INTEREST RATE RISK MANAGE-MENT GUIDELINE

Month 2023

Introduction and scope

The AMF considers interest rate risk as potentially having a significant impact on the profitability and solvency of a financial institution that engages in bank intermediation activities. It is therefore essential for each financial institution to be able to rely on a prudential framework for interest rate risk management in order to adhere to sound and prudent management practices.

The Interest Rate Risk Management Guideline sets out the AMF's prudential expectations for interest rate risk management, specifically in regard to interest rate risk in the banking book (**IRRBB**).

This guideline draws mainly from best practices proposed by the Bank for International Settlements.[1] It applies to financial services cooperatives, authorized trust companies and other authorized deposit institutions, which are collectively referred to in this guideline as "financial institution" or "institution".

IRRBB refers to the current or prospective risk to an institution's capital and earnings arising from adverse fluctuations in interest rates that affect the institution's banking book positions.

When interest rates change, the present value and timing of future cash flows also change. Such changes could affect the underlying value of an institution's assets, liabilities and off-balance sheet items and, ultimately, its economic value.

Changes in interest rates also affect an institution's earnings by altering certain interest rate-sensitive income and expenses, which could ultimately result in variations in its net interest income.

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[1]   BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision, *Interest rate risk in the banking book*, April 2016.

1. Concepts related to interest rate risk in the banking book

There are three main sub-types of IRRBB:

- **Gap risk** arises from the term structure of banking book instruments[2] 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);

- **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;

- **Option risk** arises from option derivative positions or from optional elements embedded in a financial institution's assets, liabilities and/or off-balance sheet items, where the financial institution or its clients can alter the level and timing of their cash flows. Option risk can be further characterized into automatic option risk[3] and behavioural option risk.[4]

These three sub-types of IRRBB can 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 could adversely affect an institution's financial condition.

Credit spread risk in the banking book

While the three sub-types of risk listed above are directly linked to IRRBB, credit spread risk in the banking book (**CSRBB**) is a related risk. 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.

Economic value and earnings-based measures

While the economic value and earnings-based measures share certain characteristics, financial institutions primarily utilise the latter for IRRBB management, whereas economic value-based measures provide a suitable benchmark for comparability and capital adequacy. If a financial institution were to solely minimize 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. Likewise, senior management decisions to optimize short-term net interest income fluctuations could be structurally unviable when evaluated on a longer horizon.

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[2] For the purposes of this guideline, "banking book" is defined as all products or instruments that do not fall within the trading book boundary. AUTORITÉ DES MARCHÉS FINANCIERS, *Ligne directrice sur les normes relatives à la suffisance du capital* (Capital Adequacy Guideline (available in French only)), February 2023.

[3] 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 (e.g., a capped rate loan) and where the holder will almost certainly exercise the option if it is in their financial interest to do so.

[4] Behavioural 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 behaviour of the client (e.g., rights of a borrower to prepay a loan, with or without penalty, or the right of a depositor to withdraw their balance in search of higher yield).

2. Sound and prudent interest rate risk management

> The AMF expects the financial institution to identify, assess, quantify, control, mitigate and monitor IRRBB. Likewise, the financial institution should monitor and assess CSRBB.

The AMF considers IRRBB to be a significant risk arising from the activities of financial institutions. IRRBB arises due to interest rate variability over time, while a financial institution's intermediation activities typically involve exposures to both maturity mismatch[5] and rate mismatch.[6] In addition, there are optionalities embedded in many of the common banking products[7] that may be triggered as a result of changes in interest rates.

The management of a financial institution's IRRBB should be integrated within its broader risk management framework and aligned with its business planning and budgeting activities. The AMF expects the financial institution to be familiar with all material elements of IRRBB, to identify its IRRBB exposures and to take appropriate steps to manage IRRBB.

Products and activities that a financial institution wishes to add to its offering should undergo a careful review beforehand to ensure that the IRRBB characteristics are well understood and be subject to a predetermined test phase before being fully rolled out. Prior to introducing a new product or hedging or risk-taking strategy, financial institutions should have in place appropriate operational procedures and risk control systems.

In managing IRRBB, the financial institution should ensure that CSRBB is properly monitored and assessed.

The AMF believes that the allocation of capital to IRRBB is an integral component of sound IRRBB management. An institution may transfer centralized IRRBB management to one or more centres of expertise. Moreover, IRRBB capital and associated profit and loss should be allocated and measured accordingly.

As part of this centralization process, financial institutions should utilize an appropriate funds transfer pricing (**FTP**)[8] mechanism to manage this transfer. Additionally, they should have a senior management committee to oversee this FTP process. The committee should include representatives from all major business lines as well as from the relevant control functions and treasury.

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[5] For example, long-maturity assets funded by short-maturity liabilities.

[6] For example, fixed rate loans funded by variable rate deposits.

[7] For example, non-maturity deposits, term deposits, fixed rate loans and mortgage commitments.

[8] The FTP mechanism is a process for calculating all actual costs relating to an individual product. This mechanism is used to measure the contribution of each transaction to an institution's overall profitability.

3. Governance and general interest rate risk management framework

> The AMF expects the financial institution to implement an IRRBB management framework consistent with its risk appetite for IRRBB. The financial institution should have an adequate IRRBB management framework, involving regular independent reviews and evaluations of its effectiveness.

Risk management framework

Senior management should be responsible for understanding the nature and the level of the financial institution's IRRBB exposure as well as overall policies with respect to IRRBB. Likewise, it should also ensure that there is clear guidance regarding the acceptable level of IRRBB, given the financial institution's business strategies.

In addition to the roles and responsibilities that normally devolve to it,[9] senior management should, in particular, set:

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

The AMF expects that such reviews will be carried out more frequently when the financial institution has significant IRRBB exposures or has positions in complex instruments that are exposed to IRRBB. Senior management should be informed, at least monthly, of the level and trend of the financial institution's IRRBB exposures.

Furthermore, senior management should understand the implications of the financial institution's IRRBB strategies, including the potential linkages with and impact on market, liquidity, credit and operational risk.

In addition to the roles and responsibilities that normally devolve to it,[10] the board of directors should:

- have sufficient technical knowledge to question and challenge the reports presented to it; and
- ensure that delegated staff has the capability and skills to understand IRRBB and that adequate resources are devoted to IRRBB management.

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[9]   AUTORITÉ DES MARCHÉS FINANCIERS, Governance Guideline, April 2021.

[10]   Idem

4. Risk appetite[11]

> The AMF expects the risk appetite for IRRBB to be articulated in terms of the risk to both the financial institution's economic value and earnings. The financial institution should implement policy limits that target maintaining IRRBB exposures consistent with their risk appetite.

The financial institution's risk appetite statement should delineate lines of responsibility and accountability over IRRBB management decisions and should clearly define authorized instruments, hedging strategies and risk-taking opportunities. All IRRBB policies should be reviewed at least every three years and revised as needed.

Policy limits

Policy limits should be consistent with the financial institution's overall approach for measuring IRRBB. Limits, clearly articulating the appropriate amount of IRRBB, should be applied on a consolidated basis and, as appropriate, at the level of individual entities within a group. Such 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, and for different currencies. 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 senior management to mitigate those risk exposures. The limits should also be reflective of the financial institution's prospective expectations of interest rate volatility.

Depending on the nature of a financial institution's activities and business model, sub-limits may also be identified for individual business units, portfolios, instrument types or specific instruments. The granularity of the institution's limits should reflect the characteristics of its holdings, including the various sources of its IRRBB exposures. A financial institution with significant exposures to gap risk or basis risk or having positions with explicit or embedded options should establish risk tolerance levels appropriate for these risks.

The financial institution should develop a dedicated set of risk limits and triggers to monitor the evolution of hedging strategies involving derivatives, and to control mark-to-market risks in instruments that are accounted for at market value. Proposals to use new instrument types or new strategies (including hedging) should be assessed to verify whether activities are in line with the financial institution's overall risk appetite. Procedures should be established to manage applicable risks.

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

There should be a process in place to escalate any positions that exceed, or are likely to exceed, established limits. The process should also include a clear policy on who will be

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[11] AUTORITÉ DES MARCHÉS FINANCIERS, Integrated Risk Management Guideline, May 2015.

informed, how the communication will take place and the actions to be taken in response to an exception.

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5. Measurements, assumptions, systems integrity and model governance

> The AMF expects measurement of IRRBB to be based on outcomes of both economic value and earnings-based measures, arising from a wide range of interest rate shock and stress scenarios.

Economic value and earnings-based measures

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

For purposes of sound and prudent IRRBB management, the financial institution should pay attention to the complementary nature of economic value and earnings-based measures in their risk and capital assessments, in particular in terms of:

- *outcomes*: economic value measures compute a change in the net present value of the financial institution'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 financial institution's own equity capital;

- *assessment horizons*: economic value measures reflect changes in value over the remaining life of the financial institution's assets, liabilities and off-balance sheet items, i.e., 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;

- *future business/production*: economic value measures consider the net present value of repricing cash flows of instruments on the institution's balance sheet or accounted for as an off-balance sheet item (i.e., a run-off view). Earnings-based measures may, in addition to a run-off view, assume rollover of maturing items and/or assess the scenario-consistent impact on the financial institution's future earnings inclusive of future business.[12]

Interest rate shock and stress scenarios

The financial institution's IMS for IRRBB should be able to calculate the impact on economic value and earnings of multiple scenarios, based on:

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[12]   This approach refers to a dynamic view, which can be useful for business planning and budgeting purposes. However, dynamic approaches are dependent on key variables and assumptions that are difficult to project with accuracy over an extended period and can potentially hide key underlying risk exposures.

- internally developed interest rate shock scenarios addressing the financial institution's risk profile, according to its Internal Capital Adequacy Assessment Process (ICAAP);[13]

- historical, hypothetical, and forward-looking interest rate stress scenarios, which tend to be more severe than shock scenarios;

- the six prescribed interest rate shock scenarios set out in Annex 1; and

- any other stress scenario, as required by the AMF.

Developing internal interest rate shock and stress scenarios[14]

A financial institution's stress testing framework for IRRBB should include clearly defined objectives, scenarios tailored to the financial institution's businesses and risks, well documented assumptions and robust methodologies. The framework will be used to assess the potential impact of the scenarios on the institution's financial condition, enable ongoing and effective assessment 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 financial institution and through appropriate external disclosures.

Roles and objectives

The financial institution should measure its vulnerability to loss in value and/or reductions in short-term earnings under stressful market conditions, including challenging key assumptions, and consider those results when establishing and reviewing its policies and limits for IRRBB.

The financial institution's stress testing framework for IRRBB should be an integral part of the overall risk management and governance processes. It should feed into the decision-making process at the appropriate management level, including strategic decisions.[15] In particular, IRRBB stress testing and sensitivity analysis should be considered in the ICAAP. Accordingly, the financial institution should conduct rigorous, forward-looking stress testing that identifies severe changes in market conditions, including those that could adversely impact the financial institution's capital or earnings.

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[13]   AUTORITÉ DES MARCHÉS FINANCIERS, *Ligne directrice sur les normes relatives à la suffisance du capital* (Capital Adequacy Guideline (available in French only)), February 2023.

[14]   AUTORITÉ DES MARCHÉS FINANCIERS, *Stress Testing Guideline*, June 2012.

[15]   For example, business and capital planning decisions.

Selection process for shock and stress scenarios

The identification of relevant shock and stress scenarios for IRRBB, the application of robust modelling approaches and the appropriate use of the stress testing results require collaboration within the financial institution. A stress-testing program for IRRBB should consider the opinions of different experts within the institution.[16]

The financial institution should determine, by currency and across currencies, a range of potential interest rate movements against which it will measure its IRRBB exposures. Senior 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, the financial institution 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, the financial institution should also consider negative interest rate scenarios and the possibility of asymmetrical effects of negative interest rates on the different asset and liability profiles.

The financial institution should consider the nature and sources of its IRRBB exposures, the time required to reduce or unwind unfavourable IRRBB exposures, and its capability/willingness to withstand accounting losses in order to reposition its risk profile. The financial institution should select scenarios that provide meaningful estimates of risk and include a range of shocks that is sufficiently wide to allow senior management to understand the risk inherent in its products and activities.

When developing interest rate shock and stress scenarios for IRRBB, the financial institution should consider the following:

- 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. Financial institutions should ensure that the scenarios are both severe and plausible, in light of the level of interest rates and the interest rate cycle;

- Special consideration should be given to instruments or markets where a certain level of concentration exists, because those positions may be more difficult to liquidate or offset in a stressful market environment;

- When assessing earnings risks, the financial institution should determine the effect of adverse changes in the spreads of new assets/liabilities replacing those assets/liabilities maturing within the time horizon of the forecast on its net interest income;

- A financial institution with significant option risk, whether embedded or explicit, should include scenarios that capture the exercise of such options. For example, a financial institution that has 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, the financial institution should develop

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[16]   For example, traders, the treasury department, the finance department, the asset and liability management committee, the risk management department, the institution's economists, etc.

interest rate assumptions to measure its IRRBB exposures to changes in interest rate volatilities;

- In building its interest rate shock and stress scenarios, the financial institution should specify the term structure of interest rates that will be incorporated and the basis relationship between yield curves, rate indices, etc. The financial institution should also estimate how interest rates that are administered or managed by delegated expert individuals[17] might change. The financial institution should document how its assumptions are chosen.

Forward-looking scenarios should incorporate changes in portfolio composition due to factors internal to the financial institution,[18] external factors,[19] 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.

Lastly, the financial institution should perform qualitative and quantitative reverse stress tests in order to:

- identify interest rate scenarios that could severely threaten a financial institution's capital and earnings, and

- reveal vulnerabilities arising from its hedging strategies and the potential behavioural reactions of its clients.

The financial institution should also combine forward-looking scenarios with plausible rate shock periods.

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[17] For example, prime rates or retail deposit rates, as opposed to those that are purely market-driven.

[18] For example, the financial institution's acquisition plans.

[19] For example, changing competitive, legal or tax environments.

6. Measuring IRRBB using behavioural and modelling assumptions

> The AMF expects the financial institution to understand behavioural and modelling assumptions used in measuring IRRBB. The assumptions should be conceptually robust and documented and should be rigorously tested and aligned with the financial institution's business strategies.

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

- expectations for the exercise of interest rate options (explicit and embedded) by both the institution and its clients under specific interest rate shock and stress scenarios;

- treatment of balances and interest flows arising from non-maturity deposits;

- treatment of own equity in economic value measures; and

- the implications of accounting practices for IRRBB.

Consequently, when assessing its IRRBB exposures, a financial institution should make judgments and assumptions about how an instrument's actual maturity or repricing behaviour may vary from the instrument's contractual terms because of behavioural optionalities.[20]

The degree of sophistication of IRRBB measurement techniques should be commensurate with the degree of risk inherent in the financial institution. Where financial institutions utilize models to measure and mitigate their IRRBB exposure, these models should be thoroughly vetted by an independent audit function.

Common products with behavioural optionalities

Common products with behavioural optionalities include:

- *Fixed rate loans subject to prepayment risk*

The financial institution should understand the nature of prepayment risk specific to its 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 financial institution's estimate of the effect of each interest rate shock and stress scenario on the average prepayment speed. Specifically, a financial institution should assess the expected average prepayment speed under each scenario.

- *Fixed rate loan commitments*

The financial institution may sell options to retail clients (e.g., prospective mortgage buyers or renewers) whereby, for a limited period, the clients can choose to draw down a loan at a committed rate. Unlike loan commitments to corporates, where

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[20] That is, the embedded optionality effect.

drawdowns strongly reflect characteristics of automatic interest rate options, mortgage commitments (i.e., credit products) to retail clients are also impacted by other behavioural drivers.

- *Term deposits subject to early redemption risk*

The financial institution 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. A 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.[21]

- *Non-maturity deposits (**NMDs**)*

Behavioural assumptions for NMDs that have no specific repricing date are a material determinant of IRRBB exposures under the economic value and earnings-based measures. The financial institution should document, monitor and regularly update key assumptions for NMD balances and behaviour used in their IMS. To determine the appropriate assumptions for its IMS, the financial institution should analyse its depositor base in order to identify the proportion of core deposits.[22] Assumptions should vary according to depositor characteristics (e.g., retail/wholesale) and account characteristics (e.g., transactional/non-transactional).

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[21]   If deemed not material, "hardship" or "estate" redemptions on non-cashable term deposits should not be considered as early redemption risk.

[22]   Core deposits refer to NMDs that are unlikely to reprice even under significant changes in the interest rate environment.

Modelling assumptions[23] should be conceptually sound and reasonable, and consistent with historical experience. The financial institution should carefully consider how the exercise of the behavioural optionality will vary not only under the interest rate shock and stress scenario but also across other dimensions. For instance, considerations may include:

Product	Dimensions influencing the exercise of the embedded behavioural options
Fixed rate loans subject to prepayment risk	Loan size, loan-to-value (**LTV**) ratio, borrower characteristics, contractual interest rates, seasoning, geographical location, original and remaining maturity, and other historical factors. Other macroeconomic variables such as stock indices, unemployment rates, GDP, inflation and housing price indices should be considered in modelling prepayment behaviour.
Fixed rate loan commitments	Borrower characteristics, geographical location (including competitive environment and local premium conventions), customer relationship with the institution, as evidenced by the number of products held, 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, competitive environment, remaining maturity and other historical factors. Other macroeconomic variables such as stock indices, unemployment rates, GDP, inflation and housing price indices should be considered in modelling deposit redemption behaviour.
Non-maturity deposits	Responsiveness of product rates to changes in market interest rates, current level of interest rates, spread between a financial institution's offer rate and market rate, competition from other firms, the financial institution's geographical location and demographic and other relevant characteristics of its customer base.

In addition, a financial institution with positions denominated in different currencies can expose itself to IRRBB in each of those currencies. Since yield curves vary from currency to currency, the financial institution should assess exposures in each currency and have sufficient controls to manage the risk in each of those currencies independently. A financial institution with material multicurrency exposures should include, in its IMS, methods to aggregate its IRRBB using assumptions about the correlation between interest rates in different currencies.

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[23] The financial institution should subject all material behavioural assumptions to modeling. The financial institution should also conduct due diligence and periodic reviews to determine and confirm materiality.

The AMF may exercise discretion in terms of allowing or restricting methods to aggregate IRRBB in different currencies. For example, the AMF may request that a financial institution report exposures in different currencies either without or with different assumptions about the correlation between interest rates.

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

The financial institution should be able to test the appropriateness of key behavioural assumptions, and all changes to the assumptions of key parameters should be documented. The financial institution should periodically perform sensitivity analyses for key assumptions to monitor their impact on measured IRRBB. Sensitivity analyses should be performed with reference to both economic value and earnings-based measures.

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

As market conditions, competitive environments and strategies change over time, the financial institution 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. The frequency and the nature of these reviews depend on various factors, such as complexity of the financial institution and size of IRRBB exposures, market changes, and complexity of innovation with respect to measuring IRRBB.

7. Systems and models

> The AMF expects measurement systems and models used for IRRBB to 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.

Measurement systems and data integrity

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

The financial institution 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, the financial institution should use a variety of methodologies to quantify its IRRBB exposure 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.

The financial institution's MIS should allow it to retrieve accurate IRRBB information in a timely manner. The system should also capture interest rate risk data on all the financial institution's material IRRBB exposures. In addition, there should be sufficient documentation of the major data sources used in the financial institution's risk measurement process.

Data inputs should be automated as much as possible to reduce operational errors. Data mapping should be periodically reviewed and tested against an approved model version. The financial institution should monitor the type of data extracts and have appropriate controls in place. Where cash flows are slotted into different time buckets[24] 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.

The financial institution's IMS should be able to compute economic value and earnings-based measures of IRRBB, as well as other measures of IRRBB based on the interest rate shock and stress scenarios set defined. It should also be sufficiently flexible to incorporate constraints[25] that could be imposed on the financial institution's internal risk parameter estimates.

Model governance process

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 senior management. The policy should specify the management roles and

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[24]   For example, for gap analyses.

[25]   For example, changes in modeling assumptions or sensitivities of assumptions.

designate who is responsible for the development, implementation and use of models. In addition, the model oversight responsibilities as well as policies, including on 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 processes for model risk management.

An effective validation framework should include three core elements:

- evaluation of conceptual/methodological soundness, including developmental evidence;

- ongoing model monitoring, including process verification and benchmarking; and

- outcomes analysis, including backtesting of key internal parameters (e.g., stability of deposits, prepayments, early redemptions, pricing of instruments).

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.

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 senior management.

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

The ongoing validation process should, where appropriate, establish a set of exception trigger events that obligate the model reviewers to notify 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, an approved model may be modified or decommissioned. The financial institution should articulate policies for model transition, including change and version control authorizations and documentation.

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 financial institution should document and explain model specification choices as part of the validation process.

A financial institution that purchases 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, behavioural assumptions or model settings, the financial institution should have a process in place to determine if those inputs are reliable.

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

8. Reporting

> The AMF expects measurement outcomes of IRRBB and hedging strategies to be reported to senior management on a regular basis, at relevant levels of aggregation (by consolidation level and currency).

The reporting of risk measures to senior management should occur on a frequent basis. Such reporting should compare current IRRBB exposures with policy limits as well as past IRRBB forecasts or risk estimates with actual results (i.e. earnings or surpluses) to inform potential modelling shortcomings.

Reporting should also include the results of the periodic model reviews and audits on a similar frequency. Portfolios that may be subject to significant mark-to-market movements should be clearly identified within the financial institution's MIS and subject to oversight in line with any other portfolios exposed to market risk.

The reports prepared for senior management will vary based on the financial institution's portfolio composition but they should include at least the following:

- Summaries of the financial institution's aggregate IRRBB exposures, and explanatory text that highlights the assets, liabilities, cash flows, and strategies (including hedging program activities) that are driving the level and direction of IRRBB;

- Reports demonstrating the financial institution's compliance with policies and limits;

- Key modelling assumptions such as NMD characteristics, prepayments on fixed rate loans and currency aggregation;

- Results of stress tests, including assessment of sensitivity to key assumptions and parameters; and

- 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.[26]

Reports detailing the financial institution's IRRBB exposures should be provided to senior management on a timely basis and reviewed regularly. The IRRBB reports should provide aggregate information as well as sufficient supporting detail to enable senior management to assess the sensitivity of the financial institution to changes in market conditions, with particular reference to portfolios that may potentially be subject to significant mark-to-market movements.

Senior management should ensure that the financial institution's IRRBB management policies and procedures remain appropriate and sound. Senior management should also ensure that analysis and risk management activities related to IRRBB are conducted by competent staff with the required technical knowledge and experience.

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[26] For example, consultants.

9. Public disclosure

> The AMF expects information on the level of IRRBB exposure and practices for measuring and controlling IRRBB to be disclosed to the public on a regular basis.

The level of IRRBB exposure should be measured and disclosed. The financial institution should publicly disclose:

- Its risk management objectives and policies, including the nature of IRRBB and key assumptions. This includes assumptions regarding loan prepayments and behaviour of non-maturity deposits, and frequency of IRRBB measurement; and

- The increase (decline) in earnings or economic value (or relevant measures used) for upward and downward rate shocks according to the method used for measuring IRRBB, broken down by currency (as relevant).

  Examples of upward and downward rate shocks that the financial institution should disclose include the sensitivity (pre-tax)[27] of:

    o Net interest income and economic value to parallel shifts in the yield curve of 10, 25, 100 and 200 basis points, Economic value should also be represented as a percentage of capital;

    o Net interest income and economic value to three non-parallel shifts in the yield curve to which the financial institution is vulnerable; and

    o Net interest income and economic value to, for example, key interest rates or other variables to which the financial institution is vulnerable.

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[27] Net interest income sensitivities should be measured over a 12-month period.

10. Capital adequacy and outlier test

> The AMF expects capital adequacy for IRRBB to be specifically considered as part of the Internal Capital Adequacy Assessment Process (ICAAP) and approved by the board of directors, in line with the financial institution's risk appetite.[28]

The financial institution is responsible for evaluating the level of capital that it 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 financial institution's IMS outputs, taking into account key assumptions and risk limits. The overall level of capital should be commensurate with both the financial institution's actual measured level of risk (including for IRRBB) and its risk appetite, and be duly documented in its ICAAP report.

The financial institution should not only rely on assessments of capital adequacy for IRRBB, but should also develop its own methodologies for capital allocation, based on its risk appetite, risk tolerance and policies. In determining the appropriate level of capital, the financial institution should consider both the amount and the quality of capital needed.

Capital adequacy for IRBBB should be considered in relation to the risks to economic value, given that such risks are embedded in the financial institution's assets, liabilities and off-balance sheet items. The financial institution should consider capital buffers to address any risks to future earnings.

Capital adequacy assessments for IRRBB should factor in:

- The size and tenor of internal limits on IRRBB exposures, and whether these limits are reached at the point of capital calculation;

- 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;

- The sensitivity of the internal measures of IRRBB to key modelling assumptions;

- The impact of shock and stress scenarios on positions priced off different interest rate indices (basis risk);

- The impact on economic value and net interest income of mismatched positions in different currencies;

- The impact of embedded losses;

- 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;

- The drivers of the underlying risk; and

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[28]   AUTORITÉ DES MARCHÉS FINANCIERS, *Ligne directrice sur les normes relatives à la suffisance du capital* (Capital Adequacy Guideline (available in French only)), February 2023.

- The circumstances under which the risk might crystallise.

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

11. Assessment by the AMF

> The AMF intends to regularly assess the financial institution's IRRBB and the effectiveness of the approaches that institution uses to identify, assess, quantify, control, mitigate and monitor IRRBB.[29]

During such assessments, the AMF may:

- collect sufficient information from the institution to assess its IRRBB exposure;

- regularly evaluate the adequacy, integrity and effectiveness of the institution's IRRBB management framework and assess whether its practices comply with the stated objectives and risk tolerances set by senior management, and with the expectations as set out in sections 1 to 7 of this guideline;

- evaluate whether the institution's IMS provides a sufficient basis for identifying and quantifying IRRBB, taking note particularly of the key assumptions that affect the measurement of IRRBB. The AMF may request and evaluate information about significant model or policy changes that have occurred between its regular reviews and may concentrate its efforts on reviewing the most material models and policies;

- review regularly the outputs from the institution's IMS, including the institution's IRRBB exposures (both economic value and earnings-based measures) based on the internal calculations using at least the prescribed interest rate shock scenarios specified in Annex 1, as well as any additional interest rate shock and stress scenarios it determines should be assessed. The AMF may also form its evaluation of an institution's IMS by applying prudential estimates that the AMF has developed and review the information disclosed by institutions pursuant to the expectations in section 9 of this guideline.

When reviewing the institution's IRRBB exposures and forming conclusions about the quality of the institution's IRRBB management, the AMF may consider:

- the complexity and level of risk posed by the institution's assets, liabilities and off-balance sheet activities;

- the adequacy and effectiveness of oversight by the institution's senior management;

- the institution's knowledge and ability to identify and manage the sources of IRRBB;

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[29] For more information concerning the supervisory approach, please refer to the section of the AMF website dedicated to the Supervisory Framework at https://lautorite.qc.ca/en/professionals/insurers/supervisory-framework.

- the adequacy of internal validation of IRRBB measures, including sensitivity analysis and backtesting, in particular where changes in key modelling parameters have occurred;

- the adequacy of internal controls and of the institution's MIS;

- the effectiveness of risk limits and controls that set tolerances on economic value and earnings;

- the effectiveness of the institution's IRRBB stress testing program;

- the adequacy and frequency of the internal review and audit of the IRRBB management process, including independent model validation and oversight of model risk;

- the adequacy and effectiveness of IRRBB management practices as evidenced by past and projected financial performance;

- the effectiveness of hedging strategies used by the institution to control IRRBB; and

- the appropriateness of the level of IRRBB (including embedded losses) in relation to the institution's capital, earnings and risk management systems.

The AMF could assess the adequacy of an institution's capital relative to its IRRBB exposures (against expectations set out in section 10) to determine whether the institution requires more detailed examination and should potentially be subject to additional capital requirements and/or other mitigation actions. This assessment may exceed the capital prescription from the outlier/materiality test set out in section 12.

The AMF's evaluation could be undertaken both on a standalone basis and by making comparisons with peer institutions. In particular, the AMF may compare the key behavioural and strategic assumptions being made by institutions to determine whether they can be justified with regard to the economic environment and business model. The AMF would ensure that both information and the review process are comparable and consistent across institutions.

12. Outlier test

When a review of an institution's IRRBB exposure reveals inadequate management or excessive risk relative to capital, earnings or general risk profile, the AMF may recommend mitigation actions to be taken and/or additional capital to be raised. Institutions identified as outliers are considered as being exposed to undue IRRBB.

The outlier/materiality test compares an institution's maximum economic value of equity (**ΔEVE**), under the six prescribed interest rate shock scenarios set out in Annex 1, with 15% of its Tier 1 capital.

If deemed necessary for testing purposes, the AMF could also implement additional outlier/materiality tests that use capital measures other than Tier 1, or capture the institution's IRRBB relative to earnings. For example, an institution could be considered to have undue IRRBB relative to earnings if its shocked net interest income (**ΔNII**) were such that the institution would not have sufficient income to maintain its routine operations.

Institutions are expected to hold adequate capital for the risks they undertake. With regard to IRRBB, the AMF may evaluate whether the institution 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. The following factors may be considered by the AMF:

- **The ΔEVE under a variety of shocked and stressed interest rate scenarios**: Where an institution's EVE is significantly sensitive to interest rate shocks and stresses, the AMF may evaluate the impact on the institution's capital levels arising from financial instruments held at market value, and potential impact should banking book positions held at historical cost become subject to market valuation. Throughout the assessment, the AMF would consider the impact of key assumptions on the ΔEVE calculated, including those related to the inclusion/ exclusion of commercial margins, the institution's actual equity allocation profile, the stability of NMDs and prepayment optionality.

- **The strength and stability of the earnings stream and the level of income needed to generate and maintain routine operations**. A high level of IRRBB exposure is one that could, under a plausible range of market scenarios, result in the institution reporting losses or curtailing normal dividend distribution and business operations. In such cases, senior management should ensure that the institution has sufficient capital to withstand the adverse impact of such events until it can implement mitigating actions such as reducing exposures or increasing capital.

When the AMF concludes that an institution's management of IRRBB is not sound and prudent, the AMF may recommend that the institution take one or more of the following actions:

- reduce its IRRBB exposures (e.g., by hedging);

- raise additional capital;
- set constraints on the internal risk parameters; and/or
- improve its risk management framework.

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 the type of institution, prevailing financial and economic conditions, as well as the causes of the IRRBB exposure exceeding the supervisory threshold.

Annex 1: The standardized interest rate shock scenarios

The financial institution should apply six prescribed interest rate shock scenarios to capture parallel and non-parallel gap risks for economic value of equity (**EVE**) and two prescribed interest rate shock scenarios for net interest income (**NII**). These scenarios are applied to IRRBB exposures in each currency for which the institution has material positions. In order to accommodate heterogeneous economic environments across jurisdictions, the six shock scenarios reflect currency-specific absolute shocks as specified in Table 1 below. For the purposes of capturing the local rate environment, a historical time series ranging from 2000 to 2015 for various maturities was used to derive each scenario for a given currency.

Under this approach, IRRBB is measured by means of the following six scenarios:

(i)   parallel shock up;
(ii)   parallel shock down;
(iii) steepener shock (short rates down and long rates up);
(iv)   flattener shock (short rates up and long rates down);
(v)   short rates shock up; and
(vi)   short rates shock down.

The calibration of the interest rate shock size is provided in Table 1. The data below is based on historical time series from 2000 to 2015:

Table 1. Specified size of interest rate shocks $\overline{R}_{shocktype,c}$

	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

Given Table 1, 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:

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

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

(ii)   *Short rate shock for currency c*: shock up or down that is greatest at the shortest tenor midpoint. That shock, through the shaping scalar

$$S_{short}(t_k) = (e^{\frac{-t_k}{x}}), \text{ where x=4, diminishes toward zero at the tenor of the longest}$$

point in the term structure.[30;31]

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

(iii)   *Long rate shock for currency c* (note: this is used only in the rotational shocks): Here the shock is greatest at the longest tenor midpoint and is related to the short scaling factor as:

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

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

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

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

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

The AMF may, at its discretion, set floors for the post-shock interest rates under the six interest rate shock scenarios, provided the floors are not greater than zero.

Short rate shock: Assume that the institution uses the standardized framework with K=19 time bands and t_k=25 years (the midpoint [in time] of the longest tenor bucket K), and where t_k is the midpoint (in time) for bucket *k*. In the standardized framework, if k=10 with

t_k=3.5 years, the scalar adjustment for the short shock would be $S_{short}(t_k) = (e^{\frac{-3.5}{4}}) = 0.417$. The institution 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 bp, the increase in the yield curve at t_k= 3.5 years would be 41.7 bp.

Steepener: Assume the same point on the yield curve as above, t_k=3.5 years. If the absolute value of the short rate shock was 100 bp and the absolute value of the long rate shock

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[30]   The value of x in the denominator of the function $e^{\frac{-t_k}{x}}$ controls the rate of decay of the shock.

[31] t_k is the midpoint (in time) of the k^e bucket and t_K is the midpoint (in time) of the last bucket K. There are 19 buckets in the standardized framework, but the analysis may be generalized to any number of buckets.

was 100 bp (as for the Japanese yen), the change in the yield curve at t_k=3.5 years would be the sum of the effect of the short rate shock plus the effect of the long rate shock in basis points : − 0.65 · 100 bp · 0.417 + 0.9 · 100 bp · (1 − 0.417) = +25.4 bp.

Flattener: The corresponding change in the yield curve for the shocks in the example above at t_k=3.5 years would be: +0.8 · 100 bp · 0.417 – 0.6 · 100 bp · (1 − 0.417) = −1.6 bp.

Derivation of the interest rate shocks in Table 1
In order to derive the shocks described in Table 1, the following general steps are taken:

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) are contained in Table 2. 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 2. Average interest rates by currency

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

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

Step 2

The global shock parameter is prescribed based on the weighted average of the currency-specific shock parameters: $\overline{a_i}$. The shock parameter for scenario i is a weighted average of the $a_{i,c,h}$, across all currencies and defined as $\overline{a_i}$. The following baseline global parameters are obtained:

Table 3. Baseline global interest rate shock parameters

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

Applying the $\overline{a_i}$ from Table 3 to the average long-term rates from Table 2 results in the revised interest rate shocks by currency for parallel, short and long segments of the yield curve in Table 4.

Table 4. Revised interest rate shocks $\Delta \mathring{R}_{shocktype,c}$

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

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

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 bp and variable caps (denoted as $\Delta \overline{R}_j$ are set for the scenarios concerned, those caps being 500 bp for the short-term, 400 bp for the parallel and 300 bp for the long-term interest rate shock scenario. The AMF may, at its discretion, set a higher floor under the local interest rate shock scenarios for CAD currency.

The change in the risk-free interest rate for shock scenario *j* and currency *c* can be defined as:

$$\overline{R}_{j,c} = \max\left\{100, \min\left\{\Delta \mathring{R}_{j,c}, \Delta \overline{R}_j\right\}\right\}, \text{[32]}$$

Where $\Delta \overline{R}_j = \{400, 500, 300\}$, for j= *parallel, short* and *long*, respectively.

Applying the caps and floors to the shocks described in Table 4 results in the final set of interest rate shocks by currency that is shown in Table 1.[33]

Recalibrations over time

The AMF acknowledges that global shock sizes (Table 3) of different currencies should reflect local conditions. For this reason, the AMF will review the calibration of the interest rate shock sizes (e.g., every five years).

The AMF will look to update Tables 1, 2, and 4 on a periodic basis, reflecting changes from other jurisdictions and/or CAD currency rates. Once updated, institutions will have one year to phase in new scenarios. Should the extent of the rate scenarios change materially, the AMF may review the outlier test threshold. For currencies not covered above, where an institution has a material position, the institution may estimate shocks using a methodology that is consistent with the one described in this annex.

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[32]   In the case of rotation shock scenarios, $\Delta \mathring{R}_{j,c}(t_1)$ cannot exceed 500 bp and $\Delta \mathring{R}_{j,c}(t_k)$ cannot exceed 300 bp.

[33]   The AMF may, at its discretion, set a negative lower bound for the post-shock interest rates at negative 75 basis points, where: $\mathring{R}_{j,c}(t_k) = \max\left\{\mathring{R}_{o,c}(t_k) + \mathring{R}_{j,c}(t_k), -75\, bp\right\}$.

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