

Annex I – IRRBB measurement methods (non-exhaustive list)

| Cash flow modelling | Metric | Description | Risks captured | Limitations of metric |
|--|---|--|-------------------------------|--|
| Unconditional cash flows (it is assumed that the <i>timing</i> of cash flows is independent of the specific interest rate scenario) | <u>Net Interest Income-based:</u> <ul style="list-style-type: none"> • Gap analysis: Repricing gap • Focus on net interest income component: Change of NII (NII) | Gap analysis allocates all relevant interest rate sensitive instruments into predefined time buckets according to their repricing or maturity dates, which are either contractually fixed or based on behavioural assumptions. It calculates the net positions ('gaps') in each time bucket. It approximates the change in net interest rate income ensuing from a yield curve shift by multiplying each net position with the corresponding interest rate change. | Gap risk (only parallel risk) | <ul style="list-style-type: none"> • The metric approximates the gap risk only linearly. • It is based on the assumption that all positions within a particular time bucket mature or reprice simultaneously. • It fails to measure basis and option risk. |
| | <u>Economic value:</u> <ul style="list-style-type: none"> • Duration analysis: Modified duration/PV01 of equity | The modified duration approximates the relative change in the net present value of a financial instrument due to a marginal parallel shift of the yield curve by one percentage point. The <i>modified duration of equity</i> measures the exposure of an institution to gap risk in its non-trading book. PV01 of equity is derived from the modified duration of equity and measures the absolute change of the equity value resulting from a 1 basis point (0.01%) parallel shift of the yield curve. | Gap risk (only parallel risk) | <ul style="list-style-type: none"> • The metric only applies to marginal shifts of the yield curve. In the presences of convexities, it may underestimate the effect of larger interest rate movements. • It only applies to parallel shifts of the yield curve. • It fails to measure option risk and captures basis risk at best partially. |

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| | | equity minus the modified duration of liabilities times liabilities divided by equity. PV01 of equity is obtained by multiplying the modified duration of equity by the value of equity (i.e., assets minus liabilities) and dividing by 10 000 to arrive at the value change per basis point. | | |
| | • Partial modified duration/partial PV01 | The partial modified duration of an instrument for a specific time bucket is calculated as the modified duration above, except that not the entire yield curve is shifted in parallel, but only the yield curve segment corresponding to the time bucket. These partial measures show the sensitivity of the market value of the banking book to a marginal shift of the yield curve in particular maturity segments. To each time bucket's partial measure a different magnitude of a shift can be applied, such that the effect of a change of the yield curve's shape can be computed for the entire portfolio. | Gap risk (parallel and non-parallel risk) | <ul style="list-style-type: none"> • The metric only applies to marginal interest rate changes. In the presence of convexity, the metric may underestimate the effect of larger interest rate movements. • It fails to measure the basis and option risk. |
| Cash flows partially or fully conditional on interest rate scenario (it is assumed that the <i>timing</i> of cash flows of options, of instruments with embedded, explicit options and – in more sophisticated approaches – of instruments of | <u>Net Interest Income-based:</u> Focus on net interest income (NII) • Change of NII | The change of NII is an earnings-based metric and measures the change of the net interest income over a particular time horizon (usually 1-5 years) resulting from a sudden or gradual interest rate movement. The starting point is the mapping of all cash flows of interest rate sensitive instruments to (granular) time buckets (or using the exact repricing dates of individual positions in more sophisticated systems). The base scenario for the calculations reflects the institution's current corporate plan to project the volume, pricing and repricing dates of future business transactions. The interest rates used to calculate future cash flows in the base scenario are derived from forward rates, appropriate spreads or market expected rates for different instruments. | Gap risk (parallel and non-parallel), basis risk and, provided <i>all</i> cash flows are modelled scenario dependent, also option risk | <ul style="list-style-type: none"> • Sensitivity of the outcome to the modelling and behavioural assumptions. • Complexity. |

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| which the maturity depends on clients' behaviour, is modelled conditional on the interest rate scenario) | | <p>In assessing the possible extent of NII changes, banks use assumptions and models to predict the path of interest rates, the maturing of existing assets, liabilities and off-balance-sheet items, and their potential replacement.</p> <p>Net interest income-based metrics can be differentiated according to the sophistication of projecting future cash flows: simple <i>run-off models</i> assume that existing assets and liabilities mature without replacement; <i>constant balance sheet models</i> assume that maturing assets and liabilities are replaced by comparable instruments; while the most <i>complex dynamic cash flow models</i> reflect business responses to differing interest rate environments in the size and composition of the banking book.</p> <p>All earnings-based metrics can be used in a scenario or stochastic analysis. Earnings at risk (EaR) is an example of the latter, which measures the maximum NII change at a given confidence level.</p> | | |
| | <p>Economic value: Focus on economic value of equity (EVE)</p> <ul style="list-style-type: none"> • Change in EVE | <p>The change in EVE is the change in the net present value of all cash flows originating from banking book assets, liabilities and off-balance-sheet items resulting from a change in interest rates, assuming that all banking book positions run off.</p> <p>The interest rate risk can be assessed by the ΔEVE for specific interest rate scenarios or by the distribution of ΔEVE using Monte Carlo or historical simulations. Economic value at risk (EVaR) is an example of the latter, which measures the maximum equity value change for a given confidence level.</p> | <p>Gap risk (parallel and non-parallel), basis risk and, if <i>all</i> cash flows are modelled scenario dependent, also option risk</p> | <ul style="list-style-type: none"> • Sensitivity of the outcome to the modelling and behavioural assumptions. • Stochastic metrics, which apply distributional assumption, may fail to capture tail risks and non-linearities. • Full revaluation Monte Carlo approaches are computationally demanding and may be difficult to interpret ('black-box'). • Complexity. |