Interest Rate Risk in the Banking Book

Taking a close look at the latest IRRBB developments
Interest Rate Risk in the Banking Book

Interest rate risk in the banking book (IRRBB) can be a significant risk for banking institutions and new regulations will have a significant impact on their risk management frameworks.

In July 2018, the European Banking Authority (EBA) published final guidelines for managing IRRBB. These guidelines will apply from 30 June 2019 onward and replace earlier IRRBB guidelines published May 2015. The guidelines provide technical guidance on how banks should manage IRRBB and how to determine the appropriate level of capital. The guidelines will have a significant impact on how banks measure, monitor, hedge, and manage their interest rate risk.

In this white paper RiskQuest provides an overview of the impact of these guidelines.

Main takeaways:

- The guidelines prepare for the implementation of the revised Capital Requirements Regulation (CRR) by incorporating the IRRBB standards published by the Basel Committee.
- The guidelines come into effect on 30 June 2019, but due to transitional arrangements won’t come into full effect until 1 January 2020.
- Fulfilling the IRRBB guidelines may require a significant investment from a governance, policies, measurement and an IT perspective, and will require a significant combined effort between board, ALM, risk management, finance, modelling and IT.
- Differing levels of complexity, size and ambition will determine each bank’s level of IRRBB sophistication.
- Modelling of client behaviour will be a challenge for the more sophisticated bank. However, (simplified) risk modelling can pose a similarly big challenge for smaller banks. Given the increased complexity, smaller banks will get more time to implement the changes.
- RiskQuest advises a readiness check and the set-up of a guidelines implementation program.
Introduction

Regulators felt that a renewed focus on IRRBB was necessary since – in contrast to credit, market and operational risk – IRRBB is not captured in Pillar I of the Basel accord. Without the prescriptive Pillar I rules, IRRBB practices have widely diverged across the industry.

The current exceptionally low interest rate environment and a potential increase in interest rates gave further impetus to a renewed focus on IRRBB.

IRRBB is the risk of changes in earnings or economic value due to differences in how interest rates affect assets (e.g. mortgages) and liabilities (e.g. savings). Four sources of interest rate risk can be discerned:

- **Gap risk** arises from timing differences (gaps) between incoming and outgoing cash flows or rate changes. The gaps are affected by both parallel and non-parallel changes in the yield curve.
- **Option risk** arises from the embedded options, such as prepayments or the mismatch between contractual and behavioural maturity of non-maturing deposits (NMDs).
- **Basis risk** arises since different yield curves and indices do not move in a uniform manner.

Each of the risk sources affect not only assets and liabilities, but also off-balance sheet exposures, such as the pipeline loans and new business volumes. Per source of risk an illustrative example is provided in Table 1.

Table 1: illustrative example per IRRBB risk source.

<table>
<thead>
<tr>
<th>Gap risk (parallel)</th>
<th>Gap risk (non-parallel)</th>
<th>Option risk</th>
<th>Basis Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suppose a bank funds a 10-year mortgage using overnight deposits. If interest rates rise, the funding becomes more expensive leading to lower profits.</td>
<td>A flattening of the yield curve forces the short-term rate to rise more significantly than long-term rates. A borrow short, lend long strategy becomes less profitable.</td>
<td>A decrease in interest rates increases the incentive to prepay on a mortgage loan. The mortgage loan may be replaced by one with a lower interest rate, thus leading to lower profits.</td>
<td>A 5-year FRN that pays the 3M Euribor rate + spread and is hedged using an OIS swaps with a 5-year maturity incurs basis risk as the OIS-3M basis spread may widen.</td>
</tr>
</tbody>
</table>
### Changes since 2015 IRRBB guidelines

The IRRBB 2018 guidelines are not entirely new. They replace 2015 guidelines. Some notable changes include:

- The scope of IRRBB is extended to include: credit spread risk, non-performing exposures, pension liabilities and interest rate risk for small trading books;

- Besides +/- 200 bps parallel shocks, banks must now also calculate the impact of an additional six predefined shocks reflecting non-parallel risk;

- Early warning trigger levels of 15% of Tier 1 capital are introduced for the six predefined shocks;

- In addition to the predefined shocks, internal stress scenarios must be developed (e.g. based on institution specific reverse stress testing);

- More specific requirements are introduced for the risk management and the risk measurement frameworks;

- Capital adequacy assessments of IRRBB (ICAAP) should be based on both the earnings and a value perspective;

- Principles are introduced to increase the comparability of the Supervisory Outlier Test among institutions. For example, more clarity is provided on what yield curve to use, how to aggregate the EVE measure across currencies, and on the post-shock absolute lower bound for interest rates (linear lower bound from -1% in year 1 to 0% after 20 years)

- A cap of 5 years on the average repricing date for all NMDs applies to each currency. This deviates from BCBS standards, which distinguishes between transactional retail (5yrs), non-transactional retail (4.5yrs) and wholesale (4yrs).
Changes since 2017
IRRBB consultation paper

The IRRBB 2018 guidelines follow earlier consultations. Some notable change since the last consultation of October 2017 include:

• The guidelines come into effect on 30 June 2019 giving the banks an additional 6 month deferment. As a result of several transitional arrangements (SOT, CSRBB, category 3/4 banks) the full guidelines won’t come into effect until 31 December 2019.

• In the Supervisory Outlier Test (SOT):
  - positive EVEs are weighted by 50% instead of 0% when aggregating EVE across currencies;
  - the post-shock interest rate floor was increased from -150 bps to -100 bps. It was further clarified that if the observed rate is below the floor, the observed rate should be used;
  - non-performing exposures (NPEs) can be excluded if the NPE ratio is less than 2%.

• Several definitions were improved or aligned with BCBS, such as CSRBB, constant balance sheet, core balances for NMDs, and pipeline loans;

• The expectations on CSRBB were further clarified and softened, by limiting CSRBB to the asset side and changing from identifying CSRBB to monitoring it;
Banks should have a consistent framework in place that allows for the measurement, monitoring and management of IRRBB.

This framework should establish clear lines of responsibilities, policies, processes, systems and internal controls:

- Senior management should carefully formulate the strategy, risk appetite and set limits for IRRBB both from an earnings perspective and from economic value perspective.
- The management body should pay attention to products with behavioural components, such as savings accounts and mortgages.

The bank should possess the necessary

Table 2: The IRRBB risk management framework considered per role in a bank.

<table>
<thead>
<tr>
<th>Role</th>
<th>Board</th>
<th>Treasury &amp; Strategic Planning (1st line)</th>
<th>Risk Management (2nd line)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal Capital</strong></td>
<td>• Determines risk appetite for IRRBB through risk appetite statement</td>
<td>• Takes into account capital restrictions in its overall IRRBB strategy</td>
<td>• Reports on internal capital (internal stakeholders)</td>
</tr>
<tr>
<td></td>
<td>• Understand IRRBB capital impact of business decisions</td>
<td></td>
<td>• Reports outlier test of standard shock (external stakeholders)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Measurement</strong></td>
<td>• Act on reported limited excesses</td>
<td>• Takes risks and hedge risks within approved limits</td>
<td>• Limit monitoring</td>
</tr>
<tr>
<td></td>
<td>• Understand fundamentals of IRRBB measurement</td>
<td>• Makes corporate planning assumptions (e.g. business growth)</td>
<td>• Reporting on limit excesses</td>
</tr>
<tr>
<td></td>
<td>• Understand overall IRRBB risk</td>
<td></td>
<td>• Monitors risk metrics from both earnings perspective and economic value perspective</td>
</tr>
<tr>
<td></td>
<td>• Understand strengths and weaknesses in the bank’s IRRBB approach</td>
<td></td>
<td>• Validates corporate planning assumptions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Monitoring of impact of supervisory standard shock</td>
</tr>
<tr>
<td><strong>Governance</strong></td>
<td>• Approves overall IRRBB strategy</td>
<td>• Proposes IRRBB strategy on the basis of the risk appetite statement</td>
<td>• Proposes limits given risk appetite statement and approved strategy</td>
</tr>
<tr>
<td></td>
<td>• Understanding of interest rate derivatives</td>
<td>• Expertise and knowledge of interest rate derivatives</td>
<td>• Expertise and knowledge of interest rate derivatives</td>
</tr>
<tr>
<td></td>
<td>• Understanding of the bank’s products and client behavior</td>
<td>• Expertise and knowledge of the bank’s products and client behavior</td>
<td>• Expertise and knowledge of the bank’s products and client behavior</td>
</tr>
<tr>
<td><strong>Policies, processes and controls</strong></td>
<td>• Approves policies</td>
<td></td>
<td>• Sets policy for distinction between banking book and trading book</td>
</tr>
<tr>
<td></td>
<td>• Be aware of design and operating effectiveness of IRRBB processes and controls</td>
<td></td>
<td>• Sets IRRBB policy</td>
</tr>
</tbody>
</table>
knowledge and expertise to model these where appropriate.

• The IT system and transaction system should be capable of recording the repricing profile, interest rate characteristics and option characteristics.

• Banks should perform stress testing to understand the sensitivity of risk measures to changes in key assumptions for equity capital and take the results into account in their ICAAP.

• Senior management should be informed about IRRBB levels and hedging strategies. Senior management oversee IRRBB capital allocation decisions.

IRRBB will be a joint effort for all roles across the bank. The matrix in Table 2, shows an example of what such framework could look like. The horizontal dimension shows the different roles, while the vertical dimension shows the different areas of the IRRBB management framework.

<table>
<thead>
<tr>
<th>Finance (2nd line)</th>
<th>Modelling (1st and 2nd line)</th>
<th>IT (1st and 2nd line)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal Capital</strong></td>
<td>• Reports on internal capital (external stakeholders)</td>
<td>• Development of method to translate IRRBB risk measures into internal capital requirements</td>
</tr>
<tr>
<td></td>
<td>• Reports outlier test of standard shock (external stakeholders)</td>
<td></td>
</tr>
<tr>
<td><strong>Measurement</strong></td>
<td>• Accounting treatment of fair valued instruments in banking book</td>
<td>• Proposes methodology for measuring IRRBB (e.g. valuation principles and risk metrics)</td>
</tr>
<tr>
<td></td>
<td>• Hedge accounting</td>
<td>• Designs relevant and portfolio specific interest rate scenarios (incl. basis risk)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Models customer behavior (e.g. savings and mortgage prepayments)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Value embedded options (e.g. prepayment assumption)</td>
</tr>
<tr>
<td><strong>Governance</strong></td>
<td></td>
<td>• Recording of all transactions taking into account interest rate characteristics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Allows for aggregation and disaggregation (e.g. to transaction level)</td>
</tr>
<tr>
<td><strong>Policies, processes and controls</strong></td>
<td>• Sets accounting policy</td>
<td>• Ensures IRRBB approach is implemented in an appropriate and robust system</td>
</tr>
<tr>
<td></td>
<td>• Sets modelling policy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Establishes controls around data quality</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Establishes controls to prevent and handle systems failure and disruptions</td>
<td></td>
</tr>
</tbody>
</table>
Risk Measurement

An obvious prerequisite for managing risk is the timely availability of reliable risk measures. EBA stipulates that such risk must be measured from two perspectives:

- **Earnings perspective:** Most banks will use an Amortised Cost accounting treatment for their banking book exposures and thus report Net Interest Income (NII) as profit. Senior management will want to seek a stable and predictable NII. It will need risk measures that measure changes in expected future NII resulting from interest rate movements or changes in volumes. Examples of earnings measures include: NII scenarios analysis, NII sensitivities and Earning-at-Risk.

- **Economic value perspective:** A disadvantage of the earnings perspective is that it is a short-term measure applicable over a certain horizon (e.g. the next one or two years). In contrast, the economic value perspective captures the interest rate risk over the remaining life of all banking book exposures. It captures the net present value of all expected future cash flows. Examples of Economic Value measures include: Duration of Equity, PV01 and PV01 per time bucket.

A further choice to make is whether the bank will want to use risk measures based on unconditional cash flows or conditional cash flows. The difference is that in conditional modelling the size of the cash flows depend on the interest rate scenario, while in unconditional modelling they are static. An example would be prepayment rates: some banks may want to apply a constant prepayment rate to all mortgage balances. For others, the prepayment rate may depend on the interest rate, e.g. in a decreasing interest rate scenario the prepayment rate will be higher than in a scenario where interest rates increase.

A further degree of sophistication is to apply a dynamic balance sheet. The balance sheet composition may then depend on the interest rate scenario. In that case, the risk measures do not solely measure risk in the current balance sheet, but also capture how changes in interest rates affect the composition of the balance sheet. Dynamic scenarios can be derived from business plan projections or stress tests.

Banks thus have many choices in the level sophistication for their risk measurement. The choice will depend on the bank’s ambition level and the size and complexity of its balance sheet. Regulators also have expectations on the level of sophistication. The EBA guidelines distinguish four levels of IRRBB sophistication which align with the SREP categorisation: Category 1 includes systemically important institutions (G-SIIs and O-SIIs). Category 2 institutions include medium to large institutions operating domestically or with sizable cross-border activities. Category 3 institutions include small to medium domestic institutions with a limited number of business lines or non-significant cross-border operations. Category 4 institutions with a limited scope of activities and non-significant market shares in their lines of business.

An illustration of the categories and the implications for the risk measures is shown in Figure 1.
Figure 1: Overview of the key metrics and sophistication levels

Category 4
- Unconditional cash flow modelling
- Constant balance sheet assumption
- BIS advised time buckets
- Earnings risk measure using standard shocks
- Economic value measure using prescribed shocks

Category 2
- Conditional cash flow modelling
- Dynamic balance sheet assumptions
- Adequate time buckets
- Earnings measure using standard and stress shocks including margin projections
- Economic value measures using option valuation and comprehensive set of scenarios

Category 3
- Unconditional cash flow modelling
- Constant balance sheet assumption supplemented with simple projections
- BIS advised time buckets
- Earnings measure using standard and stress shocks
- Economic value measure using prescribed shocks and stress scenarios

Category 1
- Conditional cash flow modelling
- Dynamic balance sheet assumption
- Adequate time buckets
- Earnings measure using standard and stress shocks including margin projections and changes in customer behaviour
- Economic value measures using option valuation, comprehensive set of scenarios and Monte Carlo/Historical simulation
- Daily updating of risk factors
Risk Modelling

Banks in category 1 and 2 will need sophisticated models to meet requirements, but smaller banks also need models. Below we list some areas required for all banks and where a modelling approach could bring transparency and a justification for assumptions applied.

**Cash flow modelling:** All banks need to be able to model cash flows and subsequent market values for all on- and off-balance sheet exposures under different interest rate scenarios. Techniques required include: Yield curve selection, yield curve bootstrapping, assessing repricing assumptions and modelling future volume developments.

**Core versus non-core deposits:** All banks are required to distinguish core volume from non-core volume in retail saving deposits, wholesale deposits and current accounts. Techniques that can be used to substantiate such distinction include: time series analysis, usage of inventory models, replicating portfolios, and OLS-based client rate approaches.

**Interest rate scenarios:** Each bank is required to add at least two bespoke stress scenarios that are relevant for the bank. For the less sophisticated banks it is not required that such scenarios are determined using a model and they may well rely on expert judgment. However, modelling techniques that can be helpful include: (stochastic) interest rate modelling, Principal Component Analysis, Value-at-Risk, etc.

**Behavioural assumptions:** All banks need to understand how changes in the interest rate environment changes client behaviour. They will need to reflect these assumptions in their cash flow model. Such assumptions could look as follows:

- if interest rates increase by w% then x% of clients will switch from current accounts to saving accounts;
- if interest rates increase by y% then prepayment on mortgages will decrease by z%.

For the more sophisticated banks the modelling challenge will be significant and will need to be based conditional cash flow modelling. This will mean that embedded options need to be valued, that business responses to differing interest rate environments will need to be modelled, that multiple curves for each currency need to be defined and that risk measures will need to be transformed to a capital measure for inclusion in ICAAP.

In all cases, the behavioural assumptions these models rely on should be understood, thoroughly analysed, documented properly and supported by sufficient and high-quality data. With a recent history of very low interest rates, modelling behavioural assumptions is particularly challenging.
Conclusion

IRRBB will have significant impact on banks. They will have to determine a clear strategy on how to meet these challenges. Important elements in the coming years include establishing a connection between the complexity of the IRRBB risk management framework and the sophistication level of the bank, governance and internal control, understanding the trade-off between economic value and earnings volatility, defining and explaining the behavioural assumptions, ensuring sufficient and high-quality data, and designing relevant interest rate scenarios.

Further reading


RiskQuest is an Amsterdam based consultancy firm specialised in risk models for the financial sector. The importance of these models in measuring risk has strongly increased, supported by external regulations such as Basel II/III and Solvency II.

Advanced risk models form the basis of our service offer. These models may be employed in a frontoffice environment (acceptance, valuation & pricing) or in a mid-office context (risk management and measurement). The business areas that we cover are lending, financial markets and insurance. In relation to the models, we provide advice on: Strategic issues; Model development; Model validation; Model use.