

Interest rate risk in the banking book

Chapter A: General

Introduction

- a. Interest rate risk is an integral part of banking business, and may even be a source of profit. Nevertheless, excessive levels of interest rate risk may expose banking corporations to losses and even pose a threat to their capital. The management of interest rate risk is therefore critical to the stability of any banking corporation.
- b. This Directive is based on the Basel Committee standard: Interest Rate Risk in the Banking Book, published in April 2016. The numbering of the sections in this Directive are consistent with those of the Basel Committee standard uniform Basel framework as published in December 2019 (SRP31 and SRP98).
- c. This Directive focuses on managing Interest rate risk in the banking book. However, banking corporations are to manage their total interest rate risk, which derives both from the banking book and from the trading book. The qualitative guidelines in this Directive should be implemented on the entire interest rate risk, with relevant changes,
- d. The qualitative guidelines in this Directive complement the regulatory framework of the existing corporate governance regime, and are based on, among other things, Proper Conduct of Banking Business Directive no. 301 on “Board of Directors” and Proper Conduct of Banking Business Directive no. 310 on “Risk Management”.
- e. The requirement that applies to all banking corporations to allocate adequate capital against the various risks, including interest rate risk, is handled within the framework of Proper Conduct of Banking Business Directive no. 211 on “Assessment of Capital Adequacy”.
- f. The banking corporation is to verify that the risk management, tools and systems it implements are commensurate with the bank’s nature, size and complexity as well as its capital adequacy.

Application

- g. This Directive shall apply on the following corporations (hereinafter, “banking corporation”):
 1. A banking corporation except for a joint services company; a banking corporation that is a foreign bank shall implement the Directive with necessary adjustments and is not required to calculate the standardized interest rate shocks according to Sections 90–93.
 2. A corporation that was an auxiliary corporation and dealt with acquiring payment transactions for which the instruction to execute it was given via a payment card, just before the publication of the Enhancing Competition and Reducing Concentration in the Banking Sector in Israel (Legislative Amendments) Law, 5777-2017, whether it is an auxiliary corporation or if it is not such a corporation (in this Directive, “acquirer”), except for the provisions of Sections 90–93.

Definitions

“Interest rate risk in the banking book”	As defined in Chapter B
“Non-maturity Deposit”	A deposit without an agreed upon contractual maturity date or without a specific repricing date (Non-maturity Deposit –NMD)
“Term deposit”	A deposit that is not a “Non-maturity Deposit”
“Net adjusted fair value”	As defined in Section 4.a in Appendix 8— “quantitative information on interest rate risk— sensitivity analysis” in Reporting to the Public Directives no. 621 – “board and management report”.

Chapter B: Definition of IRRBB

1.

Interest rate risk in the banking book (**IRRBB**) refers to the current or prospective risk to the banking corporation’s capital and earnings arising from adverse movements in interest rates that affect the banking corporation’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 banking corporation’s assets, liabilities, and off-balance sheet items and hence its economic value. Changes in interest rates also affect a banking corporation’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 banking corporation’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 Appendix 1.

2.

Three main subtypes of IRRBB are defined for the purposes of this directive. All three subtypes 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 banking corporation’s financial condition.

(a) **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).

(b) **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.

(c) **Option risk** arises from option derivative positions or from optional elements embedded in a banking corporation’s assets, liabilities and/or off-balance sheet items, where the banking corporation or its customer can alter the level and timing of their cash flows. Option risk can be further characterized into automatic option risk and behavioral option risk.

3.

While the three subtypes listed above are directly linked to IRRBB, credit spread risk in the banking book (CSRBB) is a related risk that banking corporations 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.

Chapter C: Principles for managing interest rate risk

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 banking corporation'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 banking corporations' internal assessment of capital adequacy (ICAAP) for IRRBB respectively. In addition, Principle 12 reflects the criteria for identifying an outlier banking corporation by the Supervisor of Banks.

- a. IRRBB is an important risk for all banking corporations that must be specifically identified, measured, monitored and controlled. In addition, a banking corporation should monitor and assess CSRBB.
- b. The board of directors¹ of each banking corporation is responsible for oversight of the IRRBB management framework, and the banking corporation's risk appetite for IRRBB. The board of directors will ensure that senior management takes the necessary steps to monitor, control and manage the risk. Banking corporations must have an adequate IRRBB management framework, involving regular independent reviews and evaluations of the effectiveness of the system.
- c. The banking corporation's risk appetite for IRRBB should be articulated in terms of the risk to both economic value and earnings. Banking corporations must implement policy limits that target maintaining IRRBB exposures consistent with their risk appetite.
- d. Measurement of IRRBB should be based on outcomes of both economic value (hereinafter, "economic value of equity") and earnings-based measures, arising from a wide and appropriate range of interest rate shock and stress scenarios.
- e. In measuring IRRBB, key behavioral and modelling assumptions should be fully understood, conceptually sound and documented. Such assumptions should be rigorously tested and aligned with the banking corporation's business strategies.
- f. 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.

¹ The Directive refers to the board of directors, but it is possible that the requirements will be fulfilled by the Risk Management Committee, where the Board is permitted to delegate its powers to it, and provided this is possible pursuant to Proper Conduct of Banking Business Directive no. 301.

g. Measurement outcomes of IRRBB and hedging strategies should be reported to the board of directors on a regular basis, at relevant levels of aggregation (by consolidation level and currency).

h. Information on the level of IRRBB exposure and practices for measuring and controlling IRRBB must be disclosed to the public on a regular basis. Guidelines in this issue were established in the relevant Reporting to the Public Directives.

i. Capital adequacy for IRRBB must be specifically considered as part of the Internal Capital Adequacy Assessment Process (ICAAP) approved by the board of directors, in line with the banking corporation's risk appetite on IRRBB.

j. Principle 12 reflects the criteria for identifying an outlier banking corporation by the Supervisor of Banks. Banking corporations identified as outliers must be considered as potentially having undue IRRBB. When a review of a banking corporation's IRRBB exposure reveals inadequate management or excessive risk relative to capital, earnings or general risk profile, the Supervisor must require mitigation actions and/or additional capital.

5.

The implementation of these principles should be commensurate with the banking corporation's nature, size and complexity as well as its structure, economic significance and general risk profile.

Principle 1 – identification and monitoring of IRRBB

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.

7.

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

8.

Banking corporations 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 by the board of directors before being implemented.

Products and activities that are new to a banking corporation 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 banking corporation's IRRBB should be integrated within its broader risk management framework and aligned with its business planning and budgeting activities.

9.

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

Principle 2 – IRRBB management framework

10.

The board of directors¹ has responsibility for understanding the nature and the level of the banking corporation's IRRBB exposure. The board of directors 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 banking corporation's business strategies.

11.

Accordingly, the board of directors is responsible for ensuring that steps are taken by the banking corporation to identify, measure, monitor and control IRRBB consistent with the approved strategies and policies. More specifically, the board of directors are 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) standards for measuring IRRBB, valuing positions and assessing performance, including procedures for updating interest rate shock and stress scenarios, at least once a year, and to update key underlying assumptions driving the banking corporation's IRRBB analysis, at least once a year;
- (d) a comprehensive IRRBB reporting and review process; and
- (e) effective internal controls and management information systems (MIS).

12.

The board of directors should oversee the approval, implementation and review of IRRBB management policies and limits. The board of directors should be informed regularly (at least once a quarter) on the level and trend of the banking corporation's IRRBB exposures. It should regularly review timely information that is sufficiently detailed to allow it to understand and assess the quality of the monitoring and controlling of IRRBB in compliance with policies approved by the board of directors. Such reviews should be carried out more frequently when the banking corporation runs significant IRRBB exposures or has positions in complex IRRBB instruments.

13.

While board of directors 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 banking corporation's IRRBB strategies, including the potential linkages with and impact on market, liquidity, credit and operational risk. The banking corporation should ensure that some of the members should have sufficient technical knowledge to question and challenge the reports made to the board of directors. Board of directors 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.

14.

Senior management is responsible for ensuring the development of appropriate policies, procedures, and practices for managing IRRBB. Senior management shall review, at least once a year, the policies and procedures for managing the interest rate risk to ensure that they remain orderly and adequate. In the case of an asset and liability management committee (ALCO), it should meet regularly and include representatives from each major department connected to IRRBB.

15.

Senior management should ensure that there is adequate separation of responsibilities in key elements of the risk management process and the functions taking the risks, to avoid potential conflicts of interest.

Banking corporations should have IRRBB identification, measurement, monitoring and control functions with clearly defined responsibilities that are sufficiently independent from risk-taking functions of the banking corporation and that report IRRBB exposures directly to the board of directors and to senior management.

16.

Senior management 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 directives to these line units.

17.

The board of directors should ensure that the banking corporation's organizational structure enables office holders or relevant committees to carry out their responsibilities, and facilitates effective decision-making and good governance. The board of directors should encourage discussions with senior management and risk management functions regarding the IRRBB management process. The risk management and strategic planning areas of the banking corporation should also communicate regularly to facilitate evaluations of risk arising from future business.

18.

Banking corporations 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 banking corporation policies.

19.

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

20.

In addition, banking corporations 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. Banking corporations 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.

21.

Banking corporations should have their IRRBB identification, measurement, monitoring and control processes reviewed by an independent auditing function on a regular basis, in accordance with the requirements of Proper Conduct of Banking Business Directive no. 307 (The Internal Audit Function).

Principle 3 – IRRBB risk appetite

22.

Banking corporations should have clearly defined risk appetite statements² that are approved by the board of directors and implemented through comprehensive risk appetite frameworks, i.e., 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) by senior management, or when trigger events occur, and revised as needed.

23.

Policy limits set by the governing bodies should be consistent with the banking corporation's overall approach for measuring IRRBB. Aggregate risk limits, clearly

² A risk appetite statement is a written articulation of the aggregated level and types of IRRBB exposures that a banking corporation will accept, or avoid, in order to achieve its business objectives.

articulating the amount of IRRBB acceptable by the board of directors, should be applied on a consolidated basis and on entities of the banking group that hold significant exposures to interest rate risk in the banking book portfolio or positions in complex interest rate risk instruments in the banking book, separately. 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.

24.

Policy limits should be appropriate to the nature, size, complexity and capital adequacy of the banking corporation, as well as its ability to measure and manage its risks. Depending on the nature of a banking corporation'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 banking corporation's holdings, including the various sources of the banking corporation's IRRBB exposures. Banking corporations with significant exposures to gap risk, basis risk or positions with explicit or embedded options should establish risk tolerances appropriate for these risks.

25.

The board of directors 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 and approved 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 banking corporation's overall risk appetite, and procedures to identify, measure, monitor and control the risks of the proposed product or activity have been established.

26.

There should be systems in place to ensure that positions that exceed, or are likely to exceed, limits defined by the board of directors and senior management should receive prompt senior 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 exceptional or unexpected loss.⁴

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

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

27.

Banking corporations' 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 banking corporation's policy approach should take into account its ability to generate stable earnings sufficient to maintain its normal business operations.

The ability to generate stable earnings should also take into account noninterest income, to the extent it is related to changes in the market interest rates that can be identified. For example, when a banking corporation provides an operational service in respect of a fee based on the volume of assets it operates, and the volume of the assets and the changes in market interest rates can be connected.

28.

Banking corporations 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:

(a) outcomes: economic value measures compute a change in the net present value of the banking corporation'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 banking corporation's own equity capital. A banking corporation should include in economic value measures at least an index for the economic value measure net of nonfinancial items and net of capital.

(b) assessment horizons: economic value measures reflect changes in value over the remaining life of the banking corporation'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

(c) future business/production: economic value measures consider the net present value of repricing cash flows of instruments on the banking corporation's balance sheet or accounted for as an off-balance sheet item (i.e., 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 banking corporation's future earnings inclusive of future business (ie a dynamic view).⁵ A banking corporation should not only use the dynamic view.

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.

29.

While the economic value and earnings-based measures share certain commonalities, it is important to manage IRRBB through both economic value and earnings-based measures. If a banking corporation solely minimizes 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.

30.

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

(a) internally selected interest rate shock scenarios addressing the banking corporation's risk profile, according to its ICAAP;

b2) historical and hypothetical interest rate stress scenarios, which tend to be more severe than shock scenarios;

(c) the six prescribed interest rate shock scenarios set out in Appendices 1 and 1a, and for an acquirer, the scenarios described in Appendix 2, and

(d) any additional interest rate shock scenarios required by the Supervisor of Banks.

31.

Banking corporations 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.

32.

A banking corporation 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 (e.g., business and capital planning decisions) of the board of directors. In particular, IRRBB stress testing should be considered in the ICAAP, requiring banking corporations to undertake rigorous, forward-looking stress testing that identifies events of severe changes in market conditions which could adversely impact the banking corporation's capital or earnings, possibly also through changes in the behavior of its customer base.

33.

A banking corporation'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 banking corporation'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 banking corporation'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 banking corporation and externally.

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 banking corporation (e.g., traders, the treasury department, the finance department, the ALCO, the risk management and risk control departments and/or the banking corporation's economists). A stress-testing program for IRRBB should ensure that the opinions of the experts are taken into account.

35.

Banking corporations 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, banking corporations 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, banking corporations should also consider negative interest rate scenarios and the possibility of asymmetrical effects of negative interest rates on their assets and liabilities.

36.

A banking corporation should consider the nature and sources of its IRRBB exposures, the time it would need to take action to reduce or unwind unfavorable IRRBB exposures, and its capability/willingness to withstand accounting losses in order to reposition its risk profile. A banking corporation should select scenarios that provide meaningful estimates of risk and include a range of shocks that is sufficiently wide to understand the risk inherent in the banking corporation's products and activities. When developing interest rate shock and stress scenarios for IRRBB, banking corporations 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. Banking corporations 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) Banking corporations should assess the possible interaction of IRRBB with its related risks, as well as other risks (e.g., credit risk, liquidity risk).

(4) Banking corporations 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) Banking corporations with significant option risk should include scenarios that capture the exercise of such options. For example, banking corporations 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, banking corporations should

develop interest rate assumptions to measure their IRRBB exposures to changes in interest rate volatilities.

(6) Banking corporations 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. Banking corporations should also estimate how interest rates that are administered or managed by management (e.g., 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.

37.

In addition, forward-looking scenarios should incorporate changes in portfolio composition due to factors under the control of the banking corporation (e.g., the banking corporation'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 are available; new market information and new emerging risks that are not necessarily covered by historical stress episodes.

38.

Further, banking corporations should perform qualitative and quantitative reverse stress tests⁶ in order to:

- (1) identify interest rate scenarios that could severely threaten a banking corporation's capital and earnings; and
- (2) reveal vulnerabilities arising from its hedging strategies and the potential behavioral reactions of its customers.

Principle 5 – behavioral and modelling assumptions

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 banking corporation 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.

40.

Hence, when assessing its IRRBB exposures, a banking corporation should make judgments and assumptions about how an instrument's actual maturity or repricing behavior may vary from the instrument's contractual terms because of behavioral optionalities.

⁶ See Principle 6 in the "Principles for Sound Stress Testing Practices and Supervision" by the Basel Committee from May 2009.

41.

Common products with behavioral optionalities include:

(1) Fixed rate loans subject to prepayment risk—Banking corporations 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 banking corporation's estimate of the effect of each interest rate shock and stress scenario on the average prepayment speed. Specifically, a banking corporation must assess the expected average prepayment speed under each scenario.

(2) Fixed rate loan commitments – Banking corporations may sell options to customers (e.g., retail mortgage buyers or renewers) whereby, for a limited period, the customers can choose to draw down a loan at a committed rate.

(3) Term deposits subject to early redemption risk – Banking corporations 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 – Behavioral 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. Banking corporations should document, monitor and regularly update key assumptions for NMD balances and behavior used in their IMS. To determine the appropriate assumptions for its NMDs, a banking corporation should analyze its depositor base in order to identify the proportion of core deposits (i.e., NMDs which are unlikely to reprice even under significant changes in interest rate environment). Assumptions should vary according to depositor characteristics (e.g., retail/wholesale) and account characteristics (e.g., transactional/nontransactional).

42.

Modelling assumptions should be conceptually sound and reasonable, and consistent with historical experience. Banking corporations 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 those set out in Table 1.

Table 1 Considerations affecting behavioral optionality	
Product	Dimensions influencing the exercise of the embedded behavioral 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 behavior.
Fixed rate loan commitments	Borrower characteristics, geographical location (including competitive environment and local premium conventions), customer relationship with banking corporation 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, 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 banking corporation's offer rate and market rate, competition from other firms, the banking corporation's geographical location and demographic and other relevant characteristics of its customer base.

43.

Banking corporations with positions denominated in different currencies can expose themselves to IRRBB in each of those currencies. Since yield curves vary from currency to currency, banking corporations generally need to assess exposures in each currency.

Banking corporations 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.

44.

Further, banking corporations should consider the materiality of the impact of behavioral optionalities within floating rate loans. For instance, the behaviour of prepayments arising from embedded caps and floors could impact the banking corporations' economic value of equity.

45.

Banking corporations 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 standardized framework described in the document. Banking corporations should periodically, and at least once a year, 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.

46.

The most significant assumptions underlying the system should be documented and clearly understood by the board of directors and senior management. Documentation should also include descriptions on how those assumptions could potentially affect the banking corporation's hedging strategies.

47.

As market conditions, competitive environments and strategies change over time, the banking corporation 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

48.

Accurate and timely measurement of IRRBB is necessary for effective risk management and control. A banking corporation's risk measurement system should be able to identify and quantify the major sources of IRRBB exposure. The mix of a banking corporation's business lines and the risk characteristics of its activities should guide management's selection of the most appropriate form of measurement system. Precise measurement of IRRBB also includes managing the risks in the models for assessing the IRRBB.

49.

Banking corporations 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, banking corporations 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.

In addition, banking corporations are to analyze the gaps between their IMS and the standardized shocks according to Sections 90–93 below and to document the explanations for significant gaps.

50.

A banking corporation'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 banking corporation's material IRRBB exposures. There should be sufficient documentation of the major data sources used in the banking corporation's risk measurement process.

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 banking corporation should monitor the type of data extracts and set appropriate controls. Input data also have to be validated, particularly when they are based on calculation or a model.

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.

53.

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

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 board of directors. 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.

55.

An effective validation framework should include three core elements:

- (1) evaluation of conceptual/methodological soundness, including evidence of this from model development ;
- (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).

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.

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 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 of directors. 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 banking corporation.

58.

The ongoing validation process should establish a set of exception trigger events that obligate the model reviewers to notify the board of directors or to senior management 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 may be modified or decommissioned. Banking corporations should articulate policies for model transition, including change and version control authorizations and documentation.

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 banking corporation should document and explain model specification choices as part of the validation process.

60.

Banking corporations 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, the banking corporation should have a process in place to determine if those inputs are reasonable for its business and the risk characteristics of its activities.

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 the board and senior management

62.

The reporting of risk measures to the board of directors will be done with the appropriate frequency and at least once per quarter while the reporting to senior management should be on an ongoing basis. The reporting should compare current exposures with policy limits and in particular, 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 banking corporation's MIS and subject to oversight in line with any other portfolios exposed to market risk.

63.

While the types of reports prepared for the board of directors and senior management will vary based on the banking corporation's portfolio composition, they should include at least the following:

- (1) summaries of the banking corporation'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 banking corporation'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 standardized interest rate shock scenarios as noted in Sections 90–93 and in the Appendices to the Directive;
- (5) results of stress tests, including assessment of sensitivity to key assumptions and parameters; and
- (6) 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).

64.

Reports detailing the banking corporation's IRRBB exposures should be provided to the banking corporation's board of directors and senior management on a timely basis and reviewed and discussed at least quarterly. The IRRBB reports should provide aggregate information as well as sufficient supporting detail to enable the board of directors and senior management to assess the sensitivity of the banking corporation to changes in market conditions, with particular reference to portfolios that may potentially be subject to significant mark-to-market movements. Senior management is responsible to ensure that the information is presented to the board of directors clearly and accessibly. Senior

management should review the banking corporation's IRRBB management policies and procedures in light of the reports, to ensure that they remain appropriate and sound. Senior management 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 banking corporation's activities.

Principle 8 – public disclosure

65.

See the guidelines in the relevant Reporting to the Public directives.

Principle 9 – IRRBB in the ICAAP

66.

Banking corporations 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 banking corporation's IMS outputs, taking account of key assumptions and risk limits. The overall level of capital should be commensurate with both the banking corporation's actual measured level of risk (including for IRRBB) and its risk appetite, and be duly documented in its ICAAP report.

67.

Banking corporations should not only rely on the Banking Supervision Department's 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, banking corporations should consider both the amount and the quality of capital needed.

68.

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

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 crystallize.

70.

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

Principle 10 – supervisory assessment of banking corporations' IRRBB exposures

- 71. Cancelled
- 72. Cancelled
- 73. Cancelled.

Principle 11 – supervisory assessment of banks' IRRBB management (8)

- 74. Cancelled.
- 75. Cancelled.
- 76. Cancelled.
- 77. Cancelled.
- 78. Cancelled.
- 79. Cancelled.
- 80. Cancelled.
- 81. Cancelled.

Principle 12 – supervisory action with respect to outlier banking corporations

82.

A banking corporation shall be identified as an outlier banking corporation if the maximum change in its economic value of equity is equal to or greater than 15 percent of its Common Equity Tier 1 Capital, with the change in economic value calculated by the 6 interest rate shock scenarios as defined in Appendices 1 and 1a, and for an acquirer, in Appendix 2.

83.

The Supervisor of Banks may implement additional tests for being an outlier/material at his discretion. Tests for being an outlier/material can serve as a capital index (for example, CET1 [Common equity tier 1], the surplus amount over the regulatory capital required of the banking corporation) to reflect the IRRBB relative to its earnings or some other index to be determined by the Supervisor.

84.

A banking corporation identified by the Supervisor of Banks as an outlier based on the criteria that were set, shall be considered an institution with a level of IRRBB that is liable to be unacceptable and thus will require an additional survey.

85.

All banking corporations are expected to hold adequate capital for the risks they undertake. With regard to IRRBB, the Supervisor should evaluate whether the banking corporation 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 Δ EVE under a variety of shocked and stressed interest rate scenarios. Where a banking corporation's EVE is significantly sensitive to interest rate shocks and stresses, The impact on its capital levels arising from financial instruments held at market value will be assessed, and potential impact should banking book positions held at historical cost become subject to market valuation. The assessment should consider the impact of key assumptions on the Δ EVE calculated, including those related to the inclusion/exclusion of commercial margins, the banking corporation'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 banking corporation reporting losses or curtailing normal dividend distribution and business operations. In such cases, management should ensure that the banking corporation has sufficient capital to withstand the adverse impact of such events until it can implement mitigating actions such as reducing exposures or increasing capital.

86.

When the Supervisor determines that a banking corporation's IMS is deficient in its measurement of IRRBB, the Supervisor should require the banking corporation to improve its IMS and/or use the standardised framework set out in Sections 94 to 129 or use any other step found correct under such circumstances.

87.

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

88.

When the Supervisor of Banks concludes that a banking corporation'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 may require the banking corporation 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 the banking corporation;
- (4) improve its risk management framework.
- (5) take any other action that the Supervisor finds appropriate under the circumstances.

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 standardized interest rate shock scenarios

90. Banking corporations should apply six prescribed interest rate shock scenarios to capture parallel and non-parallel gap risks for EVE (Scenarios 1–6 below) and two prescribed interest rate shock scenarios for NII (Scenarios 1 and 2 below).

These scenarios are applied to IRRBB exposures in each currency for which the banking corporation has material positions. In order to accommodate heterogeneous economic environments across jurisdictions, the six shock scenarios reflect currency-specific absolute shocks as specified in Tables 2 and 2a below.

For the purposes of capturing the local rate environment, a historical time series ranging from 2000 to 2015 for various maturities⁷ 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.

⁷ The range of years used for the shekel unindexed and shekel CPI-indexed is 2002 to 2017.

Table 2:

Specified size of interest rate shocks $\bar{R}_{shocktype,c}$

	ARS	AUD	BRL	CAD	CHF	CNY	EUR	GBP	HKD	IDR	INR
Parallel	400	300	400	200	100	250	200	250	200	400	400
Short	500	450	500	300	150	300	250	300	250	500	500
Long	300	200	300	150	100	150	100	150	100	350	300

	JPY	KRW	MXN	RUB	SAR	SEK	SGD	TRY	USD	ZAR
Parallel	100	300	400	400	200	200	150	400	200	400
Short	100	400	500	500	300	300	200	500	300	500
Long	100	200	300	300	150	150	100	300	150	300

Table 2a:

Specified size of domestic interest rate shocks

	Shekel, unindexed	Shekel, CPI-indexed
Parallel	250	150
Short	350	200
Long	150	100

91.

Given Table 2 and Table 2a, the instantaneous shocks to the risk-free rate for parallel, short and long, for each currency, the following parameterizations 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.

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

(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,

$$S_{short}(t_k) = e^{\frac{-t_k}{x}}$$

where $x=4$, diminishes towards zero at the tenor of the longest point in the term structure.⁸

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 currencies and the related shocks. t_k is the midpoint (in time) of the k th bucket and tK is

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

(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:

$$S_{long}(t_k) = 1 - S_{short,c}(t_k)$$

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

(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:

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

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

92.

The following examples illustrate the scenarios in 91(a)–91(d).

(1) Short rate shock: Assume that the banking corporation 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 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

$$S_{short}(t_k) = \left(e^{-\frac{3.5}{4}} \right) = 0.417.$$

Banking corporations 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 basis points.

(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: $-0.65 \times 100\text{bp} \times 0.417 + 0.9 \times 100\text{bp} \times (1-0.417) = +25.4\text{bp}$.

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

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.

$$+0.8 \times 100\text{bp} \times 0.417 - 0.6 \times 100\text{bp} \times (1-0.417) = -1.6 \text{ basis points.}$$

Table 2b					
Interest rate floors after the interest rate shock					
NIS, unindexed	NIS, indexed	CPI-USD	EUR	Other forex	
0%	-0.4%	0%	-0.2%	-0.2%	

93.

The Supervisor should review the calibration of the interest rate shock sizes every several years. Floors for the post-shock interest rates under the six interest rate shock scenarios will be as specified in Table 2b below. **For additional assumptions that can be applied in calculating the 6 interest rate shock stress scenarios, see Appendix 1a.**

Chapter D

94.

The standardised framework

The Supervisor could mandate banking corporations to follow the framework set out in this section, in whole or in part, for the purpose of internal risk management or otherwise, a banking corporation could choose to adopt it.

95.

The steps involved in measuring a banking corporation's IRRBB, based solely on EVE, are as described below. In the standardised framework chapter, the term **"Economic Value of Equity"** shall refer to the fair value of the interest-rate sensitive assets, liabilities, and off-balance sheet items; such instruments will include commitments to workers' rights and employee plan assets, but excluding noncash items (these items also include noncash employee plan assets):

- (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

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.

9 For positions that are not amenable to standardisation, there is a separate treatment for:
(a) NMDs – according to separation of core and non-core cash flows via the approach set out in Sections 107–112.

(b) Behavioural options (fixed rate loans subject to prepayment risk and term deposits subject to early redemption risk) – behavioral parameters relevant to the position type must rely on a scenario-dependent look-up table set out in Sections 119–125.

(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.

96.

Banking corporations 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.

Table 3

Maturity schedule with 19 time buckets for notional repricing cash flows repricing at t^{CF} .

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

	Time bucket intervals (M = months; Y = years)							
Short term rates	Overnight (0.0028Y)	$0/N < t^{CF}$ $\leq 1M$ (0.0417Y)	$1M < t^{CF}$ $\leq 3M$ (0.1667Y)	$3M < t^{CF}$ $\leq 6M$ (0.375Y)	$6M < t^{CF}$ $\leq 9M$ (0.625Y)	$9M < t^{CF}$ $\leq 1Y$ (0.875Y)	$1Y < t^{CF}$ $\leq 1.5Y$ (1.25Y)	$1.5Y < t^{CF}$ $\leq 2Y$ (1.75Y)
Medium term rates	$2Y < t^{CF}$ $\leq 3Y$ (2.5Y)	$3Y < t^{CF}$ $\leq 4Y$ (3.5Y)	$4Y < t^{CF}$ $\leq 5Y$ (4.5Y)	$5Y < t^{CF}$ $\leq 6Y$ (5.5Y)	$6Y < t^{CF}$ $\leq 7Y$ (6.5Y)			
Long term rates	$7Y < t^{CF}$ $\leq 8Y$ (7.5Y)	$8Y < t^{CF}$ $\leq 9Y$ (8.5Y)	$9Y < t^{CF}$ $\leq 10Y$ (9.5Y)	$10Y < t^{CF}$ $\leq 15Y$ (12.5Y)	$15Y < t^{CF}$ $\leq 20Y$ (17.5Y)	t^{CF} >20Y (25Y)		

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 Common Equity Tier 1 Capital based on Proper Conduct of Banking Business Directive no. 202.

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 banking corporation 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 nonamortised principal has been repriced or not.

99.

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

100. Cancelled.

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).

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 $CF_{i,c}(tk)$ under interest rate shock scenario i and currency c) based on their amenability to standardization.

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 standardization 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. The fixed spread components will be handled as noted in Section 98(c) above.

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

To the extent that the embedded option is a derivative instrument then, the stripped-out embedded automatic interest rate option must be treated together with explicit automatic interest rate options. Banking corporations may categorize other positions as amenable to standardisation and ignore the optionality if it can be shown to be of immaterial consequence and subject to the Supervisor's approval.

105.

Some positions are less amenable to standardisation.¹¹ For explicit automatic interest rate options, as well as embedded automatic interest rate options¹² (that are an instrument derived based on Section 22a of the Reporting to the Public Directives (Annual Financial Statement) that are separated or stripped out from the banking corporation's assets or liabilities (ie the host contract), the methodology for automatic interest rate options is described in Sections 127 and 128.

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.

107.

Under the standardised framework, banking corporations should first separate their NMDs according to the nature of the deposit and depositor. Banking corporations should then

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 banking corporation at a fixed yield would be treated as if it matured at its longest contractual term, ignoring the call option.

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.

identify, for each category, the core and non-core deposits, up to the limits specified in Table 4. Finally, banking corporations should determine an appropriate cash flow slotting for each category, in accordance with the average maturity limits specified in Table 4.

108.

NMDs must be segmented into retail and wholesale categories. Retail deposits are defined as deposits placed with a banking corporation 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 NIS 5 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. For definitions of the retail, small business and wholesale deposit categories, see Proper Conduct of Banking Business Directive no. 221 on the issue of the Liquidity Coverage Ratio.

109.

Banking corporations 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.

110.

Banking corporations 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.

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.

112.

Banking corporations 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.

¹³ Where the Supervisor instructed a banking corporation to implement the standardized framework, that banking corporation can introduce a specific category for non-remunerated deposits, subject to approval by the Supervisor.

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 / nontransactional	70	4.5
Wholesale	50	4

113.

The treatment set out in Sections 114 to 126 applies only to behavioral options that are not a derivative instrument in accordance with Section 22a of the Reporting to the Public Directives (“annual financial report”).¹⁴

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 banking corporation’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.

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

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.

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.

¹⁴ Cancelled.

¹⁵ When the Supervisor requires a banking corporation to act based on the Standardized Framework, he will instruct whether these baseline parameter estimates may be determined by the banking corporation subject to supervisory review and approval, or prescribed by the supervisor.

118.

Banking corporation must determine the baseline conditional prepayment rate ($CPR_{0,c}^p$) for each portfolio p of homogeneous prepayment-exposed loan products denominated in currency c , under the prevailing term structure of interest rates.

119.

The conditional prepayment rate (CPR) for each portfolio of homogeneous prepayment-exposed loan products denominated in currency c , under interest rate scenario i , is given using the formula that follows, where is the (constant) base CPR of a portfolio p of 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.

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

Table 5

CPR values under the shock scenarios		
Scenario number (i)	Interest rate shock scenarios	γ_i (scenario multiplier)
1	Parallel up	0.8
2	Parallel down	1.2
3	Steeper	0.8
4	Flattener	1.2
5	Short rate up	0.8
6	Short rate down	1.2

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.

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 prepayments¹⁷ according to the following formula, where $CF_{i,c}^s(k)$ refers to the scheduled interest and principal repayment, and $N_{i,c}^p(k-1)$ 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.

$$CF_{i,c}^p(k) = CF_{i,c}^s(k) + CPR_{i,c}^p \cdot N_{i,c}^p(k-1)$$

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 t_k .

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.

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 that one of the following condition is met:

- (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

123.

If one of these conditions is not met, the depositor holds an option to withdraw and the term deposits are deemed to be subject to early redemption risk.

124.

Banking corporation must determine the baseline term deposit redemption ratio ($TDRR_{0,c}^p$) 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).

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 $TDRR_{0,c}^p$ by a scalar u_i (set out in Table 6) that depends on the scenario i , as follows:

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

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.

Table 6		
Term deposit redemption rate (TDRR) under the shock scenarios		
Scenario number (i)	Interest rate shock scenarios	Scalar multipliers u_i
1	Parallel up	1.2
2	Parallel down	0.8
3	Steeper	0.8
4	Flattener	1.2
5	Short rate up	1.2
6	Short rate down	0.8

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

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

127.

This section and Section 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. Banking corporations 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 $\Delta FVAO_{i,c}^o$, is calculated for each interest rate shock scenario i . The value change is given by:

(a) 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 ;

and

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

(b) 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 banking corporation 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 $\Delta FVAO_{i,c}^q$.

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 nonretail 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.

²⁰ When the supervisor requires a banking corporation to act according to the standard framework, this estimate requires a methodology approved by the supervisor.

(3) The banking corporation'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 .

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

128.

If the banking corporation chooses to only include bought automatic interest rate options that are used for hedging sold automatic interest rate options, the banking corporation 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 $KAO_{i,c}$.

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 $k \in \{1, 2, \dots, K\}$ or time bucket midpoint $t_k, k \in \{1, 2, \dots, K\}$. Within a given time bucket k or time bucket midpoint t_k , all positive and negative notional repricing cash flows are netted²¹ 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 $CF_{i,c}(t_k), k \in \{1, 2, \dots, K\}$.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 Sections 90 to 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 the instructions provided in Appendix 1a.²³

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

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

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

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 Cancelled.

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

(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:

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

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

(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 measure.²⁴

The standard EVE risk index:

$$\max_{i \in \{1,2,\dots,6\}} \left\{ \max \left(0; \sum_{c: \Delta EVE_{i,c} > 0} \underbrace{\Delta EVE_{i,c}}_{\text{loss in currency } c} \right) \right\}$$

²⁴ For guidelines by the Supervisor of Banks on the issue of the currency schemas, see Section 3 in Appendix 1a.

APPENDIX 1: Definition of interest rate risk in the banking book

1.

Interest rate risk in the banking book (**IRRBB**) refers to the current or prospective risk to a banking corporation's capital and to its earnings, arising from the impact of adverse movements in interest rates on its banking book.

2.

Excessive IRRBB can pose a significant threat to a banking corporation's current capital base or future earnings if not managed appropriately. Changes in interest rates can affect the underlying economic value of the banking corporation's interest-rate sensitive assets, liabilities and off-balance sheet instruments, because the present value of future cash flows (and, in many cases, the amounts of cash flows themselves) change when interest rates change. Changes in interest rates also affect a banking corporation's earnings by increasing or decreasing its net interest income (NII) and the level of other interest rate-sensitive income and operating expenses.

3.

Fundamentally, there are two distinct methods for valuing banking book items, namely:

- (a) "amortized" cost, where values are based on initial cost less accumulated depreciation, taking account of the expected life / maturity of the item; and
- (b) "fair" value, where values are based on market prices (where available) or on the net present value of expected cash flows, discounted at the prevailing rate (where no market price is available).

4.

For items held at amortized cost, market interest rate changes do not significantly impact profit recognition or accounting values for existing instruments (significant changes in values would be from impairment that needs to be recognized as a permanent diminution in value). Income/cost on items held at amortized cost therefore emerges over time in line with maturity-adjusted cash flows.²⁵

5.

Accounting values of fair valued instruments can vary significantly from period to period, due to changes to external factors (eg interest rate changes can impact both the expected future cash flows and the discount rate used for calculation purposes). Income and cost are recognized either through profit and loss (P&L) or through equity, on the basis of changes to embedded value.

6.

²⁵ However, the accounting value may not be the same as the balance that needs to be managed for IRRBB purposes, because of the impact of effective interest rate calculations and the treatment of loan loss provisions.

Since most IRRBB economic value measures aim to estimate the change in economic value under shocks and stresses, the presence or absence of higher /lower accounting values for amortized cost instruments is effectively ignored, as is the emergence of profit over time. It is therefore important to note that a loss in economic value does not automatically equate with accounting losses for this element of the banking book. Conversely, for assets held at fair value/mark-to-market, changes in interest rates directly affect current accounting values, and thus have an immediate impact on both P&L and available capital.

7.

Every interest rate earned by a banking corporation on its assets, or paid on its liabilities, is a composite of a number of price components – some more easily identified than others. Theoretically, all rates contain five elements.

(1) The risk-free rate: this is the fundamental building block for an interest rate, representing the theoretical rate of interest an investor would expect from a risk-free investment for a given maturity.

(2) A market duration spread: the prices/valuations of instruments with long durations are more vulnerable to market interest rate changes than those with short durations. To reflect the uncertainty of both cash flows and the prevailing interest rate environment, and consequent price volatility, the market requires a premium or spread over the risk-free rate to cover duration risk.

(3) A market liquidity spread: even if the underlying instrument were risk-free, the interest rate may contain a premium to represent the market appetite for investments and the presence of willing buyers and sellers.

(4) A general market credit spread: this is distinct from idiosyncratic credit spread, and represents the credit risk premium required by market participants for a given credit quality (eg the additional yield that a debt instrument issued by an AA-rated entity must produce over a risk-free alternative).

(5) Idiosyncratic credit spread: this reflects the specific credit risk associated with the credit quality of the individual borrower (which will also reflect assessments of risks arising from the sector and geographical/currency location of the borrower) and the specifics of the credit instrument (eg whether a bond or a derivative).

8.

In theory these rate components apply across all types of credit exposure, but in practice they are more readily identifiable in traded instruments (eg bonds) than in pure loans. The latter tend to carry rates based on two components:

(a) The funding rate, or a reference rate plus a funding margin: the funding rate is the blended internal cost of funding the loan, reflected in the internal funds transfer price (for larger and more sophisticated banking corporations); the reference rate is an externally set benchmark rate, such as the US federal funds rate or the Bank of Israel interest rate, to which a banking corporation may need to add (or from which it may need to subtract) a funding margin to reflect its own all-in funding rate. Both the funding rate and the reference rate incorporate liquidity and duration spread, and potentially some elements of market credit spread. However, the relationship between the funding rate and market reference rate may not be stable over time – this divergence is an example of basis risk.

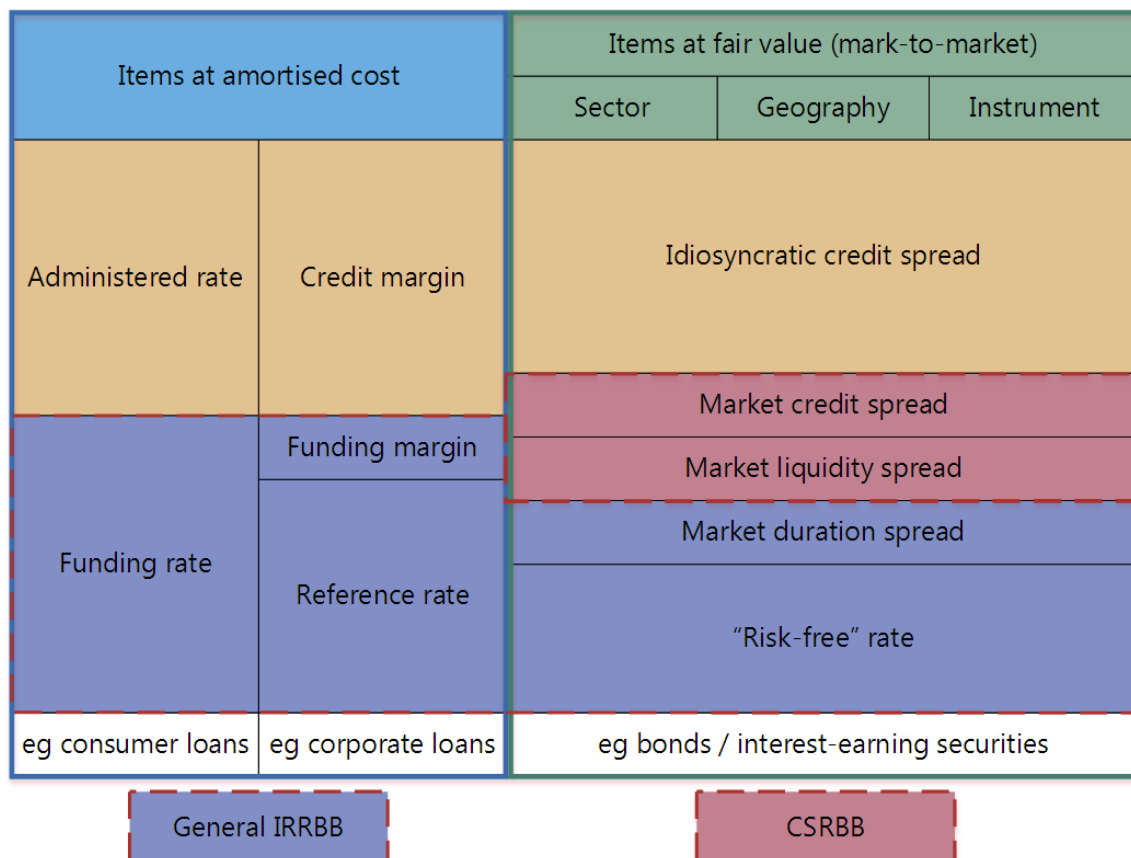
(b) The credit margin (or commercial margin) applied: this can be a specific add-on (eg the Prime rate + 3%, where the 3% may include an element of funding margin) or built into an administered rate (a rate set by and under the absolute control of the bank).

9.

In practice, decomposing interest rates into their component parts is technically demanding and the boundaries between the theoretical components cannot easily be calculated (eg changes to market credit perceptions can also change market liquidity spreads). As a result, some of the components may be aggregated for interest rate risk management purposes.

10.

Changes to the risk-free rate, market duration spread, reference rate and funding margin all fall within the definition of IRRBB. Changes to the market liquidity spreads and market credit spreads are combined within the definition of credit spread risk in the banking book (CSRBB). The diagram below gives a visual representation of how the various elements fit together.



11.

The main driver of IRRBB is a change in market interest rates, both current and expected, as expressed by changes to the shape, slope and level of a range of different yield curves that incorporate some or all of the components of interest rates.

12.

When the level or shape of a yield curve for a given interest rate basis changes, the relationship between interest rates of different maturities of the same index or market, and relative to other yield curves for different instruments, is affected. This may result in changes to a banking corporation's income or underlying economic value.

13.

CSRBB is driven by changes in market perception about the credit quality of groups of different credit-risky instruments, either because of changes to expected default levels or because of changes to market liquidity. Changes to underlying credit quality perceptions can amplify the risks already arising from yield curve risk. CSRBB is therefore defined as any kind of asset/liability spread risk of credit-risky instruments which is not explained by IRRBB, nor by the expected credit/jump-to-default risk.

14.

As noted above, this Directive focuses mainly on IRRBB. CSRBB is a related risk that needs to be monitored and assessed.

15.

IRRBB derives from three fundamental aspects relating to the level and structural characteristics of interest rates, and the effects on these of changes to yield curves. These aspects of interest rate risk can occur simultaneously, and therefore need to be managed holistically.

(a) Gap risk arises from the term structure of banking book instruments, and describes the risk arising from the timing of instrument rate changes. Since rate resets on different instruments occur at different tenors, the risk to the banking corporation arises when the rate of interest paid on liabilities increases before the rate of interest received on assets, or reduces on assets before liabilities. Unless hedged in terms of tenor and amount, the banking corporation may be exposed to a period of reduced or negative interest margins, or may experience changes in the relative economic values of assets and liabilities. The extent of gap risk depends also 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).²⁶

(b) 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 (bases) (eg an asset priced off the Prime rate funded by a liability priced off US Treasuries or government bonds). It arises from the imperfect correlation in the adjustment of the rates earned and paid on different instruments with otherwise similar rate change characteristics. For the purposes of this chapter, IRRBB is defined as excluding changes in idiosyncratic credit margins.

²⁶ This may sometimes be referred to as "yield curve risk".

(c) Option risk arises from option derivative positions or from the optional elements embedded in many banking corporation assets, liabilities and off-balance sheet items, where the banking corporation or its customers can alter the level and timing of their cash flows. For IRRBB purposes, option risk can be broken down into two distinct but related sub-types:

- (1) automatic option 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 (eg a capped rate loan) and where the holder will almost certainly exercise the option if it is in their financial interest to do so; and
- (2) behavioral option 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 behavior of the client (eg 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).

16.

In addition to the pure economic risks that can arise from changes to the level and structure of interest rates, risks can arise from:

- (1) currency mismatches, ie where the interest rate risks are in addition to normal exchange rate risks (this falls within a wider definition of basis risk); or
- (2) accounting treatment of risk positions, ie where interest rate hedging activity may achieve the desired economic effect, but fail to achieve hedge accounting treatment.

17.

There are two complementary methods of measuring the potential impact of IRRBB:

- (1) changes in expected earnings (earnings-based measures); and
- (2) changes in economic value (EV, or EVE when measuring the change in value relative to equity).

18.

The two methods are complementary in that:

- (1) both measures reflect the impact of changing cash flows arising from changing interest rates;
- (2) the change in expected earnings is reflected in the change in economic value; and
- (3) they are affected by common assumptions.

19.

The key differences between the measures include:

- (1) Outcome measure: EV measures compute a change in the net present value of the balance sheet under an interest rate stress. In undertaking such a calculation, a decision has to be made about whether the outcome should be computed as a change in the theoretical economic value of equity (EVE) – in which case, equity is either excluded from the EV calculation or included with a very short (overnight) duration; or whether the outcome should measure the change in economic value other than for assets representing equity – in which case, equity is either included with the same duration as the assets which it is deemed to be financing, or else both equity and its portfolio of financed assets are excluded (this is earnings-adjusted EV). EVE and earnings-adjusted EV are therefore specific forms

of an EV measure. All EV measures can be expressed relative to equity, but EVE includes the change to equity value that would result from revaluing under stress its own financed portfolio of assets. Earnings-based measures focus on changes to future profitability. To the extent that future earnings eventually affect levels of future equity, the two measures are aligned, but the value changes estimated include adjustments to net income that occur beyond the horizon for earnings measures.

(2) Time horizon: EV measures reflect changes in value relative to equity over the remaining life of the balance sheet, ie until all positions have run off. Earnings-based measures cover only the short to medium term, and therefore do not capture in full those risks that will continue to impact profit and loss accounts beyond the period of estimation.

(3) Future transactions: EV measures usually just focus on changes to cash flows of instruments already on the balance sheet. Earnings-based measures can be based on balance sheet run-off, or a static balance sheet, but more sophisticated or dynamic models tend to consider the impact of new business/production that is expected to be written in the future, as well as the run-off of existing business.

20.

For earnings-based measures, the focus for analysis is the impact of changes in interest rates on future accrued or reported earnings.

21.

The component of earnings that has traditionally received the most attention is NII, ie the difference between total interest income and total interest expense, taking account of hedging activity (eg via derivatives). This focus reflects both the importance of NII in banking corporations' overall earnings and its direct link to changes in interest rates.²⁷

22.

An earnings-based measure offers the possibility of measuring risk under a range of different time horizons. The normal focus is on the short/medium-term horizon (typically one to three years, no more than five years), to limit the cumulative impact of underlying assumptions and the complexity of the calculations. As a consequence, an earnings-based measure is better suited to measuring the short- and medium-term vulnerabilities of the banking corporation to IRRBB, assuming that it is able to continue in business (a going-concern viewpoint).

23.

An earnings-based measure is therefore commonly used to assess the ability of a banking corporation to generate stable earnings over a medium-term horizon, which will allow it to pay a stable level of dividend and reduce the beta on its equity price and therefore reduce its cost of capital. Hence, it is a measure in line with internal management and asset and liability management objectives.

²⁷ Note, however, that, as some banking corporations have expanded increasingly into activities that generate fee-based and other non-interest income, a broader focus on operating earnings/overall net income, incorporating both interest and non-interest income and expenses, has become more common.

24.

In order to be able to calculate changes in expected earnings under different interest rate shocks and stress scenarios, an institution will need to be able to project future earnings under both the expected economic scenario that informs its corporate plan, and the interest rate shock and stress scenarios so that the differences can be measured. Such projections involve a range of further assumptions about client/market behavior, and the banking corporation's own management response to the evolving economic climate, including:

- (1) the volume and type of new/replacement assets and liabilities expected to be originated over the evaluation period;
- (2) the volume and type of asset and liability redemptions/reductions over that period;
- (3) the interest rate basis and margin associated with the new assets and liabilities, and with those redeemed/withdrawn; and
- (4) the impact of any fees collected/paid for exercise of options.

25.

In practical terms, this may result in modelling of earnings under three different states:

- (1) run-off balance sheet: existing assets and liabilities not replaced as they mature, except to the extent necessary to fund the remaining balance sheet;
- (2) constant balance sheet: total balance sheet size and shape maintained by assuming like-for-like replacement of assets and liabilities as they run off; and
- (3) dynamic balance sheet: incorporating future business expectations, adjusted for the relevant scenario in a consistent manner, ie this is the most meaningful approach.

26.

Under an economic value approach, the measure of IRRBB is the theoretical change in the net embedded market value of the whole banking book.

27.

The EV of a tradable instrument is its present value (PV). In the absence of embedded options, the PV of the instrument is determined from its contractual cash flows, which are discounted to reflect current market rates. As a first implication, instruments with short-term or variable rate cash flows have a present value that more nearly equals their face value (ie their carrying value). As a second implication, a change in market rates would not change the EV of such instruments. Third, the PV of an interest rate-sensitive instrument with uncertain contractual cash flows can only be valued on the basis of assumptions about behavior and timing, which will tend to vary dependent upon external factors.

28.

Applying the concept of EV to the whole balance sheet of a banking corporation is more challenging: the banking book contains assets and liabilities that are accounted for at held-to-maturity valuation, and for which there may not be observable market prices (eg loans and receivables are not as readily marketable and their market value cannot be determined directly). Moreover, there may be embedded under- and overvaluations in the book on a mark-to-market basis, representing income or costs that will emerge in future reported earnings. In addition, margins on loans may be very heterogeneous, thus making determination of an appropriate discount rate problematic, and the cash flows that are being

valued are subject to variation depending upon customer behavior in response to rate changes (and customers may not behave as might rationally be expected). Finally, there may be structural positions (eg assets held to stabilize return on nonmaturity deposits and/or equity) which will produce a significant change in value under EV measurement, but where the risk measured is a direct corollary of risk reduction from an earnings volatility perspective.²⁸

29.

To avoid the complexity of measuring total EV, banking corporations typically therefore focus on measuring the level of change to the net present value of the relevant balance sheet items, based on existing or adjusted cash flows that are revalued in line with the interest rate shock and stress scenarios. The change in the valuation is a measure of the level of IRRBB, and can be compared with the current value of equity to determine the change to the EVE.

Key considerations and assumptions

30.

Both measures of IRRBB are significantly impacted by assumptions made for the purposes of risk quantification:

- (1) the range of shocks to the possible changes in the level, slope and shape of interest rate yield curves that are required to produce an IRRBB effect on EV or earnings, and the economic stress scenarios that would be consistent with these shocks;
- (2) expectations for the exercise of options (explicit and implicit) by both the banking corporation itself and its customers under the given scenarios;
- (3) treatment in risk quantifications of balances and interest flows arising from non-maturity deposits (NMDs);
- (4) the banking corporation's own determination of the implied investment term of the banking corporation's own equity capital liability; and
- (5) the implications for IRRBB of adopted accounting practices.

31.

In order to produce a quantitative estimate of IRRBB, it is necessary to assume a shock to current interest rate levels, which would allow the change in EV or earnings, and ultimately the effect on equity, to be computed. The size and shape of the shock will determine the measured outcome, and a range of shocks may be needed to identify all the potential facets of IRRBB (eg basis risks would not be captured by shocks that assume only parallel shifts of similar quantum in all yield curves). Designing interest rate change scenarios that are relevant to the business and sufficiently stressful is a key element of IRRBB management.

²⁸ For example, a banking corporation with \$100 of capital could manage its earnings volatility by investing all capital in a long-dated fixed rate government security – which would lock in a consistent income but produce economic value risk if market rates changed and the mark-to-market value of the security declined. If its aim was to achieve economic value stability, it could invest its capital in the overnight market, but its earnings would then fluctuate with market interest rates. It is not possible for it to eliminate both EV and earnings risks simultaneously, so a trade-off is needed.

32.

Behavior of option positions is one of the key set of assumptions that drive risk quantification measures. The approach taken by banking corporations generally differs between automatic options, where the customer and banking corporation can assume that the exercise of options will be based on rational expectations, and behavioral options, where behavior will not always be rational and behavioral assumptions need to be used instead.

33.

Automatic option positions can therefore be valued on the basis that exercise will always (and only) occur when there is financial benefit (with valuation based on standard financial modelling techniques and the results are fed into EV estimates). The rational expectation that the options will be exercised can also be readily fed into forward projections of interest margin under earnings-based measures.

34.

Behavioral option positions require more complex analysis of expected outcomes, since customers may exercise some options even when it is not in their financial interest to do so, or may not exercise options even when it would be to their benefit. The most complex area of behavioral analysis is for prepayment options on loans: the right to redeem early may be included voluntarily in a loan contract, or imposed on the lender by operation of the laws of the State of Israel or other country; there may or may not be early redemption penalties payable, but again the size of these penalties may not reflect the actual economic costs and benefits involved (eg if limited by law or by operation of customer redress policy); and customers may choose to redeem for other reasons than the availability of a new loan at lower cost (eg due housing prices, borrowers' demographics, changing family composition, tax changes).

35.

However, not all borrowers will act irrationally, and exercise of early redemption options will tend to have a detrimental effect on either an EV or an earnings-based measurement, ie in a classic case of convexity risk, borrowers will tend to repay fixed rate borrowings when rates fall (so that they can borrow again at a lower rate) and retain fixed rate positions when market rates rise (so that banking corporations are unable to lend at the higher rates). In order to manage this redemption or extension risk, banking corporations model their books to establish how much should be hedged, and for what period, in order to match their best expectations of cash flows. Such behavioral modelling is clearly prone to error, and needs frequent updating so that hedge positions can be adjusted. Therefore, when using economic value and earnings-based measures, banking corporations need to review and adjust their calculations to account for any expected behaviors.

36.

The use of economic value and earnings-based measures involves estimating cash flows, but the content and treatment is different: for EV measures, all existing balance sheet items (both principal and interest flows) are discounted at a relevant rate, whereas NII measures

include all cash flows, including all margins and principal flows from expected future business, and are normally not discounted.

37.

NMDs are liabilities of the banking corporations in which the depositor is free to withdraw at any time since they have no contractually agreed maturity date. Notwithstanding, NMD balances have historically proved to be relatively stable in practice, even when market rates change, and balances lost can usually be replaced with new deposits at the same rate – so, overall, NMDs behave differently to other more rate-sensitive funding.²⁹ Any interest paid on NMDs is usually at rates significantly below those paid for wholesale or larger-denomination deposits, so NMD balances have historically represented an important source of stable and cost-effective funding.³⁰

38.

In considering IRRBB, the focus for some banking corporations is therefore primarily on managing the risk of earnings volatility arising from NMDs. In order to achieve this, banking corporations first identify core deposits, ie that element of NMDs that can be considered to be particularly stable under different interest rate scenarios so that a behavioral maturity can be ascribed specifically to them and matching assets allocated to stabilize earnings. In assessing core balances, banking corporations discount those elements of transactional accounts which are subject to regular fluctuation (withdrawal followed by re-deposit) and overall seasonality of the NMD book.

39.

The matching book of assets may then be managed dynamically to adjust for changes in levels of core deposits, and to maintain a constant maturity in line with expected behavior and the banking corporation's risk appetite. Although the behavioral maturity may be determined to be very long, the matching asset position carries risk to a banking corporation's EV since, being fixed rate and of some duration, the net present value of this portfolio will vary with general interest rates. The maturity profile chosen will therefore be a compromise between protection of earnings for an extended period and increased risk to EV that could materialize on a shock event (eg a deposit run on NMDs, failure of the bank). Internal risk measures can be used to evaluate the extent and impact of the compromise made.³¹

40.

²⁹ A subset of NMDs is non-interest bearing current accounts, where balances may fluctuate but are generally not interest bearing: current account customers hold balances mainly for transactional purposes, and are more sensitive to service levels.

³⁰ However, NMD sensitivity may have increased as a result of the sustained period of accommodative monetary policy in some of the world's largest economies.

³¹ One common technique for achieving a constant maturity profile is a replicating portfolio of matching assets that produces a moving average fixed return in line with the risk appetite (eg a portfolio where one sixtieth of the total is reinvested each month for five years fixed will deliver a weighted average maturity of 2.5 years and a moving average of the five-year rate).

In the same way as with NMDs, a banking corporation's own equity capital liability represents an important source of structural risk and endowment return – in accounting terms, equity is the net value of assets less liabilities, so it represents assets for which there are no funding liabilities. Equity usually has a cost in the form of a dividend, and banking corporations therefore seek to stabilize the earnings that can be made on assets funded by equity. In this regard, see the requirement in Section 28(a) in the body of the Directive.

41.

The technique involves defining net equity capital that is eligible for behavioral treatment – some assets are non-interest bearing (eg land and buildings) and may be considered to be financed by equity, so the value of equity available for behavioral treatment may be reduced accordingly.³² Since equity capital has no contractual price reset date, banking corporations determine their own strategies for managing the earnings volatility that arises from it using techniques similar to those for NMDs. Given that equity may be written down as a result of losses, regulators will normally focus on the EVE risk associated with any earnings profile ascribed to equity that may materialize as losses under stress events.

Quantifying IRRBB: change in economic value

42.

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.

43.

The techniques differ in their complexity and ability to capture different types of interest rate sensitivity (gap risk (parallel and non-parallel), yield curve risk, basis risk and option risk). Multiple measures of EV sensitivity therefore produce a better overall understanding of risks embedded in the banking book.

44.

Gap analysis can be used to derive the duration profile of the banking book or, equivalently, the profile of the present value of a single basis point change in interest rates (PV01). Gap analysis allocates all relevant interest rate-sensitive assets and liabilities to a certain number of predefined time buckets according to their next contractual reset date. The analysis also allocates equity, NMDs, prepaying loans or other instruments with future cash flows subject to customer behaviors according to general/behavioral assumptions regarding their maturity or reset date. It then measures the arithmetic difference (the gap) between the

³² Banking corporations may also determine that a portion of equity should remain invested short-term as a buffer against losses that may be incurred under a more general business stress.

amounts of assets and liabilities in each time bucket, in absolute terms. Each time bucket gap can be multiplied by an assumed change in interest rates to yield an approximation of the change in NII that would result from an increase in interest rates. This method gives a visual impression of the risk exposure dispersion relative to the repricing profile, reflecting exposures to parallel as well as non-parallel gap risk. It does not, however, quantify this risk.³³ The measure assumes that all positions within a particular time bucket mature and reprice simultaneously, ignoring potential basis risks within the gaps.

45.

EV measures mainly focus on valuing the cash flows arising from existing assets and liabilities under different future interest scenarios, ignoring future business flows. The change in EV (ie the change in the NPV of future cash flows as a result of a change in rates) can be calculated across all types of assets and liabilities. When a change in the EV of the whole banking book is calculated, the outcome is highly influenced by the treatment of the banking corporation's own equity capital liability in the calculation. There are two possible approaches:

(1) Since accounting equity is the net residual figure that arises from subtracting total liabilities from total assets (including off-balance sheet items), measuring the change in the net present value of those assets and liabilities under a stressed interest rate scenario shows the actual level of risk to the economic value of equity. In this calculation, therefore, no rate or term is applied to equity itself, which is therefore excluded, and the NPV outcome is compared with the starting value of equity in order to measure the proportionate size of the change. This is the EVE measure.

(2) Given that equity finances surplus assets that earn an endowment return for the bank, the change in value of any asset portfolio that has been created to reduce the volatility of earnings on equity is not a relevant EV risk for the banking corporation (ie it has taken the EV risk specifically to hedge earnings risk). In this calculation, therefore, equity is included in the calculation and treated as having the same interest rate/term characteristics as the portfolio of assets that hedges the earnings on it. The NPV outcome is still compared with the starting value of equity, but measures only risks arising from non-structural positions. This measure is earnings-adjusted EV.

46.

EVE measures the theoretical change in the net present value of the balance sheet excluding equity. The measure therefore depicts the change in equity value resulting from an interest rate shock. Under this method, the value of equity under alternative stress scenarios is compared with the value under a base scenario. All cash flows from on-balance sheet and off-balance sheet interest rate-sensitive items in the banking book may be included in the computation. The market value of equity is computed as the present value of asset cash flows, less the present value of liability cash flows, without including assumptions on the interest rate sensitivity of equity. For internal measurement purposes, a banking corporation may complement its computation of EVE with a separate earnings-adjusted

³³ A variant of the technique, modified duration, could be applied, which shows the relative change in the market value of a financial instrument corresponding to marginal parallel shift of the yield curve (eg by 1 percentage point). The weakness of this technique is that it measures only marginal shifts of the yield curve and works only for parallel shifts.

EV model that uses assumptions about the investment term of equity, whereby its interest rate sensitivity is taken into account.

47.

The accuracy of the measure is extremely dependent upon the precision of the cash flows calculated, and on the discount rates used in the calculation. When the expected cash flows are calculated, any likelihood that the size and the timing of future cash flows may differ between scenarios depending upon customer behavior in reaction to the rate environment needs to be considered.

48.

Depending on its specific design, an EV/EVE measure can capture all types of interest rate sensitivity. Gap risk (parallel and non-parallel) will be captured depending on the specific yield curve risk used in the alternative scenario. In computing EV, a full revaluation of automatic options would be normal under each of the alternative scenarios, so automatic option risk measurement is an integral part of a standard EV measure. Behavioral optionality can also be captured if stressed behavioral assumptions are used in alternative scenarios. Banking corporations can then compute the EV effect of a change in customer behavior either separately or in conjunction with a yield curve shift.

49.

EV is a technique that can also be used to estimate basis risk in the banking book, either in isolation, or when combined with a general yield curve shift or with a change in assumed parameters. Basis risk can be measured by designing a scenario under which there is a divergence in the different base rates to which a banking corporation is specifically sensitive.

50.

Economic value at risk (EVaR) measures the expected maximum reduction of market value that can be incurred under normal market circumstances over a given time horizon or holding period and subject to a given confidence level. For calculation of EVaR in the banking book, the changes in the market value of the banking book and thus of the equity are computed for a set of alternative yield curve scenarios. When the EVaR approach is applied to the banking book, the time horizon is normally consistent with the economic model of the banking book. The standard VaR approach comprises three different techniques: historical simulation, variance-covariance approach³⁴ and Monte Carlo simulation.

51.

EVaR models are suited to capture all types of interest rate sensitivity such as EVE. However, EVaR measurement techniques have their limitations. EVaR is designed for normal market circumstances and does not adequately assess tail risk. Both historical

³⁴ Under this approach, interest rates of different tenors are derived from historical observations of changes and a variance-covariance matrix is constructed to account for the correlations between the rate shocks across tenors.

value-at-risk (VaR) and variance-covariance VaR are backward-looking methods which are prone to missing the tail events that carry significant risks. The Monte Carlo simulation method is very demanding in terms of technology and computational power.

Quantifying IRRBB: earnings-based measures**52.**

Earnings-based measures look at the expected increase or reduction in NII over a shorter time horizon (typically one to three years, up to a maximum five years) resulting from interest rate movements that are composed of either a gradual or a one-time large interest rate shock. The change in NII is the difference in the expected NII between a base scenario and an alternative, more stressful scenario. The base case scenario reflects the banking corporation's current corporate plan in projecting the volume, pricing and repricing dates of future business transactions. Interest rates used for resetting transactions in the base scenario can be derived from market expected rates or from spot rates. The rate for each instrument will also contain appropriate projected spreads and margins.

53.

In assessing the possible extent of change in NII, banking corporations can use models to predict the path of rates and the run-off of existing assets and liabilities. 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 (or not undertaken) in differing interest rate environments, with the expected level of prices in those circumstances.

54.

An earnings-based measure analyzes the interest rate risk profile of the banking book in a detailed way tailored to the banking corporation's specific circumstances. As it can account for new business, it reflects a full going-concern perspective. Depending on the design of the alternative scenarios, this method is able to capture all different types of interest rate risk sensitivity. Banking corporations are able to incorporate fully the cash flow changes that occur under alternative scenarios due to automatic options.

55.

However, the results of the modelling are highly sensitive to assumptions about customer behavior as well as to the anticipated management responses to different rate scenarios. Earnings-based measures cover a relatively short time horizon, so changes in earnings falling beyond the observation period are ignored (including those arising from any behavioral treatment of NMDs and/or equity that involves long-term structural positions to reduce earnings volatility). Last but not least, earnings-based measures do not necessarily identify the risks to capital that can arise from revaluation of available-for-sale portfolios.

Derivation of the interest rate shocks

56.

Sections 90–93 of the Directive describe six prescribed interest rate shock scenarios that banking corporations should apply to parallel and non-parallel gap risks for EVE and two prescribed interest rate shock scenarios for NII. In order to derive these shocks, the steps in Sections 57–63 below are taken.

57.

Step 1: generate a 16-year time series of daily average interest rates for each currency c. The average daily interest rates from the year 2000 (3 January 2000) to 2015 (31 December 2015) for foreign currencies and the daily average interest rate from 2002 to 2017 for the shekel currency are contained in Table 1. The average local percentile of the rate series is determined by calculating the average rate across all daily rates in time buckets 3m, 6m, 1Y, 2Y, 5Y, 7Y, 10Y, 15Y and 20Y.

Table 1**Daily average interest rates for each foreign currency and for the shekel**

INR	IDR	HKD	GBP	EUR	CNY	CHF	CAD	BRL	AUD	ARS	
719	1,466	295	375	300	373	183	341	1,153	517	3,363	Average

ZAR	USD	TRY	SGD	SEK	SAR	RUB	MXN	KRW	JPY	
867	329	1,494	230	330	360	868	754	471	89	Average

Shekel CPI-indexed	Shekel unindexed	Daily average interest rate from 2002 to 2017 for the shekel currency
224	425	Average

58.

Step 2: the global shock parameter is prescribed based on the weighted average of the currency-specific shock parameters, $\bar{\alpha}_i$. The shock parameter for scenario I is a weighted average of the $\alpha_{i,c,h}$ across all currencies and defined as α_i . The following baseline global parameters are obtained:

Table 2**Baseline global interest rate shock parameters**

Parallel	$\bar{\alpha}_{parallel}$	60%
Short rate	$\bar{\alpha}_{short}$	85%
Long rate	$\bar{\alpha}_{long}$	40%

59.

Applying the α_i from Table 2 to the average long-term rates from Table 1 results in the revised interest rate shocks by currency for parallel, short and long segments of the yield curve in Tables 3 and 3a.

Table 3**Revised interest rate shocks**

INR	IDR	HKD	GBP	EUR	CNY	CHF	CAD	BRL	AUD	ARS	
431	880	177	225	180	224	110	204	692	310	2,018	Parallel
611	1,246	251	319	255	317	155	290	980	440	2,858	Short
288	586	118	150	120	149	73	136	461	207	1,345	Long

ZAR	USD	TRY	SGD	SEK	SAR	RUB	MXN	KRW	JPY	
520	197	896	138	198	216	521	452	283	53	Parallel
737	279	1,270	196	280	306	738	641	401	75	Short
347	131	597	92	132	144	347	301	188	35	Long

Table 3a**Revised interest rate shocks, in shekel CPI-indexed and unindexed**

Shekel, CPI-indexed	Shekel, unindexed	Revised interest rate shocks
134	255	Parallel
190	361	Short
90	170	Long

60.

However, the proposed interest rate shock calibration can lead to unrealistically low interest rate shocks for some currencies and to unrealistically high interest rate shocks for others. In order to ensure a minimum level of prudence and a level playing field, a floor of 100 basis points and variable caps (denoted as ΔR) are set for the scenarios concerned, those caps being 500 basis points for the short-term, 400 basis points for the parallel and 300 basis points for the long term interest rate shock scenario.

61.

The change in the risk-free interest rate for shock scenario j and currency c can be defined as follows, where $\Delta \bar{R}_j$ is 400, 500 or 300 when j is parallel, short or long, respectively.³⁵11

$$\bar{R}_{j,c} = \max\{100, \min\{\Delta \bar{R}_{j,c}, \Delta \bar{R}_j\}\}$$

62.

Applying the caps and floors to the shocks described in Tables 3 and 3a results in the final set of interest rate shocks by currency that is shown in Section 90 in the Directive (tables 2 and 2a).

63.

A zero or negative lower bound for the postshock interest rates will be calculated, based on Tables 2 and 2a in Section 93 above. The postshock interest rate shall be calculated as:

$$\bar{R}_{j,c}(t_k) = \max\{\bar{R}_{0,c}(t_k) + \Delta \bar{R}_{j,c}(t_k), ((\text{Negative or zero lower bound}))\}$$

³⁵ In the case of the rotation scenarios, cannot exceed 500 basis points and cannot exceed 300 basis points.

APPENDIX 1a: Additional guidelines for calculating the standardized interest rate shocks

1. When calculating the change in EVE:
 - a. A banking corporation shall exclude its equity from its exposure level calculation
 - b. A banking corporation shall include in the exposure level calculation all the cash flows from all the interest rate-sensitive assets and liabilities and off-balance sheet items, and exclude non-cash items; see the significance of the term EVE in Section 95 of the Directive (in the Standardized framework chapter).
 - c. The EV shall be calculated in accordance with the net adjusted fair value, subject to the implementation of the assumptions in Sections 107–112 in the Directive regarding Non-maturity Deposits.
 - d. The change in EVE shall be calculated based on the assumption of a run-off balance sheet, where positions in the banking book are paid down and are not substituted in any new transactions.
2. When calculating the change in Net Interest Income (NII):
 - a. A banking corporation shall include the expected cash flows (including commercial spreads and other spread components) deriving from all the interest rate-sensitive assets, liabilities, and off-balance sheet items in the banking book.
 - b. The change in NII shall be calculated based on the assumption of a constant balance sheet, in which cash flows that come in on their maturity date or that are repriced are substituted for new cash flows with identical characteristics regarding amount, repricing date, and the spread components.
 - c. The change in NII shall be presented as the difference in future interest income over a rolling 12 months period.
3. Currency scheme
 - a. The effect of the relevant interest rate shock shall be calculated for shock scenario i and currency c separately.
 - b. When calculating the overall impact of the change in EVE and the earnings, the impacts on all the currencies shall be as follows:
 1. Impact of the shekel currency—the effects of the CPI-indexed sector and the unindexed sector are to be put together; profit and loss of each of the sectors will be taken in their entirety in a simple mathematical addition.
 2. Impact of foreign currencies—Every major foreign currency is to be calculated separately; the impacts of the foreign currencies will be added together, profits and losses will be taken in their entirety in a simple mathematical addition.
 3. The overall impact with regard to Tier 1 Capital is not to offset the shekel against other currencies. Accordingly, losses in the shekel currency and losses in foreign currencies will be added together in their entirety, profits in one of the sectors will not offset a loss in another sector and only the loss will be taken into account, profits in the two sectors will be added together.

4. Positions that are not amenable to standardization as noted in Section 106 of the Directive:

- a. NMDs – see Section (c)1 in this Appendix
- b. Fixed-rate loans involved in early repayment that are housing loans, as defined in Proper Conduct of Banking Business Directive no. 451, shall be handled in line with Sections 114–121 of the Directive.
- c. Term deposits that incorporate early repayment risk will be handled according to Sections 114–116 and Sections 122–126 of the Directive. In this regard, a term deposit that incorporates early repayment risk subject to early redemptions is as per the approach set out in Section 122 of the Directive.
- d. Derivative instruments shall be handled in accordance with Section 22a of the Reporting to the Public Directives.

5. The Supervisor of Banks may establish other guidelines in order to calculate the standardized shocks.

APPENDIX 2: Standardized interest rate shocks for an acquirer

1. An acquirer may not implement the interest rate shocks specified in the Directive in Sections 90–93; in such a case it must implement the shocks specified in Section 2 below (hereinafter, “Standardized interest rate shocks for an acquirer”).

2. Standardized interest rate shocks for an acquirer:

- a. a parallel increase shock of 250 basis points
- b. a parallel decrease shock of 250 basis points

3. The shocks shall measure the impact on Tier 1 Capital and on NII in the mechanisms describing the notice, including Appendix 1a.

4. An acquirer for whom the impacts of standardized interest rate shocks on its Tier 1 Capital or on its NII are significant, will be required by the Supervisor of Banks to reduce its exposures to interest rates, to allocate additional capital vis-à-vis the risks or to take any other steps that the Supervisor will view as correct.

Revisions

Circular-06 number	Version	Details	Date
2377	1	Original directive	May 30, 2013
2669	2	Update	September 30, 2021
2766	3	Update	December 20, 2023