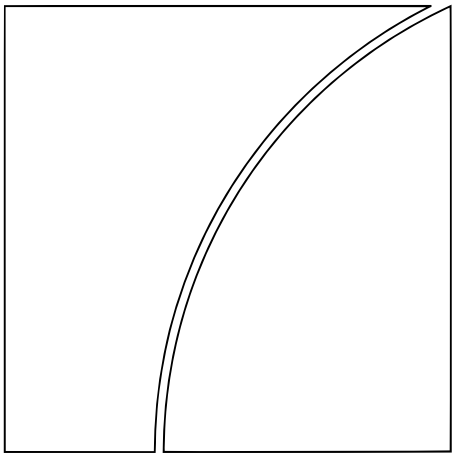
Basel Committee on Banking Supervision

SRP

Supervisory review process

SRP31

Interest rate risk in the banking book



This chapter describes requirements on assessing interest rate risk in the banking book, ie the current or prospective risk to a bank's capital and to its earnings, arising from the impact of adverse movements in interest rates on its banking book. Due to the heterogeneous nature of this risk, it is captured in Pillar 2.

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Updated to take account of the recalibration of shocks in the interest rate risk in the banking book standard and the targeted adjustments to the current methodology used to calculate the shocks published on 16 July 2024.

BANK FOR INTERNATIONAL SETTLEMENTS

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Definition of IRRBB

31.1

Interest rate risk in the banking book (IRRBB) refers to the current or prospective risk to the bank's capital and earnings arising from adverse movements in interest rates that affect the bank's banking book positions. When interest rates change, the present value and timing of future cash flows change. This in turn changes the underlying value of a bank's assets, liabilities and off-balance sheet items and hence its economic value. Changes in interest rates also affect a bank's earnings by altering interest rate-sensitive income and expenses, affecting its net interest income (NII). Excessive IRRBB can pose a significant threat to a bank's current capital base and/or future earnings if not managed appropriately. A more detailed description of IRRBB and its management techniques can be found in SRP98.

31.2

Three main sub-types of IRRBB are defined for the purposes of this chapter. All three sub-types of IRRBB potentially change the price/value or earnings/costs of interest rate-sensitive assets, liabilities and/or off-balance sheet items in a way, or at a time, that can adversely affect a bank's financial condition.

1. Gap risk arises from the term structure of banking book instruments, and describes the risk arising from the timing of instruments' rate changes. The extent of gap risk depends on whether changes to the term structure of interest rates occur consistently across the yield curve (parallel risk) or differentially by period (non-parallel risk).
2. Basis risk describes the impact of relative changes in interest rates for financial instruments that have similar tenors but are priced using different interest rate indices.
3. Option risk arises from option derivative positions or from optional elements embedded 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 characterised into automatic option risk and behavioural option risk.

31.3

While the three sub-types listed above are directly linked to IRRBB, credit spread risk in the banking book (CSRBB) is a related risk that banks need to monitor and assess in their interest rate risk management framework. CSRBB refers to any kind of asset/liability spread risk of credit-risky instruments that is not explained by IRRBB and by the expected credit/jump to default risk.

Principles for banks and supervisors on interest rate risk

31.4

The following principles define supervisory expectations on the management of IRRBB. Principles 1 to 7 are of general application for the management of IRRBB, covering expectations for a bank's IRRBB management process, in particular the need for effective IRRBB identification, measurement, monitoring and control activities. Principles 8 and 9 set out the expectations for market disclosures and banks' internal assessment of capital adequacy for IRRBB respectively.
Principles 10 to 12 address the supervisory approach to banks' IRRBB management framework and capital adequacy.

1. IRRBB is an important risk for all banks that must be specifically identified, measured, monitored and controlled. In addition, banks should monitor and assess CSRBB.
2. The governing body of each bank is responsible for oversight of the IRRBB management framework, and the bank's risk appetite for IRRBB. Monitoring and management of IRRBB may be delegated by the governing body to senior management, expert individuals or an asset and liability management committee (henceforth, its delegates). Banks must have an adequate IRRBB management framework, involving regular independent reviews and evaluations of the effectiveness of the system.
3. The banks' risk appetite for IRRBB should be articulated in terms of the risk to both economic value and earnings. Banks must implement policy limits that target maintaining IRRBB exposures consistent with their risk appetite.
4. Measurement of IRRBB should be based on outcomes of both economic value and earnings-based measures, arising from a wide and appropriate range of interest rate shock and stress scenarios.
5. In measuring IRRBB, key behavioural and modelling assumptions should be fully understood, conceptually sound and documented. Such assumptions should be rigorously tested and aligned with the bank's business strategies.
6. Measurement systems and models used for IRRBB should be based on accurate data, and subject to appropriate documentation, testing and controls to give assurance on the accuracy of calculations. Models used to measure IRRBB should be comprehensive and covered by governance processes for model risk management, including a validation function that is independent of the development process.
7. Measurement outcomes of IRRBB and hedging strategies should be reported to the governing body or its delegates on a regular basis, at relevant levels of aggregation (by consolidation level and currency).
8. Information on the level of IRRBB exposure and practices for measuring and controlling IRRBB must be disclosed to the public on a regular basis.
9. Capital adequacy for IRRBB must be specifically considered as part of the Internal Capital Adequacy Assessment Process (ICAAP) approved by the governing body, in line with the bank's risk appetite on IRRBB.
10. Supervisors should, on a regular basis, collect sufficient information from banks to be able to monitor trends in banks' IRRBB exposures, assess the soundness of banks' IRRBB management and identify outlier banks that should be subject to review and/or should be expected to hold additional regulatory capital.
11. Supervisors should regularly assess banks' IRRBB and the effectiveness of the approaches that banks use to identify, measure, monitor and control IRRBB. Supervisory authorities should employ specialist resources to assist with such assessments. Supervisors should cooperate and share information with relevant supervisors in other jurisdictions regarding the supervision of banks' IRRBB exposures.
12. Supervisors must publish their criteria for identifying outlier banks. Banks identified as outliers must be considered as potentially having undue IRRBB. When a review of a bank's IRRBB exposure reveals inadequate management or excessive risk relative to capital, earnings or general risk profile, supervisors must require mitigation actions and/or additional capital.

31.5

The implementation of these principles should be commensurate with the bank's nature, size and complexity as well as its structure, economic significance and general risk profile. This requires that supervisors gauge their responses where appropriate for banks with low IRRBB

profiles. In particular, supervisors will focus on systemic risks that are inherent in large, complex or internationally active banks.

Principle 1 – identification and monitoring of IRRBB

31.6

IRRBB is an important risk that 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 fixed rate loans funded by variable 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.

31.7

All banks must be familiar with all elements of IRRBB, actively identify their IRRBB exposures and take appropriate steps to measure, monitor and control it.

31.8

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 preacquisition 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. The management of a bank's IRRBB should be integrated within its broader risk management framework and aligned with its business planning and budgeting activities.

31.9

In identifying, measuring, monitoring and controlling IRRBB, banks should also ensure that CSRBB is properly monitored and assessed.

Principle 2 – IRRBB management framework

31.10

The governing body[1] has responsibility for understanding the nature and the level of the bank's IRRBB exposure. The governing body should approve broad business strategies as well as overall policies with respect to IRRBB. It should ensure that there is clear guidance regarding the acceptable level of IRRBB, given the bank's business strategies.

1 Footnote

1 *This refers to the body that supervises management. The structure of bank boards differs among countries. See the Corporate Governance Principles for Banks published by the Committee in July 2015.*

31.11

Accordingly, the governing body 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. More specifically, the governing body or its delegates are responsible for setting:

1. appropriate limits on IRRBB, including the definition of specific procedures and approvals necessary for exceptions, and ensuring compliance with those limits;
2. adequate systems and standards for measuring IRRBB;
3. standards for measuring IRRBB, 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;
4. a comprehensive IRRBB reporting and review process; and
5. effective internal controls and management information systems (MIS).

31.12

The governing body or its delegates should oversee the approval, implementation and review of IRRBB management policies, procedures and limits. The governing body should be informed regularly (at least semiannually) on the level and trend of the bank's IRRBB exposures. It should regularly review timely information that is sufficiently detailed to allow it to understand and assess the performance of its delegates in monitoring and controlling IRRBB in compliance with policies approved by the governing body. Such reviews should be carried out more frequently when the bank runs significant IRRBB exposures or has positions in complex IRRBB instruments.

31.13

While governing body members do not need individually to have detailed technical knowledge of complex financial instruments, or of quantitative risk management techniques, they should understand the implications of the bank's IRRBB strategies, including the potential linkages with and impact on market, liquidity, credit and operational risk. Some of the members should have sufficient technical knowledge to question and challenge the reports made to the governing body. Governing body members are responsible for ensuring that senior management has the capability and skills to understand IRRBB, and that adequate resources are devoted to IRRBB management.

31.14

Many governing bodies delegate the task for developing IRRBB policies and practices to senior management, expert individuals or an asset and liability management committee (ALCO). In the case of an ALCO, it should meet regularly and include representatives from each major department connected to IRRBB.

31.15

The governing body should clearly identify its delegates for managing IRRBB and, to avoid potential conflicts of interest, should ensure that there is adequate separation of responsibilities in key elements of the risk management process. Banks should have IRRBB identification, measurement, monitoring and control functions with clearly defined responsibilities that are sufficiently independent from risk-taking functions of the bank and that report IRRBB exposures directly to the governing body or its delegates.

31.16

The governing body's delegates for IRRBB should include members with clear lines of authority

over the units responsible for establishing and managing positions. There should be a clear communication channel to convey the delegates' directives to these line units.

31.17

The governing body should ensure that the bank's organisational structure enables its delegates to carry out their responsibilities, and facilitates effective decision-making and good governance. The governing body should encourage discussions between its members and its delegates – as well as between its delegates and others in the bank – regarding the IRRBB management process. The risk management and strategic planning areas of the bank should also communicate regularly to facilitate evaluations of risk arising from future business.

31.18

Banks should have adequate internal controls to ensure the integrity of their IRRBB management process. The internal controls should promote effective and efficient operations, reliable financial and regulatory reporting, and compliance with relevant laws, regulations and bank policies.

31.19

With regard to IRRBB control policies and procedures, banks should have appropriate approval processes, exposure limits, reviews and other mechanisms designed to provide a reasonable assurance that risk management objectives are being achieved.

31.20

In addition, banks should have in place regular evaluations and reviews of their internal control system and risk management processes. This includes ensuring that personnel comply with established policies and procedures. Such reviews should also address any significant changes that may affect the effectiveness of controls (including changes in market conditions, personnel, technology and structures of compliance with exposure limits), and ensure that there are appropriate escalation procedures for any exceeded limits. Banks should ensure that all such evaluations and reviews are conducted regularly by individuals and/or units that are independent of the function they are assigned to review. When revisions or enhancements to internal controls are warranted, there should be an internal review mechanism in place to ensure that these are implemented in a timely manner.

31.21

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 (such as consultants) should be made available to relevant supervisory authorities.

Principle 3 – IRRBB risk appetite

31.22

Banks should have clearly defined risk appetite statements[2] that are approved by the governing body and implemented through comprehensive risk appetite frameworks, ie policies and procedures for limiting and controlling IRRBB. 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. All IRRBB policies should be reviewed periodically (at least annually) and revised as needed.

1 Footnote

2 *A risk appetite statement is a 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.*

31.23

Policy limits set by the governing bodies should be consistent with the bank's overall approach for measuring IRRBB. Aggregate risk limits, clearly articulating the amount of IRRBB acceptable to the governing body, should be applied on a consolidated basis and, as appropriate, at the level of individual affiliates. Limits may 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.

31.24

Policy limits should be appropriate to the nature, size, complexity and capital adequacy of the bank, as well as its ability to measure and manage its risks. 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 level of detail of risk limits should reflect the characteristics of the bank's holdings, including the various sources of the bank's IRRBB exposures. Banks with significant exposures to gap risk, basis risk or positions with explicit or embedded options should establish risk tolerances appropriate for these risks.

31.25

The governing body or its delegates should approve major hedging or risk-taking initiatives in advance of implementation.[3] 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. Proposals to use new instrument types or new strategies (including hedging) should be assessed to ensure that the resources required to establish sound and effective IRRBB management of the product or activity have been identified, that the proposed activities are in line with the bank's overall risk appetite, and procedures to identify, measure, monitor and control the risks of the proposed product or activity have been established.

1 Footnote

3 *Positions related to internal risk transfers between the banking book and the trading book should be properly documented.*

31.26

There should be systems in place to ensure that positions that exceed, or are likely to exceed, limits defined by the governing body or its delegates 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 an exception.[4]

1 Footnote

4 *Limits could be absolute in the sense that they should never be exceeded or of whether, under specific circumstances, breaches of limits can be tolerated for a predetermined short period of time.*

Principle 4 – IRRBB measurement

31.27

Banks' internal measurement systems (IMS) should capture all material sources of IRRBB and assess the effect of market changes on the scope of their activities. In addition to the impact of an interest rate shock on its economic value, a bank's policy approach should take into account its ability to generate stable earnings sufficient to maintain its normal business operations.

31.28

Banks should pay attention to the complementary nature of economic value and earnings-based measures in their risk and internal capital assessments, in particular in terms of:

1. outcomes: economic value measures compute a change in the net present value of the bank's assets, liabilities and off-balance sheet items subject to specific interest rate shock and stress scenarios, while earnings-based measures focus on changes to future profitability within a given time horizon eventually affecting future levels of a bank's own equity capital;
2. assessment horizons: economic value measures reflect changes in value over the remaining life of the bank's assets, liabilities and off-balance sheet items, ie until all positions have run off, while earnings-based measures cover only the short to medium term, and therefore do not fully capture those risks that will continue to impact profit and loss accounts beyond the period of estimation; and
3. future business/production: economic value measures consider the net present value of repricing cash flows of instruments on the bank's balance sheet or accounted for as an off-balance sheet item (ie a run-off view). Earnings measures may, in addition to a run-off view, assume rollover of maturing items (ie a constant balance sheet view) and/or assess the scenario-consistent impact on the bank's future earnings inclusive of future business (ie a dynamic view).[5]

1 Footnote

5 *A dynamic view can be useful for business planning and budgeting purposes. However, dynamic approaches are dependent on key variables and assumptions that are extremely difficult to project with accuracy over an extended period and can potentially hide certain key underlying risk exposures.*

31.29

While the economic value and earnings-based measures share certain commonalities, the Committee observes that most commercial banks primarily utilise the latter for IRRBB management, whereas regulators tend to endorse the former as a benchmark for comparability and capital adequacy. The Committee acknowledges the importance of managing IRRBB through both economic value and earnings-based measures. If a bank solely minimises its

economic value risk by matching the repricing of its assets with liabilities beyond the short term, it could run the risk of earnings volatility.

31.30

Banks' IMS for IRRBB should be able to accommodate the calculation of the impact on economic value and earnings of multiple scenarios, based on:

1. internally selected interest rate shock scenarios addressing the bank's risk profile, according to its ICAAP;
2. historical and hypothetical interest rate stress scenarios, which tend to be more severe than shock scenarios;
3. the six prescribed interest rate shock scenarios set out in SRP31.90 to SRP31.93; and
4. any additional interest rate shock scenarios required by supervisors.

31.31

Banks should measure their vulnerability to loss under stressful market conditions – including the breakdown of key assumptions – and consider those results when establishing and reviewing their policies and limits for IRRBB.

31.32

A bank should develop and implement an effective stress testing framework for IRRBB as part of its broader risk management and governance processes. This should feed into the decision-making process at the appropriate management level, including strategic decisions (eg business and capital planning decisions) of the governing body or its delegates. 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 behaviour of its customer base.

31.33

A bank's stress testing framework for IRRBB should be commensurate with its nature, size and complexity as well as business activities and overall risk profile. The framework should include clearly defined objectives, scenarios tailored to the bank's businesses and risks, well documented assumptions and sound methodologies. The framework will be used to assess the potential impact of the scenarios on the bank's financial condition, enable ongoing and effective review processes for stress tests and recommend actions based on the stress test results. IRRBB stress tests should play an important role in the communication of risks, both within the bank and externally with supervisors and the market through appropriate disclosures.

31.34

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 (eg 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.

31.35

Banks should determine, by currency, a range of potential interest rate movements against which they will measure their IRRBB exposures. Management should ensure that risk is measured under a reasonable range of potential interest rate scenarios, including some containing severe stress elements. In developing the scenarios, banks should consider a variety of factors, such as the shape and level of the current term structure of interest rates and the historical and implied volatility of interest rates. In low interest rate environments, banks should also consider negative interest rate scenarios and the possibility of asymmetrical effects of negative interest rates on their assets and liabilities.

31.36

A bank should consider the nature and sources of its IRRBB exposures, the time it would need to take action to reduce or unwind unfavourable IRRBB exposures, and its capability/willingness to withstand accounting losses in order to reposition its risk profile. A bank should select scenarios that provide meaningful estimates of risk and include a range of shocks that is sufficiently wide to allow the governing body or its delegates to understand the risk inherent in the bank's products and activities. When developing interest rate shock and stress scenarios for IRRBB, banks should consider the following:

1. The scenarios should be sufficiently wide-ranging to identify parallel and non-parallel gap risk, basis risk and option risk. In many cases, static interest rate shocks may be insufficient to assess IRRBB exposure adequately. Banks should ensure that the scenarios are both severe and plausible, in light of the existing level of interest rates and the interest rate cycle.
2. Special consideration should be given to instruments or markets where concentrations exist, because those positions may be more difficult to liquidate or offset in a stressful market environment.
3. Banks should assess the possible interaction of IRRBB with its related risks, as well as other risks (eg credit risk, liquidity risk).
4. Banks should assess the effect of adverse changes in the spreads of new assets/liabilities replacing those assets/liabilities maturing over the horizon of the forecast on their NII.
5. 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. Given that the market value of options also fluctuates with changes in the volatility of interest rates, banks should develop interest rate assumptions to measure their IRRBB exposures to changes in interest rate volatilities.
6. Banks should specify, in building their interest rate shock and stress scenarios, the term structure of interest rates that will be incorporated and the basis relationship between yield curves, rate indices etc. Banks should also estimate how interest rates that are administered or managed by management (eg prime rates or retail deposit rates, as opposed to those that are purely market-driven) might change. Management should document how these assumptions are derived.

31.37

In addition, forward-looking scenarios should incorporate changes in portfolio composition due to factors under the control of the bank (eg the bank's acquisition and production plans) as well as external factors (eg changing competitive, legal or tax environments); new products where only limited historical data are available; new market information and new emerging risks that are not necessarily covered by historical stress episodes.

31.38

Further, banks should perform qualitative and quantitative reverse stress tests[6] in order to:

1. identify interest rate scenarios that could severely threaten a bank's capital and earnings; and
2. reveal vulnerabilities arising from its hedging strategies and the potential behavioural reactions of its customers.

1 Footnote

6 *See the Principles of sound stress testing practices and supervision published by the Committee in October 2018.*

Principle 5 – behavioural and modelling assumptions

31.39

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

1. expectations for the exercise of interest rate options (explicit and embedded) by both the bank and its customers under specific interest rate shock and stress scenarios;
2. treatment of balances and interest flows arising from non-maturity deposits (NMDs);
3. treatment of own equity in economic value measures; and
4. the implications of accounting practices for IRRBB.

31.40

Hence, when assessing its IRRBB exposures, a bank should 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.

31.41

Common products with behavioural optionalities include:

1. Fixed rate loans subject to prepayment risk – Banks should understand the nature of prepayment risk for their portfolios and make reasonable and prudent estimates of the expected prepayments. The assumptions underlying the estimates and where prepayment penalties or other contractual features affect the embedded optionality effect should be documented. There are several factors that are important determinants of the bank's estimate of the effect of each interest rate shock and stress scenario on the average prepayment speed. Specifically, a bank must assess the expected average prepayment speed under each scenario.
2. Fixed rate loan commitments – Banks may sell options to retail customers (eg prospective mortgage buyers or renewers) whereby, for a limited period, the customers can choose to draw down a loan at a committed rate. Unlike loan commitments to corporates, where drawdowns strongly reflect characteristics of automatic interest rate options, mortgage commitments (ie pipelines) to retail customers are impacted by other drivers.
3. Term deposits subject to early redemption risk – Banks may attract deposits with a contractual maturity term or with step-up clauses that enable the depositor at different time periods to modify the speed of redemption. The classification scheme should be

documented, whether a term deposit is deemed to be subject to redemption penalties or to other contractual features that preserve the cash flow profile of the instrument.

4. NMDs – Behavioural assumptions for deposits that have no specific repricing date can be a major determinant of IRRBB exposures under the economic value and earnings-based measures. Banks should document, monitor and regularly update key assumptions for NMD balances and behaviour used in their IMS. To determine the appropriate assumptions for its NMDs, a bank should analyse its depositor base in order to identify the proportion of core deposits (ie NMDs which are unlikely to reprice even under significant changes in interest rate environment). Assumptions should vary according to depositor characteristics (eg retail/wholesale) and account characteristics (eg transactional/non-transactional).

31.42

Modelling assumptions should be conceptually sound and reasonable, and consistent with historical experience. Banks must carefully consider how the exercise of the behavioural optionality will vary not only under the interest rate shock and stress scenario but also across other dimensions. For instance, considerations may include those set out in Table 1.

Considerations affecting behavioural optionality — Table 1

Product	Dimensions influencing the exercise of the embedded behavioural options
Fixed rate loans subject to prepayment risk	Loan size, loan-to-value 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, gross domestic product (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 (eg direct or brokered deposit), contractual interest rates, 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 behaviour.
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.

31.43

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 generally need to assess exposures in each currency. Banks with the necessary skills and sophistication, and with material multicurrency exposures, may choose to include, in their IMS, methods to aggregate their IRRBB in different currencies using assumptions about the correlation between interest rates in different currencies.

31.44

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 the banks' economic value of equity.

31.45

Banks should be able to test the appropriateness of key behavioural assumptions, and all changes to the assumptions of key parameters should be documented (eg by comparing the economic value of equity measured under their IMS with the standardised framework in SRP31.94 to SRP31.129). 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.

31.46

The most significant assumptions underlying the system should be documented and clearly understood by the governing body or its delegates. Documentation should also include descriptions on how those assumptions could potentially affect the bank's hedging strategies.

31.47

As market conditions, competitive environments and strategies change over time, the bank 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.

Principle 6 – data integrity and model governance

31.48

Accurate and timely measurement of IRRBB is necessary for effective risk management and control. A bank's risk measurement system should be able to identify and quantify the major sources of IRRBB exposure. The mix of a bank's business lines and the risk characteristics of its activities should guide management's selection of the most appropriate form of measurement system.

31.49

Banks should not rely on a single measure of risk, given that risk management systems tend to vary in how they capture the components of IRRBB. Instead, banks should use a variety of methodologies to quantify their IRRBB exposures under both the economic value and earnings-based measures, ranging from simple calculations based on static simulations using current holdings to more sophisticated dynamic modelling techniques that reflect potential future

business activities.

31.50

A bank's MIS should allow it to retrieve accurate IRRBB information in a timely manner. The MIS should capture interest rate risk data on all the bank's material IRRBB exposures. There should be sufficient documentation of the major data sources used in the bank's risk measurement process.

31.51

Data inputs should be automated as much as possible to reduce administrative errors. Data mapping should be periodically reviewed and tested against an approved model version. A bank should monitor the type of data extracts and set appropriate controls.

31.52

Where cash flows are slotted into different time buckets (eg for gap analyses) or assigned to different vertex points to reflect the different tenors of the interest rate curve, the slotting criteria should be stable over time to allow for a meaningful comparison of risk figures over different periods.

31.53

Banks' IMS should be able to compute economic value and earnings-based measures of IRRBB, as well as other measures of IRRBB prescribed by their supervisors, based on the interest rate shock and stress scenarios set out in SRP31.30. It should also be sufficiently flexible to incorporate supervisory-imposed constraints on banks' internal risk parameter estimates.

31.54

The validation of IRRBB measurement methods and assessment of corresponding model risk should be included in a formal policy process that should be reviewed and approved by the governing body or its delegates. 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.

31.55

An effective validation framework should include three core elements:

1. evaluation of conceptual/methodological soundness, including developmental evidence;
2. ongoing model monitoring, including process verification and benchmarking; and
3. outcomes analysis, including backtesting of key internal parameters (eg stability of deposits, prepayments, early redemptions, pricing of instruments).

31.56

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.

31.57

Model risk management for IRRBB measures should follow a holistic approach that begins with motivation, development and implementation by model owners and users. Prior to receiving authorisation 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 governing body or its delegates. 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 bank.

31.58

The ongoing validation process should establish a set of exception trigger events that obligate the model reviewers to notify the governing body or its delegates in a timely fashion, in order to determine corrective actions and/or restrictions on model usage. Clear version control authorisations 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 may be modified or decommissioned. Banks should articulate policies for model transition, including change and version control authorisations and documentation.

31.59

IRRBB models might include those developed by third-party vendors. Model inputs or assumptions may also be sourced from related modelling processes or sub-models (both in-house and vendor-sourced) and should be included in the validation process. The bank should document and explain model specification choices as part of the validation process.

31.60

Banks that purchase IRRBB models should ensure there is adequate documentation of their use of those models, including any specific customisation. If vendors provide input for market data, behavioural assumptions or model settings, the bank should have a process in place to determine if those inputs are reasonable for its business and the risk characteristics of its activities.

31.61

Internal audit should review the model risk management process as part of its annual risk assessment and audit plans. The audit activity should not duplicate model risk management processes, but should review the integrity and effectiveness of the risk management system and the model risk management process.

Principle 7 – reporting to management

31.62

The reporting of risk measures to the governing body or its delegates should be regular and should compare current exposure with policy limits. In particular, reporting should include the 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 on a regular basis. Portfolios that may be subject to significant mark-to-market movements should be clearly identified within the bank’s MIS and subject to oversight in line with any other portfolios

exposed to market risk.

31.63

While the types of reports prepared for the governing body or its delegates will vary based on the bank's portfolio composition, they should include at least the following:

1. 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;
2. reports demonstrating the bank's compliance with policies and limits;
3. key modelling assumptions such as NMD characteristics, prepayments on fixed rate loans and currency aggregation;
4. results of stress tests, including assessment of sensitivity to key assumptions and parameters; and
5. 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).

31.64

Reports detailing the bank's IRRBB exposures should be provided to the bank's governing body or its delegates on a timely basis and reviewed regularly. The IRRBB reports should provide aggregate information as well as sufficient supporting detail to enable the governing body or its delegates to assess the sensitivity of the bank to changes in market conditions, with particular reference to portfolios that may potentially be subject to significant mark-to-market movements. The governing body or its delegates should review the bank's IRRBB management policies and procedures in light of the reports, to ensure that they remain appropriate and sound. The governing body or its delegates should also ensure 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.

Principle 8 – public disclosure

31.65

The level of IRRBB exposure should be measured and disclosed. Disclosure requirements are set out in DIS70.

Principle 9 – IRRBB in the ICAAP

31.66

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

31.67

Banks should not only rely on supervisory assessments of capital adequacy for IRRBB, but should also 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.

31.68

Capital adequacy for IRBBB should be considered in relation to the risks to economic value, given that such risks are embedded in the bank’s assets, liabilities and off-balance sheet items. For risks to future earnings, given the possibility that future earnings may be lower than expected, banks should consider capital buffers.

31.69

Capital adequacy assessments for IRRBB should factor in:

1. the size and tenor of internal limits on IRRBB exposures, and whether these limits are reached at the point of capital calculation;
2. 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;
3. the sensitivity of the internal measures of IRRBB to key modelling assumptions;
4. the impact of shock and stress scenarios on positions priced off different interest rate indices (basis risk);
5. the impact on economic value and NII of mismatched positions in different currencies;
6. the impact of embedded losses;
7. the distribution of capital relative to risks across legal entities that form part of a capital consolidation group, in addition to the adequacy of overall capital on a consolidated basis;
8. the drivers of the underlying risk; and
9. the circumstances under which the risk might crystallise.

31.70

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

Principle 10 – supervisory assessment of banks’ IRRBB exposures

31.71

Supervisors should, on a regular basis, collect sufficient information from banks to assess their IRRBB exposures. While the precise information obtained could differ among supervisors, the amount of information collected should at least allow the supervisor to assess the IRRBB exposures of the bank and to identify and monitor outlier banks under Principle 12.

31.72

Supervisors should ensure that the collection of information is comparable and consistent across the banks that they supervise. Supervisors should have discretionary powers to collect additional information to assess banks' IRRBB in line with Principle 11, including the sensitivity of their IMS calculations to changes in key assumptions. For example, supervisors may collect information on:

1. the modelling of NMDs for IMS purposes and the sensitivity of a bank's economic value and earnings to changes in NMD assumptions;
2. the impact of assumptions used regarding products with behavioural optionalities;
3. the treatment of own equity in internal calculations and the extent to which this impacts the change in economic value of equity (ΔEVE) number disclosed under Principle 8;
4. repricing gaps of cash flows associated with their interest rate-sensitive assets, liabilities and off-balance sheet items (by significant currencies);
5. exposures to automatic interest rate options;
6. the types of yield curve used for IMS purposes;
7. the level of ΔEVE if calculated using the standardised framework set out in SRP31.94 to SRP31.129; and
8. economic value and earnings-based measures for interest rate shock and stress scenarios in addition to those prescribed in paragraphs SRP31.90 to SRP31.93 (including results based on banks' internally developed or other interest rate shock or stress scenarios).

31.73

Jurisdictions that intend to perform an off-site review of their banks' IRRBB should put in place adequate reporting schemes to enable peer comparison of banks and identification of banks for additional on-site work.

Principle 11 – supervisory assessment of banks' IRRBB management

31.74

Supervisors should regularly evaluate the adequacy, integrity and effectiveness of a bank's IRRBB management framework and assess whether its practices comply with the stated objectives and risk tolerances set by its governing body, and with supervisory expectations as set out in Principles 1 to 7. Supervisors should take into account a bank's size and complexity at the time of assessment.

31.75

Supervisors should evaluate whether a bank's IMS provides a sufficient basis for identifying and measuring IRRBB, taking note particularly of the key assumptions that affect the measurement of IRRBB. Supervisors should request and evaluate information about significant model or policy changes that have occurred between their regular reviews and concentrate their efforts on reviewing the most material models and policies.

31.76

Supervisors should review regularly the outputs from the bank's IMS, including the bank's IRRBB exposures (both economic value and earnings-based measures) based on the internal calculations using at least the prescribed interest rate shock scenarios specified in SRP31.90 to SRP31.93, as well as any additional interest rate shock and stress scenarios they determine should be assessed. Supervisors may also form their evaluation of a bank's IMS by applying supervisory estimates which they have developed. Supervisors should also review the information disclosed by banks under Principle 8.

31.77

When reviewing the bank's IRRBB exposures and forming conclusions about the quality of the bank's IRRBB management, supervisors should at a minimum, consider:

1. the complexity and level of risk posed by the bank's assets, liabilities and off-balance sheet activities;
2. the adequacy and effectiveness of oversight by the bank's governing body or its delegates;
3. a bank's knowledge and ability to identify and manage the sources of IRRBB;
4. the adequacy of internal validation of IRRBB measures, including sensitivity analysis and backtesting, in particular where changes in key modelling parameters have occurred;
5. the adequacy of internal monitoring and of the bank's MIS;
6. the effectiveness of risk limits and controls that set tolerances on economic value and earnings;
7. the effectiveness of the bank's IRRBB stress testing programme;
8. the adequacy and frequency of the internal review and audit of the IRRBB management process, including independent model validation and oversight of model risk;
9. the adequacy and effectiveness of IRRBB management practices as evidenced by past and projected financial performance;
10. the effectiveness of hedging strategies used by the bank to control IRRBB; and
11. the appropriateness of the level of IRRBB (including embedded losses) in relation to the bank's capital, earnings and risk management systems.

31.78

Supervisors should assess the adequacy of a bank's capital relative to its IRRBB exposures (against expectations set out in Principle 9) 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 limited to the outlier/materiality test set out in Principle 12.

31.79

The supervisory evaluation should be undertaken both on a standalone basis and by making comparisons with peer banks – in particular, supervisors should compare the key behavioural and strategic assumptions being made by banks within their jurisdictions, to determine whether they can be justified with regard to the economic environment and business model. Supervisors should ensure that the information they review is comparable and consistent across the banks that they supervise.

31.80

Supervisors should employ specialist resources to assist with the assessment of IRRBB levels and controls in the banks that they supervise. Supervisory bodies should:

1. ensure that line supervisors are appropriately trained and sufficiently knowledgeable to identify all relevant aspects of IRRBB in the banks that they regulate; and
2. employ an adequate number of IRRBB specialists.

31.81

Supervisors should cooperate and share information with relevant supervisors in other jurisdictions regarding the supervision of banks' IRRBB, in particular for banks with operations

across multiple jurisdictions. Sharing of such information could take place on a bilateral or multilateral basis (eg through supervisory colleges). The information shared could include supervisory experiences from assessing and monitoring a bank's IRRBB in different parts of its group, modelling assumptions made by banks, any impediments experienced during the supervision process, rules/criteria established to evaluate the capital that banks would need for IRRBB, and examples of good practices observed in the banks' management of IRRBB.

Principle 12 – supervisory action with respect to outlier banks

31.82

Supervisors must publish their criteria for identifying an outlier bank, defined in terms of the outlier/materiality test(s) used by the supervisor. The supervisor should implement at least one outlier/materiality test that compares the bank's maximum ΔEVE, under the six prescribed interest rate shock scenarios set out in paragraphs SRP31.90 to SRP31.93, with 15% of its Tier 1 capital, computed in line with the disclosure requirements in Principle 8.

31.83

Supervisors may also implement additional outlier/materiality tests, provided these tests are applied throughout their jurisdiction in the same form. The additional outlier/materiality tests could use a different capital measure (eg Common Equity Tier 1, or CET1, capital, amount by which regulatory capital exceeds the bank's minimum requirements) or capture the bank's IRRBB relative to earnings. For the additional outlier/materiality tests, the threshold for defining an outlier bank should be at least as stringent as 15% of Tier 1 capital.

31.84

Banks identified by supervisors under their criteria as outliers must be considered as potentially having undue IRRBB and subject to review.

31.85

All banks are expected to hold adequate capital for the risks they undertake. With regard to IRRBB, supervisors should evaluate whether the bank has adequate capital and earnings that are commensurate with its level of short-term and long-term IRRBB exposures, as well as the risk those exposures may pose to its future financial performance. Supervisors should consider the following factors:

1. The ΔEVE under a variety of shocked and stressed interest rate scenarios. Where a bank's EVE is significantly sensitive to interest rate shocks and stresses, the supervisor should evaluate the impact on its capital levels arising from financial instruments held at market value, and potential impact should banking book positions held at historical cost become subject to market valuation. Supervisors should, in their assessment, consider the impact of key assumptions on the ΔEVE calculated, including those related to the inclusion/exclusion of commercial margins, the bank's actual equity allocation profile, the stability of NMDs and prepayment optionality.
2. The strength and stability of the earnings stream and the level of income needed to generate and maintain normal business operations. A high level of IRRBB exposure is one that could, under a plausible range of market scenarios, result in the bank reporting losses or curtailing normal dividend distribution and business operations. In such cases, management should ensure that the bank has sufficient capital to withstand the adverse impact of such events until it can implement mitigating actions such as reducing exposures or increasing capital.

31.86

When a supervisor determines that a bank's IMS is deficient in its measurement of IRRBB, the supervisor should require the bank to improve its IMS and/or use the standardised framework set out in SRP31.94 to SRP31.129 to compute its IRRBB in terms of ΔEVE.

31.87

A bank could also be considered to have excessive risk relative to earnings if its shocked ΔNII was such that the bank would not have sufficient income to maintain its normal business operations.

31.88

When a national supervisor concludes that a bank's management of IRRBB is inadequate or that it has excessive risk relative to its capital or earnings, or its general risk profile, the supervisor must require the bank to take one or more of the following actions:

1. reduce its IRRBB exposures (eg by hedging);
2. raise additional capital;
3. set constraints on the internal risk parameters used by a bank; and/or
4. improve its risk management framework.

31.89

The reduction in IRRBB and/or the expected higher level of capital should be achieved within a specified time frame, to be established taking into consideration prevailing financial and economic conditions, as well as the causes of IRRBB exposure exceeding the supervisory threshold.

The standardised interest rate shock scenarios

31.90

Banks should 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 derivation of these shocks is explained in SRP98.56 to SRP98.63. These scenarios are applied to IRRBB exposures in each currency for which the bank has 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. For the purposes of capturing the local rate environment, a historical time series ranging from January 2000 to December 2023 for various maturities[7] was used to derive each scenario for a given currency. Under this approach, IRRBB is measured by means of the following six scenarios:

1. parallel shock up;
2. parallel shock down;
3. steepener shock (short rates down and long rates up);
4. flattener shock (short rates up and long rates down);
5. short rates shock up; and
6. short rates shock down.

Specified size of interest rate shocks, $\overline{S}_{shocktype,c}$ Table 2

	ARS	AUD	BRL	CAD	CHF	CNY	EUR	GBP	HKD	IDR	INR
Parallel	400	350	400	200	175	225	225	275	225	400	325
Short	500	425	500	275	250	300	350	425	375	500	475
Long	300	300	300	175	200	150	200	250	200	300	225

	JPY	KRW	MXN	RUB	SAR	SEK	SGD	TRY	USD	ZAR
Parallel	100	225	400	400	275	275	175	400	200	325
Short	100	350	500	500	375	425	250	500	300	500
Long	100	225	200	300	250	200	225	300	225	300

1 Footnote

[7] *Jurisdictions may, under national discretion, recalculate the shocks in Table 2 for their domestic currencies using data that deviate from the 24-year period if they better reflect their idiosyncratic circumstances.*

31.91

Given Table 2, 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:

1. Parallel shock for currency c: a constant parallel shock up or down across all time buckets. $\Delta S_{parallel,c}\left(t_k\right) = \pm \overline{S}_{parallel,c}$
2. Short rate shock for currency c: shock up or down that is greatest at the shortest tenor midpoint. That shock, through the shaping scalar $\alpha_{short}\left(t_k\right) = e^{\frac{-t_k}{x}}$, where x = 4, diminishes towards zero at the tenor of the longest point in the term structure.[8]

   $$\Delta S_{short,c}\left(t_k\right) = \pm \overline{S}_{short,c} \cdot \alpha_{short}\left(t_k\right) = \pm \overline{S}_{short,c} \cdot e^{\frac{-t_k}{x}}$$
3. 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: $\alpha_{long}\left(t_k\right) = 1 - \alpha_{short}\left(t_k\right)$. $\Delta S_{long,c}\left(t_k\right) = \pm \overline{S}_{long,c} \cdot \alpha_{long}\left(t_k\right) = \pm \overline{S}_{long,c} \cdot \left(1 - e^{\frac{-t_k}{x}}\right)$
4. Rotation shocks for currency c: involving rotations to the term structure (ie 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:

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

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

1 Footnote

[8] *The value of x in the denominator of the function controls the rate of decay of the shock. This should be set to the value of 4 for most currencies and the related shocks unless otherwise determined by national supervisors. tk is the midpoint (in time) of the kth bucket and tK is the midpoint (in time) of the last bucket K. There are 19 buckets in the standardised framework, but the analysis may be generalised to any number of buckets.*

31.92

The following examples illustrate the scenarios in SRP31.91(2) and SRP31.91(4).

1. Short rate shock: Assume that the bank uses the standardised 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 $\alpha_{short}\left(t_k\right) = e^{\frac{-3.5}{4}}$ = 0.417. Banks would 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. If the short rate shock was +100 basis points (bp), the increase in the yield curve at $t_k = 3.5$ years would be 41.7 bp.
2. 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 bp: −0.65 x 100 bp x 0.417 + 0.9 x 100 bp x (1−0.417) = +25.4 bp.
3. Flattener: The corresponding change in the yield curve for the shocks in the example above at $t_k = 3.5$ years would be: +0.8 x 100 bp x 0.417 – 0.6 x 100 bp x (1−0.417) = −1.6 bp.

31.93

The Committee acknowledges that shock sizes of different currencies should reflect local conditions in a timely manner. For this reason, the Committee will review the calibration of the interest rate shock sizes (eg every five years). National supervisors may, at their discretion, set floors for the post-shock interest rates under the six interest rate shock scenarios, provided the floors are not greater than zero.

The standardised framework

31.94

Supervisors could mandate their banks to follow the framework set out in this section, or a bank could choose to adopt it.

31.95

The steps involved in measuring a bank's IRRBB, based solely on EVE, are:

1. Interest rate-sensitive banking book positions are allocated to one of three categories (ie amenable, less amenable and not amenable to standardisation).
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 standardisation, they are excluded from this step. For positions with embedded automatic interest rate options, the optionality should be ignored for the purpose of slotting of notional repricing cash flows.[9] For positions that are not amenable to standardisation, there is a separate treatment for:
    1. NMDs – according to separation of core and non-core cash flows via the approach set out in SRP31.107 to SRP31.112.
    2. Behavioural options (fixed rate loans subject to prepayment risk and term deposits subject to early redemption risk) – behavioural parameters relevant to the position type must rely on a scenario-dependent look-up table set out in SRP31.119 and SRP31.125.
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.
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 (possibly net of automatic interest rate options bought to hedge sold interest rate options) 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.
5. IRRBB EVE calculation. The ΔEVE under the standardised framework will be the maximum of the worst aggregated reductions to EVE across the six supervisory prescribed interest rate shocks.

1 Footnote

9 *That is, the embedded automatic interest rate option is stripped out from the process of slotting notional repricing cash flows in Step 2 and treated together with other automatic interest rate options under Step 4.*

31.96

Banks must project all future notional repricing cash flows arising from interest rate-sensitive assets, liabilities and off-balance sheet items on to:

1. 19 predefined time buckets (indexed numerically by k) as set out in Table 3, into which they fall according to their repricing dates, or
2. the time bucket midpoints as set out in Table 3, retaining the notional repricing cash flows' maturity. This alternative requires splitting up notional repricing cash flows between two adjacent maturity bucket midpoints.

Maturity schedule with 19 time buckets for notional repricing cash flows repriciting at tCF
The number in brackets is the time bucket's midpoint — Table 3

	Time bucket intervals (M = months; Y = years)							
Short-term rates	Overnight (0.0028Y)	Overnight < tCF ≤ 1M (0.0417Y)	1M < tCF ≤ 3M (0.1667Y)	3M < tCF ≤ 6M (0.375Y)	6M < tCF ≤ 9M (0.625Y)	9M < tCF ≤ 1Y (0.875Y)	1Y < tCF ≤ 1.5Y (1.25Y)	1.5Y < tCF ≤ 2Y (1.75Y)
Medium-term rates	2Y < tCF ≤ 3Y (2.5Y)	3Y < tCF ≤ 4Y (3.5Y)	4Y < tCF ≤ 5Y (4.5Y)	5Y < tCF ≤ 6Y (5.5Y)	6Y < tCF ≤ 7Y (6.5Y)			
Long-term rates	7Y < tCF ≤ 8Y (7.5Y)	8Y < tCF ≤ 9Y (8.5Y)	9Y < tCF ≤ 10Y (9.5Y)	10Y < tCF ≤ 15Y (12.5Y)	15Y < tCF ≤ 20Y (17.5Y)	tCF > 20Y (25Y)		

31.97

For the purpose of this approach, assets are those not deducted from CET1 capital and exclude fixed assets (such as real estate or intangible assets) and equity exposures in the banking book. Liabilities include all non-remunerated deposits but exclude CET1 capital under the Basel III framework.

31.98

A notional repricing cash flow CF(k) is defined as:

1. any repayment of principal (eg at contractual maturity);
2. 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
3. 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 until their contractual maturity irrespective of whether the non-amortised principal has been repriced or not.

31.99

The date of each repayment, repricing or interest payment is referred to as its repricing date.

31.100

Banks have the choice of whether to deduct commercial margins and other spread components from the notional repricing cash flows, using a prudent and transparent methodology.

31.101

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 or time bucket midpoints (other than the spread component which is not repriced).

31.102

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 or time bucket midpoints (henceforth, denoted by $CF_{i,c}(k)$ or $CF_{i,c}(t_k)$under interest rate shock scenario i and currency c) based on their amenability to standardisation.

31.103

Notional repricing cash flows can be slotted into appropriate time buckets or time bucket midpoints 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:

1. Fixed rate positions: such positions generate cash flows that are certain till the point of contractual maturity. Examples are fixed rate loans without embedded prepayment options, term deposits without redemption risk and other amortising products such as mortgage loans. All coupon cash flows and periodic or final principal repayments should be allocated to the time bucket midpoints closest to the contractual maturity.
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 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 time bucket midpoint closest to the next reset date bucket.

31.104

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.[10] That is, the stripped-out embedded automatic interest rate option must be treated together with explicit automatic interest rate options. Supervisors may allow banks to categorise other positions as amenable to standardisation and ignore the optionality if it can be shown to be of immaterial consequence.

1 Footnote

10 For example, a floating rate loan or debt security with a floor would be treated as if there were no floor; hence it would be treated as if it fully repriced at the next reset date, and its full outstanding balance slotted in the corresponding time band. Similarly, a callable bond issued by a bank at a fixed yield would be treated as if it matured at its longest contractual term, ignoring the call option.

31.105

Some positions are less amenable to standardisation.[11] For explicit automatic interest rate options, as well as embedded automatic interest rate options[12] that are separated or stripped out from the bank's assets or liabilities (ie the host contract), the methodology for automatic interest rate options is described in SRP31.127 and SRP31.128.

2 Footnotes

11 A common feature of these positions is optionality that makes the timing of notional repricing cash flows uncertain. This optionality introduces a non-linearity, which suggests that delta-equivalent approximations are imprecise for large interest rate shock scenarios.

12 *An example of a product with embedded automatic interest rate options is a floating rate mortgage loan with embedded caps and/or floors. Notional repricing cash flows for those loans are treated as a fixed rate loan until the next repricing date, thereby ignoring the option, which instead is treated like a separate automatic interest rate option.*

31.106

Positions not amenable to standardisation include

1. NMDs,
2. fixed rate loans subject to prepayment risk and
3. term deposits subject to early redemption risk.

31.107

Under the standardised framework, banks should 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.

31.108

NMDs must be segmented into retail and wholesale categories. Retail deposits are defined as deposits placed with a bank by an individual person. Deposits made by small business customers 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 (provided the total aggregated liabilities raised from one small business customer are less than €1 million). Retail deposits should be considered as held in a transactional account when regular transactions are carried out in that account (eg when salaries are regularly credited) or when the deposit is non-interest bearing.[13] 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.

1 Footnote

13 *A specific category may be introduced for non-remunerated deposits, subject to supervisory approval.*

31.109

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.

31.110

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.

31.111

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

31.112

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.

Caps on core deposits and average maturity by category — Table 4

	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

31.113

The treatment set out SRP31.114 to SRP31.126 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.[14]

1 Footnote

14 *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.*

31.114

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 a bank's 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.

31.115

Under the standardised framework, 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.[15]

1 Footnote

15 *These baseline parameter estimates may be determined by the bank subject to supervisory review and approval, or prescribed by the supervisor.*

31.116

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.

31.117

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.

31.118

Banks must determine or supervisors prescribe the baseline conditional prepayment rate $CPR^{p}_{0,c}$ for each portfolio p of homogeneous prepayment-exposed loan products denominated in currency c, under the prevailing term structure of interest rates.

31.119

The conditional prepayment rate (CPR) for each portfolio p of homogeneous prepayment-exposed loan products denominated in currency c, under interest rate scenario i, is given using the formula that follows, where $CPR^{p}_{0,c}$ is the (constant) base CPR of a portfolio pof homogeneous prepayment-exposed loans given in currency c[16] and given the prevailing term structure of interest rates. γ_i is a multiplier applied for scenario i as given in Table 5.

CPRs under the shock scenarios Table 5

Scenario number (i)	Interest rate shock scenarios	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

1 Footnote

16 *Alternatively, the base CPR may also vary over the life of each loan in the portfolio. In that case, it is denoted as for each time bucket k or time bucket midpoint tk.*

31.120

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.

31.121

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[17] according to the following formula, 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 (ie 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.

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

1 Footnote

17 *For simplicity, we have assumed there is no annual limit on prepayments. If a bank has an annual limit on uncompensated prepayments, this limit will apply.*

31.122

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 or time bucket midpoints up to their corresponding contractual maturity dates if it can be shown to the satisfaction of the supervisor that:

1. the depositor has no legal right to withdraw the deposit; or
2. 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.[18]

1 Footnote

18 *However, often penalties do not reflect such an economic calculation but instead are based on a simpler formula such as a percentage of accrued interest. In such cases, there is potential for changes to profit or loss arising from differences between the penalty charged and the actual economic cost of early withdrawal.*

31.123

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 a bank issues term deposits that do not meet the above criteria to wholesale customers, it must assume that the customer will always exercise the right to withdraw in the way that is most disadvantageous to the bank (ie the deposit is classified as an automatic interest rate option).

31.124

Banks must determine or supervisors prescribe the baseline term deposit redemption ratio $TDRR^{p}_{o,c}$ 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) or time bucket midpoint (t_1).

31.125

The term deposit redemption ratio for time bucket k or time bucket midpoint t_k applicable to each homogeneous portfolio p of term deposits in currency c and under scenario i is obtained by multiplying $TDRR^{p}_{o,c}$ by a scalar u_i (set out in Table 6) that depends on the scenario i, as follows:

$$TDRR^{p}_{i,c} = \min(1, u_i \cdot TDRR^{p}_{o,c})$$

Term deposit redemption rate (TDRR) under the shock scenarios Table 6

Scenario number (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

31.126

The notional repricing cash flows which are expected to be withdrawn early under any interest rate shock scenario i are described as follows, where $TD^{p}_{0,c}$ is the outstanding amount of term deposits of type p.

$$CF^{p}_{i,c}(1) = TD^{p}_{0,c} \cdot TDRR^{p}_{i,c}$$

31.127

This paragraph and SRP31.128 describe the method for calculating an add-on for automatic interest rate options, whether explicit or embedded.[19] 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:

1. For each sold automatic option o in currency c, the value change, denoted $\triangle FVAO^{o}_{i,c}$, is calculated for each interest rate shock scenario i. The value change is given by:
    1. an estimate of the value of the option to the option holder,[20] given:
    (i)

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

    (ii)

    a relative increase in the implicit volatility of 25%; minus

    2. the value of the sold option to the option holder, given the yield curve in currency c at the valuation date.
2. Likewise, for each bought automatic interest rate option q, the bank 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 $\triangle FVAO^{q}_{i,c}$.
3. The bank's total measure for automatic interest rate option risk under interest rate shock scenario i in currency c is calculated as follows, where n_c (m_c)is the number of sold (bought) options in currency c.

$$KAO_{i,c} = \sum_{o=1}^{n_c} \triangle FVAO^{o}_{i,c} - \sum_{q=1}^{m_c} \triangle FVAO^{q}_{i,c}$$

2 Footnotes

19 *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 subsection.*

20 *This estimate requires a methodology approved by the supervisor.*

31.128

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 (ie CET1, Additional Tier 1 or total capital) to the total automatic interest rate

option risk measure $KAO_{i,c}$.

31.129

First, the loss in economic value of equity $\Delta EVE_{i,c}$ under scenario i and currency c is calculated for each currency with material exposures, ie those accounting for more than 5% of either banking book assets or liabilities, as follows:

1. Under each scenario i, all notional repricing cash flows are slotted into the respective time bucket $k \in \{1, 2, -, K\}$ or time bucket midpoint t_k, $k \in \{1, 2, -, K\}$. Within a given time bucket k or time bucket midpoint t_k, all positive and negative notional repricing cash flows are netted[21] to form a single long or short position, with the cancelled parts removed from the calculation. Following this process across all time buckets or time bucket midpoints leads to a set of notional repricing cash flows $CF_{i,c}(k)$ or $CF_{i,c}(t_k)$, $k \in \{1, 2, -, K\}$.[22]
2. Net notional repricing cash flows in each time bucket k or time bucket midpoint t_k are weighted by a continuously compounded discount factor, described below, that reflects the interest rate shock scenario i in currency c as set out in SRP31.90 to SRP31.93, 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[23] 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). $DF_{i,c}(t_k) = \exp(-R_{i,c}(t_k) \cdot t_k)$
3. These risk-weighted net positions are summed to determine the EVE in currency c under scenario i (excluding automatic interest rate option positions):

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

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

4. 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:

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

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

5. 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

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

measure.[24]

4 Footnotes

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

[22] *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 (scenario-dependent cash flow products).*

[23] *The discounting factors must be representative of a risk-free zero coupon rate. An example of an acceptable yield curve is a secured interest rate swap curve.*

[24] *National supervisors would, however, be allowed to prescribe a different method of currency aggregation for their banks, if the national supervisor is able to support, with evidence, that such a method would remain in line with the jurisdiction's appetite for IRRBB.*