

EBA/GL/2015/08

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# EBA Guidelines

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On the management of interest rate risk arising from non-trading  
activities

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# Section 1 - Compliance and reporting obligations

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## Status of these guidelines

1. This document contains guidelines issued pursuant to Article 16 of Regulation (EU) No 1093/2010<sup>1</sup>. In accordance with Article 16(3) of Regulation (EU) No 1093/2010, competent authorities and financial institutions must make every effort to comply with the guidelines.
2. Guidelines outline the EBA view of appropriate supervisory practices within the European System of Financial Supervision or of how European Union law should be applied in a particular area. Competent authorities as defined in Article 4(2) of Regulation (EU) No 1093/2010 to whom guidelines apply should comply by incorporating them into their practices as appropriate (e.g. by amending their legal framework or their supervisory processes), including where guidelines are directed primarily at institutions.

## Reporting requirements

3. According to Article 16(3) of Regulation (EU) No 1093/2010, competent authorities must notify the EBA as to whether they comply or intend to comply with these guidelines, or otherwise with reasons for non-compliance, by 07.12.2015. In the absence of any notification by this deadline, competent authorities will be considered by the EBA to be non-compliant. Notifications should be sent by submitting the form available on the EBA website to [compliance@eba.europa.eu](mailto:compliance@eba.europa.eu) with the reference 'EBA/GL/2015/08'. Notifications should be submitted by persons with appropriate authority to report compliance on behalf of their competent authorities. Any change in the status of compliance must also be reported to EBA.
4. Notifications will be published on the EBA website, in line with Article 16(3).

# Section 2 - Subject matter, scope and definitions

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## Subject matter

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<sup>1</sup> Regulation (EU) No 1093/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Banking Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/78/EC, (OJ L 331, 15.12.2010, p.12).

5. These guidelines:
  - (a) specify the identification, management and mitigation of IRRBB;
  - (b) provide the definition of the change in interest rates as referred to in Article 98(5) of Directive 2013/36/EU and methods for the calculation of the outcome of the supervisory standard shock.

## Scope of application

6. The level of application of these guidelines should be consistent with the level of application of supervisory review and evaluation process. These guidelines cover measurement methods for both economic value and earnings effects of IRRBB.
7. These guidelines do not apply to risks arising from changes in the perceived credit quality of individual instruments, which may result in fluctuations in spreads relative to underlying interest rates (credit spread risk).

## Addressees

8. These guidelines are addressed to competent authorities as defined in point (i) of Article 4(2) of Regulation (EU) No 1093/2010 and to financial institutions as defined in Article 4(1) of Regulation (EU) No 1093/2010.

## Definitions

9. Unless otherwise specified, terms used and defined in Directive 2013/36/EU and in Regulation (EU) No 575/2013 have the same meaning in the guidelines.
10. In addition, for the purposes of these guidelines, IRRBB includes, in particular:
  - (a) risks related to the timing mismatch in the maturity and repricing of assets and liabilities and off-balance sheet short and long-term positions (repricing risk);
  - (b) risks arising from changes in the slope and the shape of the yield curve (yield curve risk);
  - (c) risks arising from hedging exposure to one interest rate with exposure to a rate that reprices under slightly different conditions (basis risk); and
  - (d) risks arising from options, including embedded options, e.g. consumers redeeming fixed-rate products when market rates change (option risk).

# Section 3 - Implementation

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## Date of application

11. These guidelines apply from 1 January 2016.

## Repeal

12. The CEBS guidelines on technical aspects of the management of interest rate risk arising from non-trading activities under the supervisory review process, dated 3 October 2006, are repealed with effect from 1 January 2016.

# Section 4 – Management of IRRBB

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## 1. High-level Guidelines

### Proportionality

13. Institutions should comply with these guidelines in a manner proportionate to their size, complexity and intensity of activity, taking account of Table 3 in Annex B and the provisions of Title 2.1.1 of the EBA guidelines on common procedures and methodologies for the supervisory review and evaluation process (SREP guidelines).<sup>2</sup>

### IRRBB 1 – Internal capital

14. **Institutions should demonstrate that their internal capital is commensurate with the level of the interest rate risk in their banking book, taking into account:**
  - (a) the impact on capital resources of potential changes in their economic value and future earnings resulting from changes in the levels of interest rates, and,
  - (b) the availability of capital for IRRBB at various levels of consolidation, sub-consolidation and solo entity, as required to do so by competent authorities and consistent with the level of application of the supervisory review and evaluation process.
15. When managing their IRRBB institutions should not rely on the calculations of the outcome of the supervisory standard shock as set out in Article 98(5) of Directive 2013/36/EU or in IRRBB 5, but should develop and use their own internal capital allocation methodologies in accordance with their risk profile and risk management policies.

### IRRBB 2 – Measurement of IRRBB

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<sup>2</sup> EBA/GL/2014/13.

- 16. Institutions should measure their exposure to interest rate risk in the banking book, in terms of both potential changes to economic value (EV), and changes to expected net interest income (NII) or earnings.**

In measuring their exposure to IRRBB, institutions should consider and evaluate the impact of:

- (a) assumptions made in respect of non-interest bearing assets and liabilities of the banking book (including capital and reserves);
  - (b) assumptions made in respect of customer behaviour for ‘non-maturity deposits’ (i.e. the maturity assumed for liabilities with short contractual maturity but long behavioural maturity);
  - (c) behavioural and automatic optionality embedded in assets or liabilities.
17. When measuring their IRRBB institutions should not rely on the calculations of the outcome of the supervisory standard shock as set out in Article 98(5) of Directive 2013/36/EU or in IRRBB 5, but should develop and use their own assumptions and calculation methods.

### **IRRBB 3 – Interest Rate Shock Scenarios**

- 18. Institutions should routinely measure EV and NII/earnings sensitivity under different scenarios for potential changes in the level and shape of the interest rate yield curve, and to changes in the relationship between different market rates (i.e. basis risk).**
19. Institutions should also consider whether a purely static analysis of the impact of a given interest rate shock or shocks on their current portfolio should be supplemented by a more dynamic interest rate simulation approach. Larger and/or more complex institutions, in particular institutions under categories 1 and 2 of the SREP guidelines<sup>3</sup> should also take into account scenarios where different interest rate paths are computed and where some of the assumptions (e.g. relating to behaviour, contribution to risk and balance sheet size and composition) are themselves functions of changing interest rate levels.

### **IRRBB 4.1 – Internal governance arrangements**

- 20. Institutions should implement robust internal governance arrangements with regard to IRRBB.**
- (a) The institution should ensure that its management body bears the ultimate responsibility for controlling IRRBB. The management body should determine the institution's overall IRRBB strategy and approve the respective policies and processes.
  - (b) Institutions should ensure the regular validation of the models used to quantify their IRRBB. The IT systems used by institutions should enable them to fully measure/assess and monitor the contribution of individual transactions to their overall exposure.

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<sup>3</sup> EBA/GL/2014/13.

- (c) Institutions' internal risk reporting systems should provide timely and comprehensive information about their exposures to IRRBB.

#### **IRRBB 4.2 – IRRBB Policies**

**21. Institutions should have well-reasoned, robust and documented policies to address all IRRBB issues that are important to their individual circumstances.**

22. Without prejudice to the proportionality principle, such issues should include:

- (a) the internal definition and enforcement of the boundary between “banking book” and ‘trading activities’;
- (b) the definition of economic value and its consistency with the method used to value assets and liabilities (for example based on the discounted value of future cash flows, and/or on the discounted value of future earnings);
- (c) the definition of earnings risk and its consistency with the institution’s approach to developing corporate plans and financial forecasts;
- (d) the size and the form of the different interest rate shocks to be used for internal IRRBB calculations;
- (e) the use of dynamic and / or static approaches in the application of interest rate shocks;
- (f) the treatment of ‘pipeline transactions’ (including any related hedging);
- (g) the aggregation of multicurrency interest rate exposures;
- (h) the measurement and management of basis risk resulting from different interest rate indexes;
- (i) the inclusion (or not) of non-interest bearing assets and liabilities of the banking book (including capital and reserves) in calculations measuring IRRBB;
- (j) the behavioural treatment of current and savings accounts (i.e. the maturity assumed for liabilities with short contractual maturity but long behavioural maturity);
- (k) the measurement of IRRBB effects arising from embedded and automatic options in assets or liabilities, including convexity effects and non-linear payoff profiles;
- (l) the degree of granularity employed in measurement calculations (e.g. use of time buckets, inclusion of interest cash flows or just principal positions).

#### **IRRBB 5 – Supervisory standard shock**

- 23. Institutions should report to the competent authority the change in economic value that results from calculating the outcome of the standard shock, as referred to in Article 98(5) of Directive 2013/36/EU and in these guidelines.**
24. When calculating the outcome of the standard shock, institutions should apply in particular the following:
- (a) The standard shock should be based on a sudden parallel +/- 200 basis point shift of the yield curve (applying a 0% floor). If +/-200 basis points is lower than the actual level of change in interest rates, calculated using the 1st and 99th percentile of observed one-day interest rate changes over a five year period scaled up to a 240-day year, the higher level of shock arising from the latter calculation should be applied as the standard shock.
  - (b) An appropriate general 'risk-free' yield curve should be applied. That curve should not include instrument-specific or entity-specific credit risk spreads or liquidity risk spreads. An example of an acceptable yield curve is the 'plain vanilla' interest rate swap curve.
  - (c) Equity capital should be excluded from liabilities, so that the effect of the stress scenario on the economic value of all assets, including those financed by equity capital, can be noted.
  - (d) The assumed behavioural repricing date for customer balances (liabilities) without specific repricing dates should be constrained to a maximum average of 5 years (where the average assumed repricing date is computed as the average of the assumed repricing dates of different accounts subject to behavioural repricing weighted by the nominal value of all such accounts. This means that for the computation of the average maturity, both the stable and the volatile portion will be included).
25. When computing the effect of the 'standard shock' on their economic value, institutions should use one of the calculation methods set out under the Capital at Risk / Economic Value of Equity headings in Tables 1 (Annex A) and Table 3 (Annex B). 'Level 2-4' institutions (as referred to in Annex B) may be asked by supervisors to use more complex calculation methods, incorporating more granular data and changes in client behaviour under stress scenarios.

## 2. Detailed guidelines

### 2.1. SCENARIOS AND STRESS TESTING

#### Additional guidance on IRRBB 3 and on IRRBB 4.1/4.2

##### a) Interest rate scenarios for ongoing internal management

26. Institutions should measure their exposure as a result of applying an appropriate range of different interest rate scenarios, taking into account of the nature, scale and complexity of the interest rate risk arising from their activities as well as their risk profiles. When selecting the scenarios to be used, institutions should consider:

- (a) sudden up and down parallel shifts in the yield curve of varying magnitudes;
  - (b) sudden tilts and changes in the shape of the yield curve (e.g. short-term interest rates increasing/decreasing/remaining unchanged while medium-term and/or long-term interest rates move at a different pace or even in opposite direction; furthermore, even within the categories of short-term, medium-term and long-term interest rates, shocks that diverge at different points in the yield curve);
  - (c) basis risk (including that arising from changes in the relationships between key market rates);
  - (d) potential changes to the behaviour of different types of asset or liability under the assumed scenarios;
  - (e) applying specific interest rate scenarios for exposures in different currencies.
27. Institutions may supplement their analysis by introducing, for instance:
- (a) gradual (as opposed to sudden) shifts, tilts or changes in the shape of the yield curve;
  - (b) scenarios based on statistical analysis of past behaviour of interest rates;
  - (c) scenarios based on simulations of future interest rate paths;
  - (d) scenarios based on the assumptions underlying the institution's corporate profitability forecasts.
28. In performing their scenario analysis, institutions should at a minimum be able to demonstrate that:
- (a) the underlying assumptions of the internal measurement system (see 2.2. and 2.3. of this Section) are appropriate for the different interest rate scenarios used; and
  - (b) economic consistency considerations have been properly taken into account when specifying scenarios (e.g. consistency between interest rate shocks in different currencies and foreign exchange rates used when computing the overall impact expressed in the institution's base reporting currency).
29. A scenario analysis for the internal measurement of IRRBB should be performed at least on a quarterly basis, with the frequency of calculation increased in times of higher interest rate volatility, or when measured risk levels are significant in the context of the institution's business.
- b) Interest rate scenarios for stress testing**
30. Institutions should regularly perform stress tests to measure their vulnerability under stressed market conditions. Stress testing for interest rate risk should be integrated into each institution's overall stress testing structures and programmes. In these stress tests, interest rate risk should interact with other risk categories and second-round effects should be computed. These tests

may be less frequent than the calculations presented above under the heading 'Interest rate scenarios for ongoing internal management'.

31. Institutions should not rely on the standardised 200-basis point parallel interest rate shock performed for the competent authority (see IRRBB 5), but should use an appropriate range of different stress scenarios, in particular:
  - (a) sudden parallel interest rate shocks larger than 200 basis points (including extreme shifts);
  - (b) substantial tilts and shifts in the shape of the yield curve (for instance based on those for ongoing internal management, but with more extreme rate changes), and
  - (c) substantial changes in the relationships between key market rates (basis risk).
32. Furthermore, stress tests should consider:
  - (a) a breakdown in key assumptions about the behaviour of asset and/or liability classes;
  - (b) changes in key interest rate correlation assumptions;
  - (c) significant changes to current market and macro conditions and to the competitive and economic environment, and their possible development; and
  - (d) specific scenarios that relate to the individual business model and profile of the institution.
33. IRRBB should be included in institutions' overall stress testing program. IRRBB should also be considered as one of the potential drivers in the institution's overall reverse stress testing programmes.

## 2.2. MEASUREMENT ASSUMPTIONS

### Additional guidance on IRRBB 2

#### a) Behavioural assumptions for accounts with embedded customer optionality

34. In assessing the implications of such optionality, institutions should be able to take account of the potential:
  - (a) impacts on current and future loan prepayment speeds arising from the underlying economic environment, interest rates and competitor activity;
  - (b) the speed/elasticity of adjustment of product rates to changes in market interest rates; and
  - (c) the migration of balances between product types as a result of changes in their features, terms and conditions.

35. Institutions should have policies in place governing the setting of, and the regular assessment of, the key assumptions for the treatment of on and off-balance-sheet items that have embedded options in their interest rate risk framework. This means that institutions should:

- (a) be able to identify all material products and items subject to embedded options that could affect either the interest rate charged or the behavioural repricing date (as opposed to contractual maturity date) of the relevant balances;
- (b) have appropriate pricing and risk mitigation strategies (e.g. use of derivatives) to manage the impact of optionality within risk appetite, which may include early redemption penalties chargeable to the customer as an offset to the potential break costs (where permitted);
- (c) ensure that modelling of key behavioural assumptions is justifiable in relation to the underlying historical data, and based on prudent hypotheses: a margin of conservatism should be used where there are uncertainties, especially when actual experience differs from past assumptions and expectations;
- (d) be able to demonstrate that they have accurate modelling (back-tested against experience);
- (e) maintain appropriate documentation of assumptions in their policies and procedures, and have a process for keeping them under review;
- (f) understand the sensitivity of the institution's risk measurement outputs to these assumptions, including undertaking stress testing of the assumptions and taking the results of such tests into account in internal capital allocation decisions;
- (g) perform regular internal validation of these assumptions to verify their stability over time and to adjust them if necessary.

**b) Behavioural assumptions for customer accounts without specific repricing dates**

36. In making behavioural assumptions about accounts without specific repricing dates for the purposes of interest rate risk management, institutions should:

- (a) be able to identify 'core' (as opposed to 'transient') balances on transaction accounts - i.e. that element of the balance that is consistently kept in the customer account as distinct from balances that are drawn down regularly and then replaced;
- (b) ensure that assumptions about the decay of low cost balances are prudent and appropriate in balancing the benefits to EaR against the additional economic value risk entailed in locking in a future interest rate return on the assets financed by these balances, and the potential foregone revenue under a rising interest rate environment;
- (c) have appropriate documentation of these assumptions in their policies and procedures, and a process for keeping them under review;

- (d) understand the impact of the assumptions on the institution's own chosen risk measurement outputs, including by regularly calculating the measures using contractual terms rather than behavioural assumptions to isolate the effects on both EV and EVR; and
- (e) undertake stress testing to understand the sensitivity of the chosen risk measures to changes in key assumptions, taking the results of such tests into account in internal capital allocation decisions.

**c) Corporate planning assumptions for own equity capital**

37. If institutions decide to adopt a policy intended to stabilise earnings arising from their own equity, they should:

- (a) have an appropriate methodology for determining what element of equity capital should be considered eligible for such treatment (e.g. adjusting for capital invested in non-interest earning assets such as tangible assets, intangible assets, investments in associates etc.);
- (b) determine what would be a prudent investment maturity profile for the eligible equity capital (e.g. expressed in terms of a particular run-off profile, average maturity or duration range/profile) that balances the benefits of income stabilisation arising from taking longer dated fixed return positions against the additional economic value sensitivity of those positions under an interest rate stress, and the risk of earnings underperformance should rates rise;
- (c) include appropriate documentation of these assumptions in their policies and procedures, and a process for keeping them under review (with appropriate audit trail);
- (d) understand the impact of the chosen maturity profile on the institution's own chosen risk measurement outputs, including by regular calculation of the measures without inclusion of the equity capital to isolate the effects on both EV and EaR; and
- (e) undertake stress testing to understand the sensitivity of risk measures to changes in key assumptions for equity capital, taking the results of such tests into account in their IRRBB internal capital allocation decisions.

38. In deciding the investment term assumptions for equity capital, institutions should avoid taking income stabilisation positions that significantly reduce their capability to adjust to significant changes in the underlying economic and business environment.

39. The investment term assumptions used to manage the risks to earnings and value sensitivity arising from equity capital should be considered as part of the normal corporate planning cycle, and such assumptions should not be altered just to reflect a change in the institution's expectations for the path of future interest rates. Any use of derivative or asset portfolios to achieve the desired investment profile should be clearly documented and recorded.

40. If an institution prefers not to set explicit assumptions for the investment term of equity capital (or sets assumptions that are explicitly short-term), the return generated on assets financed by such capital may be more volatile. The institution should therefore still have robust systems in place and management information available so that it can identify the implications of its chosen approach for the volatility of both earnings and economic value.

## 2.3. METHODS FOR MEASURING INTEREST RATE RISK

### Additional guidance on IRRBB 2 and IRRBB 3

#### IRRBB measurement methods

41. Institutions should not rely on a single measure of risk but should instead use a wide range of quantitative tools and models, including methods taken from those listed in Annex A (Table 1) of these guidelines, to ensure that the various aspects of interest rate risk are captured adequately. The number and the complexity of different quantitative tools and models used by an institution to measure interest rate risk should be appropriate for nature, scale and complexity of the activities of the institution. The limitations of each quantitative tool and model used should be fully understood by the institution, and these limitations should be taken into account in the interest rate risk management process. In assessing its interest rate risk, an institution should be aware of the risks that may arise as a consequence of accounting treatment of transactions in the banking book.
42. When measuring IRRBB:
- (a) A base scenario should be applied to reflect the assumptions regarding business development and customer behaviour incorporated into the institution's business plans. The interest rates used for repricing under the base scenario should be derived from spot or forward rates (as appropriate) by applying suitable spreads for different instruments.
  - (b) The refinement of time bands into which the portfolio is divided should adequately reflect the exposures in the portfolio. Institutions should particularly prevent the offsetting of large exposures which are not actually matched by repricing date, thereby hiding yield curve risk.
  - (c) When selecting the discount rates for each instrument type, a yield curve should be selected that most closely represents the characteristics of the instrument type concerned.
  - (d) When assessing IRRBB, institutions are encouraged to use different types of yield curve, including instrument/credit-specific yield curves, for their own internal calculations of IRRBB. The set of calculations should always include a measurement of the IRRBB using a 'risk-free' yield curve that does not include instrument-specific or entity-specific credit risk spreads or liquidity risk spreads.
  - (e) When modelling a yield curve, an adequate number of tenors and adequate interpolation techniques should be applied. A set of six tenors is generally considered the minimum requirement.

(f) When assessing IRRBB, interest rate scenarios should be used as specified in 2.1. on Scenarios and stress testing. These scenarios should be designed proportionately to reflect the specific characteristics and material risk exposures of each institution.

43. Institutions should identify all different components of the interest rate risk in their banking book. All material risk sub-components should be measured. Table 2 provides examples of methods that may be used to identify the different types of IRRBB.

44. **Table 2: Identification of sub-components of interest rate risk in the banking book**

<b>Component</b>	<b>Method</b>	<b>Focus</b>
Repricing risk	Gap analysis	The volume of mismatches in different time bands
Yield curve risk	Gap analysis, partial durations	The dispersion and concentration of mismatches in different time bands
Basis risk	Inventory of instrument groups based on different interest rates	Use of derivatives and other hedging instruments in terms of different bases, convexity and timing difference neglected by gap analysis
Option risk	Inventory of all instruments with embedded options	The volume of mortgages, current accounts, savings and deposits where the customer has the option to deviate from the contractual maturity

45. For the monitoring of IRRBB, an institution should use at least one earnings-based measure and at least one economic value measure of interest rate risk, but more sophisticated business models should consider multiple measures that, in combination, capture all the material interest risk types in the banking book. The application of simple models and measures is acceptable only where it can be shown that these are sufficient to produce a prudent estimate of risk.

46. Examples of sophistication would include the use of more time bands or tenors, more granular input data and dynamic modelling of feedback from stress scenario assumptions into assumptions about future business volumes and pricing.

47. Table 3 in Annex B contains a matrix giving examples of different sophistication levels for each quantitative tool and measure.

48. In accordance with IRRBB 5, institutions should not rely upon the ‘standard shock’ as the only measure of their IRRBB. In particular, they should also have an earnings measure, and should consider whether alternative economic value measures are better suited to their business model.

## 2.4. THE GOVERNANCE OF INTEREST RATE RISK

[Additional guidance on IRRBB 4.1 and IRRBB 4.2](#)

**a) Overall IRRBB strategy**

49. Based on the overarching business strategy, the management body should approve the overall IRRBB strategy of the institution, including the acceptable level for IRRBB and IRRBB mitigation (see also Principle 17 of EBA GL 44 on internal governance).
50. The institution's tolerance for IRRBB should be expressed in terms of the acceptable short-term and long-term impact of fluctuating interest rates on both economic value and earnings and be reflected in appropriate limits. Institutions with significant exposures to basis risk, yield curve risk or positions with explicit or embedded options should define their risk tolerance in relation to each of these material sub-types of IRRBB.
51. The overall IRRBB strategy should also include the decision about the extent to which the business model should rely on generating earnings by 'riding the yield curve', i.e. funding assets with a comparatively long repricing period from liabilities with a comparatively short repricing period. Where the business model relies heavily on this source of earnings, the management body should explain its IRRBB strategy and how it plans to survive periods of flat or inverse yield curves.
52. Institutions should treat IRRBB as a material risk and assess it explicitly and comprehensively in their risk management processes. Any other approach should be fully documented and justified in the course of supervisory dialogue.
53. Limit controls should be in place to ensure positions that exceed certain predetermined levels trigger prompt management reaction.
54. Institutions using derivative instruments to mitigate IRRBB exposures should possess the necessary knowledge and expertise. Each institution should demonstrate that it understands the consequences of hedging with interest rate derivatives.
55. When making decisions on hedging activities, institutions should be aware of the effects of accounting policies, but the accounting treatment should not drive their risk management approach. The management of economic risks should be a priority, and the accounting impacts managed as a secondary concern.

**b) Risk policies, processes and controls**

56. In relation to IRRBB, the management body should, based on its overall IRRBB strategy, implement robust risk policies, processes and systems which should ensure that:
  - (a) procedures for updating scenarios for the measurement/assessment of IRRBB are defined;
  - (b) the measurement approach and the corresponding assumptions for measuring/assessing IRRBB, including the allocation of internal capital to IRRBB risks, are appropriate and proportional;
  - (c) the assumptions of the models used are regularly reviewed and amended;

- (d) standards for the evaluation of positions and the measuring of performance are defined;
  - (e) appropriate documentation and control over permissible hedging strategies and hedging instruments exists; and
  - (f) the lines of authority and responsibility for managing IRRBB exposures are defined.
57. Institutions should regularly validate their IRRBB models and IT systems. This validation should be performed by a suitably qualified and independent individual.
58. Institutions may rely on third-party IRRBB models to manage and control IRRBB, provided that these models are adequately customised to properly reflect the specific characteristics of the institution in question. Institutions are expected to fully understand the underlying analytics, assumptions and methodologies of the third-party models and to ensure that they are adequately integrated into the institutions' overall risk management systems and processes.
- c) IRRBB IT systems and data quality**
59. The IT systems and applications used by the institution to carry out, process and record operations as well as to generate reports should be capable of supporting the management of IRRBB. In particular, the systems should:
- (a) be capable of fully and clearly recording all transactions made by the institution, taking into account their IRRBB characteristics;
  - (b) be tailored to the complexity and number of transactions creating IRRBB; and
  - (c) offer sufficient flexibility to accommodate a reasonable range of stress scenarios and new scenarios.
60. The IT system/transaction system should be capable of recording the repricing profile, interest rate characteristics (including spread) and option characteristics of the products to enable measurement of repricing as well as yield curve, basis risk and option risk. In particular, the transaction system should especially be able to gather detailed information on the repricing date(s) of a given transaction, interest rate type or index, any options (including early repayment or redemption) and the fees relating to the exercise of these options.
61. The systems used to measure the IRRBB should be capable of capturing the IRRBB characteristics of all products. The systems should also allow the disaggregation of the impact of individual IRRBB instruments/portfolios at the risk level of the banking book.
62. For complex, structured products in particular, the transaction system should be able to gather information about the separate parts of the product and to capture their IRRBB characteristics (e.g. the characteristics of assets and liabilities grouped by certain characteristics like repricing dates or optionality elements). The institution should ensure that the IT system is able to keep up with the introduction of new products.

63. Adequate organisational controls of IT systems should be in place to prevent the corruption of data used by IRRBB computer systems and applications, and to control changes to the coding used in those applications, so as to ensure, in particular:
- (a) the reliability of data used as input, and the integrity of processing systems for IRRBB models;
  - (b) that the likelihood of errors occurring in the IT system, including those occurring during data processing and aggregation, is minimised; and
  - (c) that adequate measures are taken if market disruptions or slumps occur.
64. Risk measures should be based on reliable market and internal data. Institutions should scrutinize the quality of external sources of information used to establish the historical databases of interest rates, as well as the frequency at which databases are updated. To ensure the high quality of data, institutions should implement appropriate processes that ensure that the data entered into IT system is correct. Institutions should also establish appropriate mechanisms to verify the correctness of the aggregation process and the reliability of model results. These mechanisms should confirm the accuracy and reliability of data.
65. The institution should have appropriate procedures to handle any discrepancies and irregularities that arise at the time of data processing. The institution should determine the reasons for these and should have procedures in place for the mutual reconciliation of the positions to enable these discrepancies and irregularities to be eliminated.
66. The institution should set up an appropriate process to ensure that the data used to feed models measuring the IRRBB across the group, e.g. for simulating earnings, is consistent with the data used for corporate planning.

**d) Internal Reporting**

67. The frequency of internal reports should increase with the complexity of the institution's operations, with quarterly reports being the minimum frequency for institutions with less complex portfolios. Similarly, the content of the reports should reflect changes in the risk profile of the institution and in the economic environment.
68. Internal reports should be provided to the different levels of management, and should contain an appropriate level of information for the particular level (e.g. management body, senior management) and for the specific situation of the institution and the economic environment.
69. Aggregated information should provide sufficient detail to enable the management to assess the sensitivity of the institution to changes in market conditions and other important risk factors. These reports should contain information on exposures to repricing, basis, yield curve and optionality risk as well as information on the types and results of stress tests performed, including the standard shocks prescribed by the competent authority.

70. The risk measurement system should generate reports in a format that allows the different levels of the institution's management to understand the reports easily and to make appropriate decisions in a timely manner. The reports should constitute the basis for regular monitoring of whether the institution operates in line with its strategy and the interest rate risk limits it has adopted.

## 2.5. CAPITAL IDENTIFICATION, CALCULATION AND ALLOCATION

### Additional guidance on IRRBB 1

71. In their ICAAP analysis of the amount of capital required for IRRBB, institutions may consider differentiating between:

- (a) current internal capital held for risks to economic value that could arise from a sudden interest rate shock; and
- (b) future internal capital requirements arising from the impact of rate changes on future earnings capacity, and the resultant implications for internal capital buffer levels.

72. Where an institution's policies/limits permit the taking of interest rate risk positions within the banking book, these risks should be measured and monitored like any other market risk. Internal capital should be specifically allocated to reflect these risks, the quantum of which may be gauged by considering other capital requirements for market risk. Institutions should regularly consider whether any positions held should be characterised as 'trading' and thereby treated accordingly for capital adequacy purposes.

73. In addition to considering whether internal capital should be held for actual IRRBB economic value risk, institutions should also consider:

- (a) the size and tenor of any mismatch limits intended to allow the institution to take advantage of an interest rate expectation by creating or leaving un-hedged interest rate risk positions in the banking book (subject to appropriate governance and within an agreed risk appetite definition);
- (b) the size and tenor of any mismatch limits put in place to allow for small timing and balance mismatches arising from retail banking products where precise micro-hedging may be impractical;
- (c) the sensitivity of the calculated interest rate risk to imperfect modelling assumptions (model risk); and
- (d) short-term timing and other imperfections in the matching of portfolios to behavioural/planning assumptions, or where the policy allows discretion by indicating a duration range or allowing mismatch tolerances for behavioural items.

74. To calibrate the amount of internal capital to be held for IRRBB economic value risk, institutions should use appropriate economic value measurement systems for their business profile (see 2.3 on methods for measuring interest rate risk) and an appropriate range of interest rate scenarios (see 2.1 on scenarios and stress testing) in order to quantify the potential scale of any IRRBB effects under stressed conditions.
- (a) Institutions should consider whether an allocation of internal capital is appropriate for some (or all) of the economic value at risk resulting specifically from behavioural or corporate planning assumptions (see 2.2 on measurement Assumptions).
  - (b) Institutions that operate economic capital models should ensure that the internal capital allocation for IRRBB is properly factored into the overall economic capital allocation, and that any assumptions on diversification are documented and derived from full analysis of the underlying correlation data. Economic capital costs may be allocated back to business units and products to ensure that the full costs of the underlying business/products are properly understood by those responsible for managing them.
  - (c) Institutions that are exposed to interest risk in different currencies should ensure that all material positions are taken into account, and that internal capital allocated for economic value at risk allows for different changes in interest rates for each currency (as opposed to assuming all rates for all currencies will move in parallel).
75. In considering whether an allocation of internal capital should be made in respect of interest EaR (as part of a capital buffer allocation for stress testing), institutions should take into account:
- (a) the relative importance of NII to total net income, and therefore the impact of significant variations in NII from year to year;
  - (b) the actual levels of NII achievable under different scenarios (i.e. the extent to which margins are wide enough to absorb volatility arising from interest rate positions, changes in the cost of liabilities); and
  - (c) the potential for actual losses to be incurred under stressed conditions, or as a result of secular changes in the market environment, where it might become necessary to liquidate positions that are intended as a long-term hedge to stabilise earnings.
76. To determine whether an amount of internal capital should be allocated for potential future risks to earnings arising from changes to interest rate risks under stressed conditions, institutions should use appropriate EaR measurement systems for their business profile (see 2.3 on methods for measuring interest rate risk) and an appropriate range of interest rate scenarios (see 2.1 on scenarios and stress testing).
77. Institutions should consider internal capital buffer adjustments where the results of their stress testing highlight the potential for reduced NII (and therefore reduced capital generation capacity) under stress scenarios. To the extent that NII has been protected/stabilised against adverse movements in rates through risk management strategies based on behavioural and/or

corporate planning assumptions, institutions may be able to reduce the size of this internal buffer allocation, and buffer allocations can be drawn down should the stress scenario materialise.

# Annex A - IRRBB Measurement Methods

Table 1: Tools for measuring different components of interest rate risk

Quantitative tools and models	Description	Advantages and limitations	Risk types potentially measured
<b>Earnings measures</b>			
<b>Static model</b>			
Gap analysis	Gap analysis is a simple tool for identifying and estimating the interest rate exposure to repricing risk. It measures the arithmetic difference between the nominal amounts of interest-sensitive assets and liabilities of the banking book in absolute terms. Gaps with a larger volume of assets have a positive sign reflecting increasing value (income) of the banking book with rising value (income) of assets. Liability gaps have a negative sign reflecting decreasing value (income) of the banking book with rising value (income) of liabilities. Gap analysis allocates all relevant interest-sensitive assets and liabilities into a certain number of predefined time bands according to their next contractual repricing date or behavioural assumptions regarding the maturity or the repricing date. A gap can be multiplied by an assumed change in interest rates to yield an approximation of the change in net annualised interest income that would result from such an interest rate movement.	<p><b>Advantage:</b> Simple method that is relatively easy to understand and explain.</p> <p><b>Limitations:</b> Based on the assumption that all positions within a particular maturity segment mature or reprice simultaneously.</p> <p>Static model that does not take account of the interest sensitivity of the optionality parameters.</p> <p>Yield curve and/or basis risk cannot be analysed adequately using gap analysis.</p>	Repricing risk
<b>Dynamic models</b>			
Earnings at risk	EaR measures the loss of NII (and other income) over a particular time horizon (one to five years) resulting from interest rate movements, either gradual movements or as a one-off large interest rate shock. Allocation of relevant assets and liabilities to time bands by maturity or repricing date is a starting point. EaR is the difference in NII between a base scenario and alternative scenario. The interest rates used for repricing in the base scenario are derived from the forward rates by applying appropriate	<p><b>Advantages:</b> It analyses the interest rate risk profile of the banking book in a detailed way tailored to the bank's specific circumstances. Comprehensive dynamic method that takes account of all components of the interest rate sensitivity and gives a good indication of the short-term effects of</p>	Repricing risk Yield curve risk Basis risk Option risk

Quantitative tools and models	Description	Advantages and limitations	Risk types potentially measured
	<p><i>spreads and spot/forward rates for different instruments. In the alternative scenario, the interest rate and spread shifts are added onto the forward rates used in the base scenario.</i></p> <p><i>With properly designed comprehensive stress test scenarios it is a dynamic method that takes account of all components of the interest rate sensitivity including yield curve risk, basis risk, credit spread risk and insight into the changes in savings and payment behaviour taking account of projected changes in maturities and repricing relationships and the size of the banking book. EaR can be applied as a measure for a single shock or as a simulation method applying a large range of scenarios followed by computation of a maximum loss within predefined confidence interval.</i></p>	<p><i>convexity and yield curve risk.</i></p> <p><b>Limitations:</b> <i>The results of the modelling are highly sensitive to assumptions about customer behaviour and management responses to different scenarios. It covers a relatively short horizon, so changes in earnings outside the observation period are ignored.</i></p>	
<b>Economic value measures</b>			
<b>Static model</b>			
<p><i>Capital at risk / economic value of equity</i></p>	<p><i>CaR/EVE measures the theoretical change in the net present value of the current balance sheet and therefore of its equity value resulting from an interest rate shock. In this method the value of equity under alternative stress scenarios is compared with the value under a base scenario. The value of equity is computed as the present value of assets less liabilities, not including assumptions about equity capital. For internal purposes, institutions may complement this computation of CaR/EVE with a model of CaR/EVE that takes the assumptions regarding equity capital into account.</i></p> <p><i>The accuracy of the valuation of the balance sheet positions is heavily dependent on the cash flows calculated and the discount rates used</i></p>	<p><b>Advantages:</b> <i>A simple measure of interest rate risk that takes account of some key elements of interest rate risk.</i></p> <p><b>Limitations:</b> <i>An NPV calculation that does not adjust for the impact on cash flows of the rate scenario will not pick up basis or option risk.</i></p> <p><i>Valuation based on net present value calculations is heavily dependent upon assumptions made regarding the timing of cash flows and the discount rate used.</i></p> <p><i>The method may underestimate the short-term effect of convexity and yield curve risk.</i></p>	<p><i>Repricing risk</i></p> <p><i>Yield curve risk</i></p>
<p><i>Modified duration of equity and PV01 of equity</i></p>	<p><i>Modified duration shows the relative change in the market value of a financial instrument corresponding to marginal parallel shifts of the yield curve by one percentage point. On an aggregated basis it can be applied</i></p>	<p><b>Advantages:</b> <i>It analyses the economic value impact of a given change in interest rates relating to a particular class</i></p>	<p><i>Repricing risk</i></p>

Quantitative tools and models	Description	Advantages and limitations	Risk types potentially measured
	<p>to the total banking book. The exposure to repricing risk in the banking book is expressed by the modified duration of equity. An absolute measurement derived from modified duration of equity is PV01 of equity. This measure expresses the absolute change of the equity value resulting from a one basis point (0.01%) parallel shift of the yield curve.</p> <p>The starting point is the allocation of assets and liabilities into time bands according to their repricing date and the type of instrument. For each instrument type an appropriate yield curve is selected. For each time band and instrument type a modified duration is computed. The modified duration of equity is then computed as an average of the modified durations of all time bands weighted by the exposures in the appropriate time bands (positive sign for asset gaps and negative sign for liability gaps). PV01 of equity is derived by multiplying the modified duration of equity by the value of equity (assets – liabilities) and divided by 10,000 to arrive at basis point value.</p>	<p>of assets and liabilities or the balance sheet as a whole in a simple way.</p> <p><b>Limitations:</b></p> <p>It only applies to marginal shifts of the yield curve. Relatively large movements in interest rates, and therefore convexity, cannot be measured accurately.</p> <p>It only applies to parallel shifts of the yield curve and it cannot be used to measure basis or yield curve risk.</p> <p>It is a static model that does not take account of the interest sensitivity of the optionality parameters.</p>	
<p><i>Partial modified durations and partial PV01</i></p>	<p>Partial modified durations and PV01 are computed for the net interest rate positions in sub-portfolios representing different time bands of the banking book according to the methodology described above. These partial measures show the sensitivity of the market value of the banking book to a marginal parallel shift of a yield curve in particular maturity segments. To each sub-portfolio's partial measure a different magnitude of a parallel shift can be applied by which the effect of the change of the shape of the yield curve can be computed for the entire portfolio. By dividing the banking book into time band sub-portfolios, institutions should consider the distribution of exposures across the time bands so that the sub-portfolios adequately reflect the exposure of the banking book to the yield curve risk.</p>	<p><b>Advantages:</b></p> <p>It analyses the impact of the changes of yield curve shapes on the economic value of the banking book.</p> <p><b>Limitations:</b></p> <p>It only applies to marginal shifts of the yield curve within each segment.</p> <p>It is a set of static measures that does not take into account the optionality, basis risk and convexity.</p>	<p>Yield curve risk</p>
<p><b>Dynamic models</b> <i>Capital at risk / economic value of equity</i></p>	<p>A more sophisticated version of the static measure (explained above), where the cash flows are re-calculated dynamically to take into account the fact that their size and the timing may differ under the various scenarios as a result of customer behaviour in reaction to the chosen</p>	<p><b>Advantages:</b></p> <p>As long as the alternative stress scenarios are adequately designed, it is a comprehensive measure of interest rate risk that takes into account all</p>	<p>Repricing risk Yield curve risk Basis risk</p>

Quantitative tools and models	Description	Advantages and limitations	Risk types potentially measured
	<p><i>scenario. This measure is designed to also account for basis risk and it can estimate the long-term effect of a change in a yield curve shape if alternative scenarios are adequately designed.</i></p>	<p><i>components of interest rate risk.</i></p> <p><b>Limitations:</b> <i>Valuation based on net present value calculations is heavily dependent upon assumptions made as to the timing of cash flows and the discount rate used.</i> <i>The method may underestimate the short-term effect of convexity and yield curve risk.</i></p>	<p><i>Option risk</i></p>
<p><i>Effective duration of equity</i></p>	<p><i>Effective duration measures value changes due to marginal parallel shifts of the yield curve. An example is the modified duration that additionally arises from the interest rate sensitivity of embedded optionality. The computation of the effective duration is based on deriving the change in value of a portfolio due to an interest rate increase or decrease compared to a base scenario, where not only the changes in the discount rate are incorporated, but also the interest rate-related changes in the magnitude of the expected cash flows for instruments containing embedded options.</i></p>	<p><b>Advantages:</b> <i>It analyses the economic value impact of a given change in interest rates taking the option risk into account in a simple way.</i></p> <p><b>Limitations:</b> <i>It only applies to marginal shifts of the yield curve and it accounts only for the interest sensitive part of the option risk in the portfolio.</i></p>	<p><i>Repricing risk</i> <i>Option risk</i></p>
<p><i>Value at Risk</i></p>	<p><i>The VaR method measures the expected maximum loss of market value that can be incurred under normal market circumstances over a given time horizon and subject to a given confidence level. For calculation of VaR in the banking book the changes in the market value of the banking book and therefore of the equity is computed for a set of alternative yield curve scenarios. When the VaR approach is applied to the banking book, the time horizon should be consistent with the economic model of the banking book and is usually expected to be one year.</i></p> <p><i>The VaR approach covers three different techniques:</i></p> <ul style="list-style-type: none"> <li><i>Historical simulation: alternative interest rate scenarios are derived from historical observations. Historical periods applied need to be long enough to capture significant shocks but short enough to still be relevant. Choosing a holding period for computational purposes, an institution needs to avoid autocorrelation within the sample, but at the same time ensure a significant number of observations and</i></li> </ul>	<p><b>Advantages:</b> <i>It takes into account the historical volatility of prices and interest rates.</i> <i>It takes into account diversification effects in or between portfolios or balance sheet positions.</i> <i>The method not only measures the magnitude of the loss, but also allows the probability of the loss to be chosen.</i></p> <p><b>Limitations:</b> <i>VaR measure is designed for normal market circumstances and does not adequately cover tail risk. It is therefore not sufficient to rely on VaR measures alone when considering extreme distress situations.</i> <i>Both historical VaR and variance-covariance VaR are backward-looking methods where history is</i></p>	<p><i>Repricing risk</i> <i>Yield curve risk</i> <i>Basis risk</i> <i>Option risk</i></p>

Quantitative tools and models	Description	Advantages and limitations	Risk types potentially measured
	<p><i>presence of a shock within the observations.</i></p> <ul style="list-style-type: none"> <li>• <i>Variance-covariance matrix: interest rates of different tenors for simulations derived from historical observations and variance-covariance matrix used to account for the correlations of the rates between tenors. The same considerations as by historical VaR apply.</i></li> <li>• <i>Monte Carlo simulation: interest rate yield curves and interest rate paths randomly simulated. This technique is especially suited for valuation of products containing options.</i></li> </ul> <p><i>The extent to which different interest rate risk types are measured depends on the model design and scenarios used. VaR models are suitable for capturing the optionality and convexity of products as well as the yield curve risk and basis risk.</i></p>	<p><i>indicative of the future and therefore more likely not to capture the tail risks.</i></p> <p><i>The variance-covariance method assumes that the returns are normally distributed statistically, and that the portfolios are a linear combination of the underlying positions; as a result, the method is less appropriate for portfolios with high optionality.</i></p> <p><i>The Monte Carlo simulation method is very demanding in terms of technology and computation.</i></p> <p><i>VaR models can become ‘black box’ systems that users rely upon without fully understanding them.</i></p>	

## Annex B - Sophistication Matrix for IRRBB measurement

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Table 3 below contains a matrix providing examples of different sophistication levels for each quantitative tool and measure, but many more degrees of sophistication are possible. To assess different interest rate sensitivities, an institution might choose several sophistication levels for one single measure. For example, it might use a static version of a measure to assess linear interest rate risk and a dynamic version to reveal its sensitivity to assumptions regarding consumer behaviour. Less sophisticated banks may quantify their sensitivity to behavioural assumptions by using multiple versions of the same static measures – i.e. without modelling the complete set of dynamic effects. The aim is that banks should select this mix of relevant and proportionate measures so that all material sensitivities to the interest rate changes are adequately captured, including sensitivity to behavioural assumptions.

The matrix in Table 3 is intended to aid individual institutions and competent authorities by suggesting a possible combination of quantitative tools and measures appropriate for a given sophistication level.

A general supervisory expectation should be that larger or more complex institutions should use more granular time bands and should analyse risk using transaction level data whenever possible. Institutions offering financial products containing embedded optionality should use measurement systems that can adequately capture the sensitivity of the options to interest rate changes. Institutions with products providing behavioural optionality to consumers should use adequate dynamic modelling approaches to quantify IRRBB sensitivity to the changes in consumer behaviour that could occur under different interest rate stress scenarios.

The four sophistication ‘levels’ for institutions are intended to stand as broad definitions of increasingly large and complex types of business model. Thus:

- Level 1 institutions could be small local banks with a simple product set that involves only limited exposure to the interest rate risk, such as specialist private banks or small-scale savings banks.
- Level 2 institutions could be small retail banks with a wider range of products giving exposure to interest rate risk including behavioural risk.
- Level 3 institutions could be mid-sized local or international banks including utility banks.
- Level 4 institutions could be large international and universal banks.

The sophistication level of risk measures selected by each institution should correspond to the sophistication level of the institution itself. If, in a particular case, the complexity is not a function of scale, institutions should choose and implement risk measures that reflect their specific business model and that adequately capture all sensitivities.

Table 3: Different sophistication levels of interest rate risk measurement

<u>Quantitative tools and models</u>	<u>Indicative sophistication levels of quantitative tools and models</u>			
	<u>Level 1</u>	<u>Level 2</u>	<u>Level 3</u>	<u>Level 4</u>
<b>Earnings measures</b>				
<b>Gap analysis</b>	Time bands advised in the Basel Committee on Banking Supervision’s “Principles for the Management and Supervision of Interest Rate Risk” from July 2004 (‘Basel 2004 Guidelines’).	More refined time bands reflecting the banking book composition.	Dynamic GAP taking into account run-off activities and financial plans and putting commercial margins in perspective with interest rate environment.	Dynamic GAP taking into account run-off activities and financial plans, and putting commercial margins in perspective with interest rate environment.
<b>Earnings at risk</b>	Standard shock applied to earnings in a constant balance sheet. Based on time bands advised in Basel 2004 Guidelines.	Standard shock and other yield curve stress tests specified in Section 4 – 2.1 on scenarios and stress testing in the additional detailed guidance applied to earnings, reflecting constant balance sheet or simple assumptions about future business development.	Yield curve stress tests, basis risk stress tests and option stress tests as specified in Section 4 – 2.1 on scenarios and stress testing in the additional detailed guidance separately applied to earnings projected by business plan or constant balance sheet.	Comprehensive stress scenarios, combining assumed shifts of yield curves with changes in basis and credit spreads, as well as changes in customer behaviour, used to reforecast business volumes and earnings to measure the difference compared with the underlying business plan.
<b>Economic value measures</b>				
<b>Capital at risk / Economic value of Equity</b>	Application of standard shock. Using time bands, tenors and aggregation of input data that is consistent with internal IRRBB measurement standards or using time bands and weights advised in Basel 2004 Guidelines, Yield curve model with a minimum of 6 tenors.	More refined time bands reflecting the banking book composition with own duration weights. Application of standard shock and other yield shifts specified in Section 4 – 2.1 on scenarios and stress testing in the additional detailed guidance. Sufficient yield curve tenors.	Refined time bands subdivided into instrument types with own duration weights or the measure computed on transaction/cash-flow basis. Application of standard shock and other yield shifts specified in the Section 4 – 2.1 on scenarios and stress testing in the additional detailed guidance. Adequate tenors in yield curves. Yield curve stress tests, basis risk stress tests as	Measure computed on a transaction or cash-flow basis. Comprehensive stress scenarios combining the shifts of yield curves and changes in customer behaviour.

<b>Quantitative tools and models</b>	<b>Indicative sophistication levels of quantitative tools and models</b>			
	<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>	<b>Level 4</b>
			specified in Section 4 - 2.1 on scenarios and stress testing in the additional detailed guidance. Modelling the interest rate sensitivity of modelling assumptions taking into account convexity.	
<b>Modified duration of equity and PV01 of equity</b>	Time bands and weights advised in Basel 2004 Guidelines. Application of standard shock. Yield curve model minimum six tenors.	More refined time bands reflecting the banking book composition with own duration weights. Application of standard shock and other yield shifts specified in Section 4 – 2.1 on scenarios and stress testing in the additional detailed guidance. Sufficient yield curve tenors.	Refined time bands subdivided into instrument types with own duration weights. Application of standard shock and other yield shifts specified in Section 4 – 2.1 on scenarios and stress testing in the additional detailed guidance. Adequate tenors in yield curves. Application of partial measures per time band.	Duration computed per transaction in the banking book. Application of standard shock and other yield shifts specified in Section 4 – 2.1 on scenarios and stress testing in the additional detailed guidance. Adequate tenors in yield curves. Application of partial measures per time band.
<b>Effective duration of equity</b>	Alternative scenarios based on standard shock and effect of option estimated roughly for entire portfolio.	Alternative scenarios based on standard shock and other shifts of yield curve specified in Section 4 – 2.1 on scenarios and stress testing in the additional detailed guidance. The effect of options estimated per instrument type.	Alternative scenarios based on standard shock and other shifts of yield curve specified in Section 4 – 2.1 on scenarios and stress testing in the additional detailed guidance. The effect of options estimated on transaction level.	Alternative scenarios based on standard shock and other shifts of yield curve as specified in Section 4 – 2.1 on scenarios and stress testing in the additional detailed guidance. The effect of options estimated at transaction level.
<b>Value at risk</b>	Yield curve model minimum six tenors.	Sufficient tenors on yield curves where material exposure exists. Inclusion of other sensitivity parameters as well as delta (Greek letters).	Adequate tenors in yield curves where material exposure exists. Full optionality valuation. Daily update of risk factors. Usage of, at least, volatility smiles.	Adequate tenors in all yield curves. Full optionality valuation. Include Monte Carlo simulations on portfolios with material optionality. Daily update of risk factors. Usage of volatility surfaces for all underlyings in the banking book.