shock and stress scenarios;

g) Banks should estimate how interest rates that are administered or managed by the management (e.g. prime rates or retail deposit rates, as opposed to those that are purely market driven) might change;

h) Banks should also measure the time they would need to take action to reduce or unwind unfavorable IRRBB exposures, and their capability / willingness to withstand accounting losses in order to reposition their risk profile; and

i) Forward-looking scenarios should incorporate changes in portfolio composition due to factors under the control of the bank (e.g. the bank's acquisition and production plans) as well as external factors (e.g. changing competitive, legal or tax environments); new products where only limited historical data is

available; new market information and new emerging risks that are not necessarily covered by historical stress episodes.

5.5 Further, banks should perform qualitative and quantitative reverse stress tests in order to identify interest rate scenarios that could severely threaten bank's capital and earnings; and reveal vulnerabilities arising from its hedging strategies and the potential behavioural reactions of its customers.

6. Data integrity and model validation

6.1 Banks' risk measurement system should be able to identify and quantify major sources of IRRBB exposure. The mix of banks' business lines and the risk characteristics of its activities should guide management's selection of the most appropriate form of measurement system.

6.2 The banks should not rely on a single measure of risk. They should use a variety of methodologies to quantify their IRRBB exposures under both the economic value[1] and earnings-based measures[2], ranging from simple calculations based on static simulations using current holdings to more sophisticated dynamic modelling techniques that reflect potential future business activities.

6.3 Management Information System (MIS) in banks should be able to retrieve accurate IRRBB information in a timely manner and should capture interest rate risk data on all of the bank's material IRRBB exposures. There should be sufficient documentation of the major data sources used in the risk measurement process. Data inputs should be automated as much as possible to reduce administrative errors. Data mapping should be reviewed periodically and tested against an approved model. Banks should monitor the type of data extracts and set appropriate controls.

[1] Change in economic value can be measured using a variety of techniques, the most common of which are: (1) PV01: present value of a single basis point change in interest rates based on gap analysis; (2) EVE: economic value of equity; and (3) EVaR: economic value at risk. However, for reporting and disclosure purpose, banks are advised to use EVE as prescribed in Paragraph 8 of this document.

[2] Earnings-based measures look at the expected change in NII over a shorter time horizon (typically one to three years) resulting from interest rate movements. Earnings measures can be differentiated according to the complexity of their forward calculations of income, from simple run-off models which assume that existing assets and liabilities mature without replacement, to constant balance sheet models which assume that assets and liabilities are replaced like for like, to the most complex dynamic models which reflect the changes in the volumes and types of business that will be undertaken in differing interest rate environments. However, for reporting and disclosure purpose, banks are advised to use constant balance sheet models as prescribed in Paragraph 8 of this document.

6.4 The validation of IRRBB measurement methods and assessment of corresponding model/measurement risk should be included in a formal policy process and reviewed/approved by the Board / its Committee. The policy should specify the management roles and designate who is responsible for the development, implementation and use of models. In addition, the model oversight responsibilities as well as policies including the development of initial and ongoing validation procedures, evaluation of results, approval, version control, exception, escalation, modification and decommission processes need to be specified and integrated within the governance processes for model risk management. An effective validation framework should include three core elements:

a) evaluation of conceptual/methodological soundness, including developmental evidence;
b) ongoing model monitoring, including process verification and benchmarking; and
c) outcomes analysis, including back-testing of key internal parameters (e.g. stability of deposits, prepayments, early redemptions, pricing of instruments).

6.5 In addressing the expected initial and ongoing validation activities, the policy should establish a hierarchical process for determining model risk soundness based on both quantitative and qualitative dimensions such as size, impact, past performance and familiarity with the modelling technique employed. The ongoing validation process should establish a set of exception trigger events that obligate the model reviewers to notify the Board or its Committee in a timely fashion, in order to determine corrective actions and/or restrictions on model usage. Clear version control authorizations should be designated, where appropriate, to model owners. With the passage of time and due to observations and new information gained over time, an approved model shall be modified or decommissioned. Banks should articulate policies for model transition, including change and version control authorizations and documentation.

6.6 Prior to receiving authorization for usage, the process for determining model inputs, assumptions, modelling methodologies and outputs should be reviewed and validated independently of the development of IRRBB models. The review and validation results and any recommendations on model usage should be presented to and approved by the Board or its Committee or ALCO. Upon approval, the model

should be subject to ongoing review, process verification and validation at a frequency that is consistent with the level of model risk determined and approved by the Board.

6.7 Banks relying on third party vendors for IRRBB measurement models, or sourcing model inputs or assumptions from related modelling processes or sub-models (both in-house and vendor sourced), should include them in the validation process. Banks should document and explain model specification choices as part of the validation process. Banks that purchase IRRBB models should ensure there is adequate documentation of their use of those models, including any specific customization. If vendors provide input for market data, behavioral assumptions or model settings, banks should have a process in place to determine if those inputs are reasonable for its business and the risk characteristics of its activities.

6.8 Internal audit should review the model risk management process as part of its annual risk assessment and audit plans. The audit activity should review the integrity and effectiveness of the risk management system and the model risk management process. RBI will look into the systems and procedures of computation of IRRBB of banks. If persistent deficiencies are observed, RBI shall require banks to compute IRRBB based on ΔEVE as given in the **Appendix 2** till such time all deficiencies are removed.

7. Capital assessment for IRRBB under Pillar 2

7.1 Banks are responsible for evaluating the level of capital that they should hold, and for ensuring that it is sufficient to cover IRRBB and its related risks. The contribution of IRRBB to the overall internal capital assessment should be based on the banks' MIS outputs, taking account of key assumptions and risk limits. The overall level of capital should be commensurate with both the banks' actual measured level of risk (including for IRRBB) and its risk appetite and be duly documented in its ICAAP report under Pillar 2.

7.2 Banks should develop their own methodologies for capital allocation, based on their risk appetite. In determining the appropriate level of capital, banks should consider both the amount and the quality of capital needed.

7.3 The capital adequacy for IRRBB should be considered in relation to the risks to economic value, given that such risks are embedded in banks' assets, liabilities and

off-balance sheet items. For risks to future earnings, given the possibility that future earnings shall be lower than expected, banks should consider capital buffers.

Capital adequacy assessments for IRRBB should factor in:

a) the size and tenor of internal limits on IRRBB exposures, and whether these limits are reached at the point of capital calculation;
b) the effectiveness and expected cost of hedging open positions that are intended to take advantage of internal expectations of the future level of interest rates;
c) the sensitivity of the internal measures of IRRBB to key modelling assumptions;
d) the impact of shock and stress scenarios on positions priced off different interest rate indices (basis risk);
e) the impact on economic value and NII of mismatched positions in different currencies;
f) the impact of embedded losses;
g) the distribution of capital relative to risks across legal entities that form part of a capital consolidated group, in addition to the adequacy of overall capital on a consolidated basis;
h) the drivers of the underlying risk; and
i) the circumstances under which the risk might crystallise.

The outcomes of the capital adequacy for IRRBB should be considered in bank's ICAAP and flow through to assessments of capital associated with business lines.

7.4 RBI shall assess the adequacy of capital relative to its IRRBB exposures to determine whether the bank requires more detailed examination and should potentially be subject to additional capital requirements and/or other mitigation actions. This assessment need not be linked to the outlier test set out below.

Outlier Test

7.5 Banks which generate a decline in EVE (i.e. ΔEVE) of more than 15 per cent of its Tier 1 capital under any one of the six prescribed interest rate shock scenarios mentioned in **Appendix-1**, shall be identified as 'outliers' potentially having undue IRRBB exposure. These banks shall be required by the RBI to take one or more of the following actions as determined during the Supervisory Review and Evaluation Process (SREP):

(a) raise additional capital; (b) reduce its IRRBB exposures (e.g., by hedging); (c) set constraints on the internal risk parameters used by a bank; and/or (d) improve its risk management framework.

8. Reporting and Disclosures

8.1 Reports detailing banks' IRRBB exposures should be provided to the Board or its appropriate committees, on a timely basis and reviewed regularly. The IRRBB reports should provide aggregate information as well as sufficient reporting detail to enable the Board or its committee to assess the sensitivity of the bank to changes in market conditions. The IRRBB management policies and procedures should be reviewed by the Board or its Committees in light of the reports, to ensure that they remain appropriate and sound. It should be ensured that analysis and risk management activities related to IRRBB are conducted by competent staff with technical knowledge and experience, consistent with the nature and scope of the bank's activities. Portfolios that may be subject to significant mark-to-market movements should be clearly identified within banks' MIS and subject to oversight in line with any other portfolios exposed to market risk.

8.2 While the types of reports prepared for the Board or its Committee will vary based on the bank's portfolio composition, the board should be informed at least semi-annually on the following:

a) summaries of the bank's aggregate IRRBB exposures, and explanatory text that highlights the assets, liabilities, cash flows, and strategies that are driving the level and direction of IRRBB;
b) reports demonstrating the bank's compliance with policies and limits;
c) key modelling assumptions such as NMD characteristics, prepayments on fixed rate loans and currency aggregation;
d) results of stress tests, including assessment of sensitivity to key assumptions and parameters;
e) summaries of the reviews of IRRBB policies, procedures and adequacy of the measurement systems, including any findings of internal and external auditors and/or other equivalent external parties (such as consultants); and

f) results of the periodic model reviews and audits as well as comparisons of past forecasts or risk estimates with actual results to inform potential modelling shortcomings.

8.3 Banks shall disclose the measured ΔEVE and ΔNII under the prescribed interest rate shock scenarios set out in **Appendix 1**. Disclosures shall be in the formats given in **Appendix 3**.

8.4 Banks shall be guided by the following while computing the impacts on ΔEVE and ΔNII for the purpose of disclosures:

a) For the disclosure of ΔEVE
   i. Banks should exclude their own equity from the computation of the exposure level.
   ii. Banks should include all cash flows from all interest rate-sensitive assets[3], liabilities and off-balance sheet items in the banking book in the computation of their exposure. Banks should disclose whether they have excluded or included commercial margins and other spread components in their cash flows.
   iii. Cash flows should be discounted using either a risk-free rate[4] or a risk-free rate including commercial margins and other spread components (only if the bank has included commercial margins and other spread components in its cash flows). Banks should disclose whether they have discounted their cash flows using a risk-free rate or a risk-free rate including commercial margins and other spread components.
   iv. ΔEVE should be computed with the assumption of a run-off balance sheet, where existing banking book positions amortise and are not replaced by any new business.
b) For the disclosure of ΔNII
   i. Banks should include expected cash flows (including commercial margins and other spread components) arising from all interest rate-sensitive assets, liabilities and off-balance sheet items in the banking book.

[3] Interest rate-sensitive assets are assets which are not deducted from Common Equity Tier 1 capital and which exclude (i) fixed assets such as real estate or intangible assets as well as (ii) equity exposures in the banking book
[4] The discounting factors must be representative of a risk-free zero-coupon rate. An example of an acceptable yield curve is Zero Coupon Yield Curve published by the benchmark administrator.

ii. ΔNII should be computed assuming a constant balance sheet, where maturing or repricing cash flows are replaced by new cash flows with identical features as regards the amount, repricing period and spread components.

iii. ΔNII should be disclosed as the difference in future interest income over a rolling 12-month period.

Appendix-1

Interest Rate Shock Scenarios

Banks shall apply six prescribed interest rate shock scenarios to capture parallel and non-parallel gap risks for EVE and two prescribed interest rate shock scenarios for NII (the scenarios of parallel shock up and parallel shock down). These scenarios are applied to IRRBB exposures in each currency for which banks have material positions. In order to accommodate heterogeneous economic environments across jurisdictions, the six shock scenarios reflect currency specific absolute shocks as specified in Table 2 below. Under this approach, IRRBB is measured by means of the following six scenarios:

a) parallel shock up;
b) parallel shock down;
c) steepener shock (short rates down and long rates up);
d) flattener shock (short rates up and long rates down);
e) short rates shock up; and
f) short rates shock down

2. The interest rate shocks for exposures to INR and other currencies[1] are as follows:

Table 2

	Specified size of interest rate shocks:									
	INR	**ARS, BRL, IDR, MXN, RUB, TRY, ZAR**	**AUD**	**CAD, USD, SEK, SAR**	**CHF**	**CNY, GBP**	**EUR, HKD**	**JPY**	**KRW**	**SGD**
Parallel	250	400	300	200	100	250	200	100	300	150
Short	300	500	450	300	150	300	250	100	400	200
Long	200	300	200	150	100	150	100	100	200	100

[1] These shocks have been calibrated by BCBS based on data of historical time series ranging from 2000 to 2015 for various maturities. These shocks will be reviewed by RBI from time to time. Exposure in currencies less than 5 percent of the total of either the bank's global assets or global liabilities, shall be treated under residual category and the shocks pertaining to the largest among the residual currencies shall be applied to it. If banks have exposures to currencies not listed in Table 2, the highest of the shocks prescribed will be applicable.

Given the above table, the instantaneous shocks to the risk-free rate for parallel, short and long, for each currency, the following parameterisations of the six interest rate shock scenarios should be applied:

a) Parallel shock for currency c: a constant parallel shock up or down across all time buckets.

$$\Delta R_{parallel,c}(t_k) = \pm \overline{R}_{parallel,c}$$

b) Short rate shock for currency c: Shock up or down that is greatest at the shortest tenor midpoint. That shock, through the shaping scalar $S_{short}(t_k) = (e^{\frac{-t_k}{x}})$, where x=4, diminishes towards zero at the tenor of the longest point in the term structure[2] [3].

$$\Delta R_{short,c}(t_k) = \pm \overline{R}_{short,c} \cdot S_{short}(t_k) = \pm \overline{R}_{short,c} \cdot e^{\frac{-t_k}{x}}$$

c) Long rate shock for currency c (note: this is used only in the rotational shocks): Here the shock is greatest at the longest tenor midpoint and is related to the short scaling factor as: $S_{long}(t_k) = 1 - S_{short}(t_k)$

$$\Delta R_{long,c}(t_k) = \pm \bar{R}_{long,c} \cdot \left(1 - e^{\frac{-t_k}{x}}\right)$$

d) Rotation shocks for currency c: involving rotations to the term structure (i.e. steepeners and flatteners) of the interest rates whereby both the long and short rates are shocked and the shift in interest rates at each tenor midpoint is obtained by applying the following formulas to those shocks:

$$\Delta R_{steepener,c}(t_k) = -0.65 \cdot \left|\Delta R_{short,c}(t_k)\right| + 0.9 \cdot \left|\Delta R_{long,c}(t_k)\right|$$

$$\Delta R_{flatener,c}(t_k) = +0.8 \cdot \left|\Delta R_{short,c}(t_k)\right| - 0.6 \cdot \left|\Delta R_{long,c}(t_k)\right|$$

Examples:

Short rate shock:
Assume that a bank uses the framework with K=19 time bands and with t_k=25 years (the midpoint (in time) of the longest tenor bucket K), and where t_k is the midpoint (in time) for bucket k. In the standardised framework, if k=10 with t_k=3.5 years, the scalar adjustment for the short shock would be: $S_{short}(t_k) = \left(e^{\frac{-3.5}{4}}\right) = 0.417$. Banks would

[2] The value of x in the denominator of the function $e^{\frac{-t_k}{x}}$ controls the rate of decay of the shock. This should be set to the value of 4 for all currencies.

[3] t_k is the midpoint (in time) of the kth bucket and t_K is the midpoint (in time) of the last bucket K. There are 19 buckets in the indicative framework, but the analysis may be generalised to any number of buckets.

multiply this by the value of the short rate shock to obtain the amount to be added to or subtracted from the yield curve at that tenor point.

$$\Delta R_{short,c}(t_k) = \pm \overline{R}_{short,c} \cdot S_{short}(t_k) = \pm \overline{R}_{short,c} \cdot e^{\frac{-t_k}{x}}$$

$$\Delta R_{short,c}(3.5 years) = \pm \bar{R}_{short,c} \cdot 0.417$$

If the short rate shock was +100 bp, the increase in the yield curve at t_k =3.5 years would be 41.7 bp.

$$\Delta R_{short,c}(3.5 years) = 100 \cdot 0.417 = 41.7\ bp$$

Steepener: Assume the same point on the yield curve as above, t_k =3.5 years. If the absolute value of the short rate shock was 100 bp and the absolute value of the long rate shock was 100 bp (as for the Japanese yen), the change in the yield curve at t_k=3.5 years would be the sum of the effect of the short rate shock plus the effect of the long rate shock in basis points:

$$\Delta R_{steepener,c}(t_k) = -0.65 \cdot \left| \Delta R_{short,c}(t_k) \right| + 0.9 \cdot \left| \Delta R_{long,c}(t_k) \right|$$

$$\Delta R_{short,c}(3.5 years) = 100bp \cdot 0.417 = 41.7\ (calculated\ above)$$

$$S_{long}(t_k) = 1 - S_{short}(t_k) = 1 - 0.417 = 0.583\ bp$$

$$\Delta R_{long,c}(3.5 years) = 100bp \cdot (1 - 0.417) = 58.3bp$$

$$\Delta R_{steepener,c}(3.5 years) = -0.65 \cdot 41.7bp + 0.9 \cdot 58.3bp = \pm 25.4bp$$

Flattener: The corresponding change in the yield curve for the shocks in the example above at t_k=3.5 years would be:

$$\Delta R_{flatener,c}(t_k) = +0.8 \cdot \left| \Delta R_{short,c}(t_k) \right| - 0.6 \cdot \left| \Delta R_{long,c}(t_k) \right|$$

$$\Delta R_{flatener,c}(3.5 years) = +0.8 \cdot 41.7bp - 0.6 \cdot 58.3bp = -1.6bp$$

Appendix-2

Indicative methodology for computing ΔEVE

Banks have been provided with flexibility to develop their own system to compute ΔEVE. However, it is expected that banks' systems and parameters used to compute ΔEVE are not significantly different from the methodology and process provided in this Appendix. Wherever, significant deviation is considered desirable by banks, a well-reasoned argument for the same should be recorded and made available to RBI when requested.

2. Steps involved in computation:

2.1 The steps involved in measuring banks' ΔEVE for IRRBB would generally be following:

Step 1. Interest rate-sensitive banking book positions are allocated to one of three categories (i.e. amenable, less amenable and not amenable to standardisation).

Step 2. Determination of slotting of cash flows based on repricing maturities.

This is a straightforward translation for positions amenable to standardisation.

For positions less amenable to standardization, they are excluded from this step.

For positions with embedded automatic interest rate options, the embedded interest rate option is stripped out from the process of slotting of notional repricing cash flow. The optionality should be treated together with other interest rate options as per Step 4 given below.

For positions that are not amenable to standardisation, there is a separate treatment for:

(a) Non-Maturity Deposits (NMDs) – According to separation of core and non-core cash flows via the approach described in subsequent paragraph of this Appendix.

(b) Behavioural options (fixed rate loans subject to prepayment risk and term deposits subject to early redemption risk) – Behavioural parameters relevant to the position type may rely on a scenario-dependent look-up table provided in subsequent paragraph of this Appendix.

Step 3: Determination of ΔEVE for relevant interest rate shock scenarios for each currency. The ΔEVE is measured per currency for all six prescribed interest rate shock scenarios.

Step 4: Add-ons for changes in the value of automatic interest rate options (whether explicit or embedded) are added to the EVE changes. Automatic interest rate options sold are subject to full revaluation (net of automatic interest rate options bought to hedge sold interest rate options wherever permitted or possible) under each of the six prescribed interest rate shock scenarios for each currency. Changes in values of options are then added to the changes in the EVE measure under each interest rate shock scenario on a per currency basis.

Step 5. IRRBB EVE calculation. The ΔEVE under the standardised framework will be the maximum of the worst aggregated reductions to EVE across the six prescribed interest rate shocks in Appendix 1.

3. Cash flow bucketing

3.1 Banks may project all future notional repricing cash flows arising from interest rate-sensitive assets[1], liabilities[2], and off-balance sheet items onto 19 predefined time buckets (indexed numerically by k) as given in Table 3 below into which they fall according to their repricing dates.

3.2 Banks may deduct commercial margins and other spread components from the notional repricing cash flows, using a prudent and transparent methodology, if they consider it appropriate to do so.

3.3 Floating rate instruments are assumed to reprice fully at the first reset date. Hence, the entire principal amount is slotted into the bucket in which that date falls, with no additional slotting of notional repricing cash flows to later time buckets (other than the spread component which is not repriced).

[1] Assets which are not deducted from Common Equity Tier 1 (CET1) capital and which exclude (i) fixed assets such as real estate or intangible assets and (ii) equity exposures in the banking book.
[2] Liabilities (including all non-remunerated deposits), other than CET1 capital under the Basel III framework.

Table 3

Indicative table for maturity schedule for notional repricing cash flows repricing at t^{CF}

Time Bucket								
Short-term rates	Overnight (0.0028 Y)	Overnight < t^{CF} <= one month (O/N-1 month) (0.0417Y)	1-month < t^{CF} <= 3 months (0.1667 Y)	3 months < t^{CF} <=6 months (0.375 Y)	6 months < t^{CF} <= 9 months (0.625 Y)	9 months < t^{CF} <= 1 year (0.875 Y)	1 year < t^{CF} <= 1.5 years (1.25Y)	1.5 year < t^{CF} <= 2 years (1.75Y)
Medium-term rates	2 years < t^{CF} <= 3 years (2.5Y)	3 years < t^{CF} <= 4 years (3.5Y)	4 years < t^{CF} <= 5 years (4.5Y)	5 years < t^{CF} <= 6 years (5.5Y)	6 years < t^{CF} <= 7 years (6.5Y)			
Long-term rates	7 years < t^{CF} <= 8 years (7.5Y)	8 years < t^{CF} <= 9 years (8.5Y)	9 years < t^{CF} <= 10 years (9.5Y)	10 years < t^{CF} <= 15 years (12.5Y)	15 years < t^{CF} <= 20 years (17.5Y)	t^{CF} > 20 years (25Y)		

The number in brackets is the time bucket's midpoint.

3.4 All notional repricing cash flows associated with interest rate-sensitive assets, liabilities and off-balance sheet items, for each currency, are allocated to the prescribed time buckets (henceforth, denoted by $CF_{i,c}$ (k) under interest rate shock scenario i and currency c) based on their amenability to standardisation.

4. Process for positions that are amenable to standardisation

4.1 Notional repricing cash flows can be slotted into appropriate time buckets based on their contractual maturity, if subject to fixed coupons, or into the next repricing period if coupons are floating. Positions amenable to standardisation fall into two categories:

4.1.1 Fixed rate positions: Such positions generate cash flows that are certain till the point of contractual maturity[3]. All coupon cash flows and periodic or final principal repayments should be allocated to the appropriate time buckets based on their contractual maturity.

4.1.2 Floating rate positions: Such positions generate cash flows that are not predictable past the next repricing date other than that the present value would be

[3] Examples are fixed rate loans without embedded prepayment options, term deposits without redemption risk and other amortising products such as mortgage loans.

reset to par. Accordingly, such instruments can be treated as a series of coupon payments until the next repricing and a par notional cash flow at the appropriate time bucket into the next reset date bucket.

4.2 Positions amenable to standardisation include positions with embedded automatic interest rate options where the optionality (whether sold or bought) should be ignored for the purpose of slotting of notional repricing cash flows. That is, the stripped-out embedded automatic interest rate option must be treated together with explicit automatic interest rate options.

5. Process for positions that are less amenable to standardisation

For explicit automatic interest rate options, as well as embedded automatic interest rate options[4] that are separated or stripped out from assets or liabilities (i.e. the host contract), the methodology for automatic interest rate options is described in subsequent paragraph of this Appendix.

6. Process for positions not amenable to standardisation

Positions not amenable to standardisation include (i) Non Maturity Deposits (NMDs), (ii) fixed rate loans subject to prepayment risk and (iii) term deposits subject to early redemption risk.

6.1 Treatment of NMDs

Banks may first separate their NMDs according to the nature of the deposit and depositor. Banks should then identify, for each category, the core and non-core deposits, up to the limits specified in Table 4. Finally, banks should determine an appropriate cash flow slotting for each category, in accordance with the average maturity limits specified in Table 4.

Table 4

Caps on core deposits and average maturity by category

	Cap on proportion of core deposits (%)	Cap on average maturity of core deposits (years)
Retail/transactional	90	5
Retail/non-transactional	70	4.5
Wholesale	50	4

[4] An example of a product with embedded automatic interest rate options is a floating rate mortgage loan with embedded caps and/or floors. Any behavioural option position with wholesale customers that may change the pattern of notional repricing cash flows are considered as embedded automatic interest rate option.

(a) NMD categories

NMDs must be segmented into retail and wholesale categories. Retail deposits are defined as deposits placed by an individual person. Deposits made by small business customers (with total aggregate deposits up to Rs. 7.5 crores) and managed as retail exposures are considered as having similar interest rate risk characteristics to retail accounts and thus can be treated as retail deposits. Retail deposits should be considered as held in a transactional account when regular transactions are carried out in that account (e.g., when salaries are regularly credited) or when the deposit is non-interest bearing. Other retail deposits should be considered as held in a non-transactional account. Deposits from legal entities, sole proprietorships or partnerships are captured in wholesale deposit categories.

(b) Separation of NMDs

Banks should distinguish between the stable and the non-stable parts of each NMD category using observed volume changes over the past 10 years. The stable NMD portion is the portion that is found to remain undrawn with a high degree of likelihood. Core deposits are the proportion of stable NMDs which are unlikely to reprice even under significant changes in the interest rate environment. The remainder constitutes non-core NMDs.

Banks are required to estimate their level of core deposits using this two-step procedure for each deposit category, and then to aggregate the results to determine the overall volume of core deposits subject to imposed caps as shown in Table 4.

(c) Cash flow slotting

NMDs should finally be slotted into the appropriate time bucket. Non-core deposits should be considered as overnight deposits and accordingly should be placed into the overnight time bucket.

Banks should determine an appropriate cash flow slotting procedure for each category of core deposits, up to the maximum average maturity per category as specified in Table 4.

6.2 Treatment of positions with behavioural options other than NMDs

6.2.1 The treatment set out in this paragraph applies only to behavioural options related to retail customers. Where a wholesale customer has a behavioural option that may change the pattern of notional repricing cash flows, such options must be included within the category of automatic interest rate options[5].

6.2.2 The standardised framework is applied to fixed rate loans subject to prepayments and term deposits subject to early redemption risk. In each case, the customer has an option, which, if exercised, will alter the timing of banks' cash flows. The customer's exercise of the option is, among other factors, influenced by changes in interest rates. In the case of the fixed rate loan, the customer has an option to repay the loan early (ie prepay); and for a fixed-term deposit, the customer may have an option to withdraw their deposit before the scheduled date.

6.2.3 The optionality in these products is estimated using a two-step approach. Firstly, baseline estimates of loan prepayments and early withdrawal of fixed-term deposits are calculated given the prevailing term structure of interest rates. In the second stage, the baseline estimates are multiplied by scenario-dependent scalars that reflect the likely behavioural changes in the exercise of the options.

6.3 Fixed rate loans subject to prepayment risk

6.3.1 Prepayments, or parts thereof, for which the economic cost is not charged to the borrower, are referred to as uncompensated prepayments. For loan products where the economic cost of prepayments is never charged, or charged only for prepayments above a certain threshold, the standardised framework for fixed rate loans subject to prepayments set out below must be used to assign notional repricing cash flows.

6.3.2 Banks may determine the baseline conditional prepayment rate (CPR) for each portfolio p of homogeneous prepayment-exposed loan products denominated in currency c, under the prevailing term structure of interest rates. The CPR for each portfolio of homogeneous prepayment- exposed loan products denominated in currency c, under interest rate scenario i, is given as:

$$CPR_{i,c}^{p} = \min(1, \gamma_i \cdot CPR_{0,c}^{p})$$

[5] An example of such an option would be a puttable fixed coupon bond issued by the bank in the wholesale market, for which the owner has the right to sell the bond back to the bank at a fixed price at any time.

where ($CPR^{p}_{0,c}$) is the (constant) base CPR of a portfolio of homogeneous prepayment-exposed loans given in currency *c* and given the prevailing term structure of interest rates. γ_i is a multiplier applied for scenario as given in Table 5.

6.3.3 Prepayment speeds vary according to the interest rate shock scenario. The multipliers γ_i reflect the expectation that prepayments will generally be higher during periods of falling interest rates and lower during periods of rising interest rates.

Table 5

CPRs under the shock scenarios

Scenario number *(i)*	Interest rate shock	γ_i (scenario multiplier)
1	Parallel up	0.8
2	Parallel down	1.2
3	Steepener	0.8
4	Flattener	1.2
5	Short rate up	0.8
6	Short rate down	1.2

6.3.4 The prepayments on the fixed rate loans must ultimately be reflected in the relevant cash flows (scheduled payments on the loans, prepayments and interest payments). These payments can be broken up into scheduled payments adjusted for prepayment and uncompensated prepayments:

$$CF^{P}_{i,c}\,(k) = CF^{S}_{i,c}\,(k) + CPR^{p}_{i,c} \cdot N^{p}_{i,c}\,(k-1)$$

Where $CF^{S}_{i,c}\,(k)$ refers to the scheduled interest and principal repayment, and $N^{p}_{i,c}\,(k-1)$ denotes the notional outstanding at time bucket k – 1. The base cash flows (i.e. given the current interest rate yield curve and the base CPR) are given by *i*=0, while the interest rate shock scenarios are given for *i*=1 to 6.

6.4 Term deposits subject to early redemption risk

6.4.1 Term deposits lock in a fixed rate for a fixed term and would usually be hedged on that basis. However, term deposits may be subject to the risk of early withdrawal, also called early redemption risk. Consequently, term deposits may only be treated as fixed rate liabilities and their notional repricing cash flows slotted into the time buckets up to their corresponding contractual maturity dates if it can be shown that:

- the depositor has no legal right to withdraw the deposit; or

- an early withdrawal results in a significant penalty that at least compensates for the loss of interest between the date of withdrawal and the contractual maturity date and the economic cost of breaking the contract.

6.4.2 If neither of these conditions is met, the depositor holds an option to withdraw and the term deposits are deemed to be subject to early redemption risk. Further, if banks issue term deposits that do not meet the above criteria to wholesale customers, they must assume that the customer will always exercise the right to withdraw in the way that is most disadvantageous to banks (i.e. the deposit is classified as an automatic interest rate option).

6.4.3 Banks may determine the baseline term deposit redemption ratio TDRR, applicable to each homogeneous portfolio p of term deposits in currency c and use it to slot the notional repricing cash flows. Term deposits which are expected to be redeemed early are slotted into the overnight time bucket (k=1).

6.4.4 The term deposit redemption ratio for time bucket *k* applicable to each homogeneous portfolio *p* of term deposits in currency *c* and under scenario *i* is obtained by multiplying $TDRR_{0,c}^{p}$ by scalar u_i that depends on the scenario *i*, as follows:

$$TDRR_{i,c}^{p} = \min(1, u_i \cdot TDRR_{0,c}^{p})$$

The values of scalar u_i are given in the following table.

Table 6

Term deposit redemption rate (TDRR) scalars under the shock scenarios

Scenario *(i)*	Interest rate shock scenarios	Scalar multipliers u_i
1	Parallel up	1.2
2	Parallel down	0.8
3	Steepener	0.8
4	Flattener	1.2
5	Short rate up	1.2
6	Short rate down	0.8

6.4.5 The notional repricing cash flows which are expected to be withdrawn early under any interest rate shock scenario *i* are described as:

$$CF_{i,c}^{p}(1) = TD_{0,c}^{p} \cdot TDRR_{i,c}^{p}$$

Where $TD_{0,c}^{p}$ is the outstanding amount of term deposits of type *p*.

7. Automatic interest rate options

7.1 This paragraph describes the method for calculating an add-on for automatic interest rate options, whether explicit or embedded[6]. This applies to sold automatic interest rate options. Banks have a choice to either include all bought automatic options or include only automatic options used for hedging sold automatic interest rate options:

a) For each sold automatic option *o* in currency *c*, the value change, denoted $\Delta FVAO_{i,c,}$ is calculated for each interest rate shock scenario *i*. The value change is given by:

   i. an estimate of the value of the option to the option holder, given:

      a. a yield curve in currency c under the interest rate shock scenario *i*; and

      b. a relative increase in the implicit volatility of 25%;

   minus

   ii. the value of the sold option to the option holder, given the yield curve in currency c at the valuation date.

b) Likewise, for each bought automatic interest rate option *q*, banks must determine the change in value of the option between interest rate shock scenario *i* and the current interest rate term structure combined with a relative increase in the implicit volatility of 25%. This is denoted as $\Delta FVAO\ ^{q}{}_{i,c}$.

c) Banks' total measure for automatic interest rate option risk under interest rate shock scenario *i* in currency *c* is calculated as:

$$KAO_{i,c} = \sum_{0=1}^{n_c} \Delta FVAO_{i,c}^{o} - \sum_{q=1}^{m_c} \Delta FVAO_{i,c}^{q}$$

Where n_c (m_c) is the number of sold (bought) options in currency *c*.

[6] The most important automatic interest rate options likely to occur in the banking book are caps and floors, which are often embedded in banking products. Swaptions, such as prepayment options on non-retail products, may also be treated as automatic interest rate options, as, in cases where such options are held by sophisticated financial market counterparties, the option holder will almost certainly exercise the option if it is in their financial interest to do so. Any behavioural option positions with wholesale customers that may change the pattern of notional repricing cash flows are considered as embedded automatic interest rate options for the purposes of this sub-paragraph.

7.2 If the bank chooses to only include bought automatic interest rate options that are used for hedging sold automatic interest rate options, the bank must, for the remaining bought options, add any changes in market values reflected in the regulatory capital measure of the respective capital ratio (i.e. CET1, AT1 or total capital) to the total automatic interest rate option risk measure $KAO_{i,c}$.

8. Determination of change in EVE for each currency for all six-prescribed interest rate shock scenarios

The change in economic value of equity under scenario *i* and currency *c* is calculated for each currency, as follows:

a) Under each scenario i, all notional repricing cash flows are slotted into the respective time bucket k € {1, 2, ….,K} . Within a given time bucket k all positive and negative notional repricing cash flows are netted[7] to form a single long or short position, with the cancelled parts removed from the calculation. Following this process across all time buckets leads to a set of notional repricing cash flows $CF_{i,c}(k)$, k € {1,2,….,K}[8].

b) Net notional repricing cash flows in each time bucket k are weighted by a continuously compounded discount factor:

$$DF_{i,c}(t_k) = \exp\left(-R_{i,c}(t_k) \cdot t_k\right)$$

that reflects the interest rate shock scenario i in currency c as set out in Appendix 1, and where t_k is the midpoint of time bucket k. This results in a weighted net position, which may be positive or negative for each time bucket. The cash flows should be discounted using either a risk-free rate[9] or a risk-free rate including commercial margin and other spread components (only if the bank has included commercial margins and other spread components in its cash flows).

c) These risk-weighted net positions are summed to determine the EVE in currency c under scenario i (excluding automatic interest rate option positions):

[7] Intra-bucket mismatch arises as notional repricing cash flows with different maturity dates but falling within the same time bucket, are assumed to match perfectly. This is mitigated by introducing a high number of time buckets (i.e. K=19)

[8] Note that depending on the approach taken for NMDs, prepayments and products with other embedded behavioural options, the notional repricing cash flows may vary by scenario i (scenario-dependent cash flow products).

[9] The discounting factors must be representative of a risk-free zero coupon rate. An example of an acceptable yield curve is Zero Coupon Yield Curve published by the benchmark administrator.

$$EVE_{i,c}^{nao} = \sum_{k=1}^{K} CF_{i,c}(k) \cdot DF_{i,c}(t_k)$$

d) Then, the full change in EVE in currency c associated with scenario i is obtained by subtracting $EVE_{i,c}^{nao}$ from the EVE under the current interest rate term structure $EVE_{0,c}^{nao}$ and by adding the total measure for automatic interest rate option risk $KAO_{i,c}$ as follows:

$$\Delta EVE_{i,c} = \sum_{k=1}^{K} CF_{0,c}(k) \cdot DF_{0,c}(t_k) - \sum_{k=1}^{K} CF_{i,c}(k) \cdot DF_{i,c}(t_k) + KAO_{i,c}$$

e) Finally, the EVE losses $\Delta EVE_{i,c} > 0$ are aggregated under a given interest rate shock scenario i and the maximum loss across all interest rate shock scenarios is the EVE risk measure.

$$\text{Standardised EVE risk measure} = \max_{i \in \{1,2,\ldots,6\}} \left\{ \mathbf{max}\left(\mathbf{0}; \sum_{c:\Delta EVE_{i,c}>0} \underbrace{\Delta EVE_{i,c}}_{\textbf{loss in currency } c} \right) \right\}$$

Appendix-3

Formats for disclosure of IRRBB

Table A

Purpose: To provide a description of the risk management objectives and policies concerning IRRBB	
Scope of application: Mandatory for all banks	
Content: Qualitative and quantitative information	
Frequency: Annual	
Format: Flexible	
Qualitative disclosure	
A	A description of how the bank defines IRRBB for purposes of risk control and measurement.
B	A description of the bank's overall IRRBB management and mitigation strategies. Examples are: monitoring of EVE and NII in relation to established limits, hedging practices, conduct of stress testing, outcomes analysis, the role of independent audit, the role and practices of the ALCO, the bank's practices to ensure appropriate model validation, and timely updates in response to changing market conditions.
C	The periodicity of the calculation of the bank's IRRBB measures, and a description of the specific measures that the bank uses to gauge its sensitivity to IRRBB.
D	A description of the interest rate shock and stress scenarios that the bank uses to estimate changes in the economic value and in earnings.
E	Where significant modelling assumptions used in the bank's internal measurement system (i.e. the EVE metric generated by the bank for purposes other than disclosure, e.g. for internal assessment of capital adequacy) are different from the modelling assumptions prescribed for the disclosure in Table B, the bank should provide a description of those assumptions and of their directional implications and explain its rationale for making those assumptions (e.g. historical data, published research, management judgment and analysis).
F	A high-level description of how the bank hedges its IRRBB, as well as the associated accounting treatment.
G	A high-level description of key modelling and parametric assumptions used in calculating ΔEVE and ΔNII in Table B, which includes: • For ΔEVE, whether commercial margins and other spread components have been included in the cash flows used in the computation and discount rate used. • How the average repricing maturity of non-maturity deposits in (1) below has been determined (including any unique product characteristics that affect assessment of repricing behaviour). • The methodology used to estimate the prepayment rates of customer loans, and/or the early withdrawal rates for time deposits, and other significant assumptions.

	• Any other assumptions (including for instruments with behavioural optionalities that have been excluded) that have a material impact on the disclosed ΔEVE and ΔNII in Table B, including an explanation of why these are material. • Any methods of aggregation across currencies and any significant interest rate correlations between different currencies.
H	(Optional) Any other information which the bank wishes to disclose regarding its interpretation of the significance and sensitivity of the IRRBB measures disclosed and/or an explanation of any significant variations in the level of the reported IRRBB since previous disclosures.
Quantitative disclosures	
1	Average repricing maturity assigned to NMDs.
2	Longest repricing maturity assigned to NMDs.
	Quantitative information is based on the daily or monthly average of the year or on the data as of the reporting date. Note: If a bank computes the information daily/monthly, it cannot choose to disclose it based on data as on March 31 only. In such cases, bank should disclose the information based on daily/monthly average of the year.

Table B

Scope of application: Mandatory for all banks				
Content: Quantitative information.				
Frequency: Annual, as at end-March.				
Format: Fixed.				
Accompanying narrative: Commentary on the significance of the reported values and an explanation of any material changes since the previous reporting period.				
In reporting currency	***Δ EVE***		***Δ NII***	
Period	**T**	**T–1**	**T**	**T–1**
Parallel up				
Parallel down				
Steepener				
Flattener				
Short rate up				
Short rate down				
Maximum				
Tier 1 capital				
Maximum as % of Tier 1 Capital				

Definitions

For each of the specified interest rate shock scenarios, the bank must report for the current period (T) and for the previous period (T-1):

- the change in the economic value of equity based on its internal measurement system, using a run-off balance sheet and an instantaneous shock and
- the change in projected NII over a forward-looking rolling 12-month period compared with the bank's own best estimate 12-month projections, using a constant balance sheet assumption and an instantaneous shock.