3. Interest Rate Risk for non-marked-to-market assets

Introduction

- **Definition: sensitivity of the P&L to interest rate shifts in different maturities (i.e. changes in the term structure of interest rates)**

- **Types of interest rate risk:**

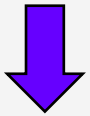
(i) Marked-to-market financial assets - market risk of interest rate-sensitive financial assets (e.g. bonds).

(ii) Non-marked-to market financial assets (e.g. loans and deposits) – balance sheet risks:

- Risk of fluctuation of the Net Interest Income of a bank stemming from the impact of interest rate changes on the cash-flows generated by assets and liabilities.
- Risk of optionality embedded in assets and liabilities, impacting on the volume of assets and liabilities that generate cash-flows, e.g. prepayment of loans and early redemption of deposits.

Interest Rate Risk for non marked-to-market assets

- **Most assets and liabilities in the banking book are not marked-to-market.**



- Their value does not change due to interest rate moves.
- Nonetheless, interest rate moves still impact on the Net Income (NI) of banks, because many of these assets and liabilities generate cash-flows that are sensitive to interest rates.
- These changes in the cash-flows impact on the Net Interest Income (NII, the difference between interest charged and interest paid by banks) and therefore on NI.

EBA Guidelines

- FIs must measure their exposure to IRR in the banking book, in terms of both potential changes to economic value (EV), and changes to expected NII or earnings, considering:
  - different scenarios for potential changes in the level and shape of the yield curve, and to changes in the relationship between different market rates (i.e. basis risk);
  - assumptions made on non-interest bearing assets and liabilities of the banking book (including capital and reserves);
  - assumptions made on customer behaviour for 'non-maturity deposits' (i.e. the maturity assumed for liabilities with short contractual maturity but long behavioural maturity);
  - behavioural and automatic optionality embedded in assets or liabilities, considering:
    (a) impacts on current and future loan prepayment speeds 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, due to changes in their features.

EBA Guidelines

- FIs must demonstrate that their internal capital is adequate for their IRR in banking book, taking into account the impact on capital resources of potential changes in their economic value and future earnings resulting from changes in the levels of interest rates.
- FIs must identify all different components of the interest rate risk in their banking book. All material risk sub-components should be measured.
- The institution's tolerance for IRRBB must be expressed in terms of limits on acceptable short-term and long-term impact of fluctuating interest rates on both EV and NII.
- The frequency of internal reports should increase with the complexity of the FI's operations, with quarterly reports being the minimum frequency for institutions with less complex portfolios.

Measurement

- Measurement:

(i) interest rate or repricing gaps:

- differences between assets and liabilities to be repriced in different time buckets (usually up to 1 year, with usual time bands being 1 week, 2 weeks, 1m, 2, 3, 6 and 12m)
- excludes non-interest rate bearing balance sheet items (e.g. fixed assets and capital, even though capital may be considered as a fixed rate liability).
- **these gaps may be static or dynamic.**

(ii) Earnings-at-risk (EaR) – impact on earnings (NI or EV) from several very unfavorable scenarios for interest rates.

(iii) Duration Gap Analysis – change in the net worth of banks due to changes in interest gaps

$$\Delta NII_t = (GAP_t)\,\Delta R_t = (RSA_t - RSL_t)\,\Delta R_t$$

(RSA and RSL = risk sensitive assets and liabilities)

3.1. Interest Rate Gaps

Interest Rate Gaps

Example 1

- The Bank is negatively impacted by interest rate increases.
- Impact of a change in the yield curve on the NI in the following year:

$$\Delta NI_{1y} = \sum_{j=1}^{k} \Delta i_j \cdot gap_j \cdot (12 - m_j)$$

being i the interest rate for the mid-point maturity of each gap (m), j the order number of the gap and k the total number of gaps up to 1y.

Repricing Bucket	Assets	Liabilities	Interest Rate Gap	Cumulative Gap
Currency (£m)				
0 – 1 month	500	4,600	–4,100	–4,100
1 – 2 months	443	324	119	–3,981
2 – 3 months	156	1,781	–1,625	–5,606
3 – 4 months	342	430	-88	–5,694
4 – 5 months	213	24	189	–5,505
5 – 6 months	224	69	155	–5,350
6 – 9 months	356	17	339	–5,011
9 – 12 months	324	46	278	–4,733
12 – 15 months	614	32	582	–4,151
15 – 18 months	459	123	336	–3,815
18 – 24 months	875	275	600	–3,215
2 years – 3 years	1,365	135	1,230	–1,985
3 years – 4 years	845	86	759	–1,226
4 years – 5 years	725	58	667	–559
5 years – 6 years	413	0	413	–146
6 years – 7 years	45	0	45	–101
7 years – 10 years	89	0	89	–12
10 years +	12	0	12	0
Total	8,000	8,000		

Source: Choudhry, Moorad (2018) "The Moorad Choudhry Anthology: Past, Present and Future Principles of Banking and Finance", Wiley.

Interest Rate Gaps

- The sensitivity of NII to interest rate shocks are usually based on parallel yield curve shifts.
- **1y impact of a 1 pp upward parallel shift in the yield curve = -48.1m£.**
- Problems with this calculation:

(i) Bank balance sheets are not constant over time, namely due to option risks (e.g. prepayments, revolving loans);

(ii) Parallel shifts in the yield curve are rare;

(iii) Some assets and liabilities won't reprice by the exact amount of the shock in rates and on the exact dates assumed;

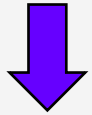
(iv) Basis risk – assets and liabilities often have different benchmark rates at the same tenor or the same benchmark rate at different tenors.

Repricing Bucket Currency (£m)	Interest Rate Gap	IR Gap x Rate Shock x Remaining Months/12		(£m)
0 – 1 month	–4,100	–4,100 × 1% × 11.5/12	=	–39.29
1 – 2 months	119	119 × 1% × 10.5/12	=	1.04
2 – 3 months	–1,625	–1,625 × 1% × 9.5/12	=	–12.86
3 – 4 months	–88	–88 × 1% × 8.5/12	=	–0.62
4 – 5 months	189	189 × 1% × 7.5/12	=	1.18
5 – 6 months	155	155 × 1% × 6.5/12	=	0.84
6 – 9 months	339	339 × 1% × 4.5/12	=	1.27
9 – 12 months	278	278 × 1% × 1.5/12	=	0.35
12 – 15 months	582			
15 – 18 months	336			
18 – 24 months	600			
2 years – 3 years	1,230			
3 years – 4 years	759			
4 years – 5 years	667			
5 years – 6 years	413			
6 years – 7 years	45			
7 years – 10 years	89			
10 years +	12			
				–48.10

Source: Choudhry, Moorad (2018) "The Moorad Choudhry Anthology: Past, Present and Future Principles of Banking and Finance", Wiley.

Interest Rate Gaps

- This calculation can be simplified if only the cumulative interest rate or repricing gap (CGAP) is considered, getting a rougher but faster estimate.
- In this example, the cumulative 1y gap = -4.733 m£ (sum of the values in the 1st column of the previous table or the value in the last column of the initial table)



- 1y impact of a 1 pp upward parallel shift in the yield curve =-4.733x0,01=47,33.
- This figure is very close to the one obtained by using the several marginal gaps.

Interest Rate Gaps

Example 2:

- For the 1st gap in the table below, the impact of a 1 pp increase in interest rates is:

$$\Delta NII_i = (-\$10 \text{ million}) \times .01 = -\$100{,}000$$

	(1) Assets	(2) Liabilities	(3) Gaps	(4) Cumulative Gap
1. One day	$ 20	$ 30	$−10	$−10
2. More than one day–three months	30	40	−10	−20
3. More than three months–six months	70	85	−15	−35
4. More than six months–twelve months	90	70	+20	−15
5. More than one year–five years	40	30	+10	−5
6. Over five years	10	5	+5	0
	$260	$ 260		0

Source: Saunders, Anthony and Marcia Millon Cornett (2018), Financial Institutions Management – A Risk Management Approach, 9th Edition, McGraw-Hill International.

- 1y CGAP:

$$CGAP = (-\$10) + (-\$10) + (-\$15) + \$20 = -\$15 \text{ million}$$ (or the 1y CGAP in column (4))

- Assuming a parallel upward shift in the yield curve up to 1y :

$$\Delta NII_i = (CGAP)\,\Delta R_i$$
$$= (-\$15 \text{ million})\,(.01) = -\$150{,}000$$

3.2. Alternative Methods

Earnings-at-risk (EaR)

- Impact on earnings - NI or Economic Value of Equity (EVE) - from several very unfavorable scenarios for interest rates.

- EVE sensitivity calculation is also based on interest rate gaps, by computing the sum of the NPV of each bucket gap, assuming the current interest rates and then assessing the impact of different shifts in the yield curve.
- Typically, banks assess their EVE sensitivities to different shock scenarios.
- The interest rate shocks assumed should reflect a stressful rate environment that is both plausible and severe.
- The bank’s ALCO committee usually set limits also on the change in EVE, based on the bank’s risk appetite.

Earnings-at-risk (EaR)

- Key steps:

(i) Develop a bottom-up forecast of NII for the next 1–5 years;

(ii) Capture assumptions for all conceivable interest rate environments on:

  (1) How all products would be repriced;

  (2) New business volumes;

  (3) Forecast prepayments / early redemptions;

  (4) The level of loan defaults.

(iii) Run a simulation to evaluate the impact of multiple different interest rate paths on NII and EVE;

(iv) Review the distribution of NII and EVE outputs;

(v) Focus on outlying values, particularly on the downside.

(vi) If these are of concern to management, prepare strategies to implement, in order to reduce the exposure.