# Session 4.3
# Workshop IRR Management

***Solutions***

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This example is based on an example contained in HKMA Interest Rate Risk Exposure Returns available at:
http://www.info.gov.hk/hkma/eng/bank/spma/attach/IR-1.pdf
http://www.info.gov.hk/hkma/eng/bank/spma/attach/IR-1-return.pdf

ABC bank has the following items in the banking book.

**ASSETS**

1A. 1000 HKD of 20 year managed rate mortgages, which can be repriced in 2 month's time
2A. 400 HKD of 3month fixed rate loans
3A. 500 HKD of 3 year fixed rate mortgage loans
4A. 100 HKD other non-interest bearing assets

**LIABILITIES**

1L. 1000 HKD of savings deposits
2L. 300 HKD of 5 month fixed rate deposits
3L. 300 HKD of 18 month fixed rate deposits
4L. 250 HKD of 2-year variable rate deposits to be repriced in 3 month's time
5L. 150 HKD capital

Off-balance sheet items and basis risk and will not be considered in the simple analysis that we perform for this example.

The document at

http://www.bis.org/publ/bcbs108.pdf?noframes=1

contains the 16 principles promulgated by the BIS for interest rate risk management. The following paragraphs capture the main thrust of subjecting the gap to a 200 basis point shock and then testing whether the resulting change in economic value is acceptable

81. This standardised rate shock should in principle be determined by banks, based on the following:
For exposures in G10 currencies, either:
(a) an upward and downward 200 basis point parallel rate shock, or
(b) 1st and 99th percentile of observed interest rate changes using a one year (240 working days) holding period and a minimum five years of observations.
For exposures in non-G10 currencies, either:
(a) a parallel rate shock substantially consistent with 1st and 99th percentile of observed interest rate changes using a one year (240 working days) holding period and a minimum five years of observations for the particular non-G10 currency, or

(b) 1st and 99th percentile of observed interest rate changes using a one year (240 working days) holding period and a minimum five years of observations.

84. Banks must hold capital to support the level of interest rate risk they undertake. Supervisors should be particularly attentive to the capital sufficiency of "outlier banks" – those whose interest rate risk in the banking book leads to a economic value decline of more than 20% of the sum of Tier 1 and Tier 2 capital following the standardised interest rate shock or its equivalent (as determined under Principle 14).

85. The response in cases where supervisors determine that there is insufficient capital will depend on a variety of factors. However, the response must result in the bank either holding additional capital or reducing the measured risk (through, for example, hedging or a restructuring of the banking book), or a combination of both, depending on the circumstances of the case.

Note that in the following solutions, the weightings in column 18a come directly from Annex 4 of the BIS document on Interest Rate Risk Management referenced above and reproduced below.

**Table 1**
**Weighting factors per time band (second step in the calculation process)**

| Time band | Middle of time band | Proxy of modified duration | Assumed change in yield | Weighting factor |
|---|---|---|---|---|
| Up to 1 month | 0.5 months | 0.04 years | 200 bp | 0.08% |
| 1 to 3 months | 2 months | 0.16 years | 200 bp | 0.32% |
| 3 to 6 months | 4.5 months | 0.36 years | 200 bp | 0.72% |
| 6 to 12 months | 9 months | 0.71 years | 200 bp | 1.43% |
| 1 to 2 years | 1.5 years | 1.38 years | 200 bp | 2.77% |
| 2 to 3 years | 2.5 years | 2.25 years | 200 bp | 4.49% |
| 3 to 4 years | 3.5 years | 3.07 years | 200 bp | 6.14% |
| 4 to 5 years | 4.5 years | 3.85 years | 200 bp | 7.71% |
| 5 to 7 years | 6 years | 5.08 years | 200 bp | 10.15% |
| 7 to 10 years | 8.5 years | 6.63 years | 200 bp | 13.26% |
| 10 to 15 years | 12.5 years | 8.92 years | 200 bp | 17.84% |
| 15 to 20 years | 17.5 years | 11.21 years | 200 bp | 22.43% |
| Over 20 years | 22.5 years | 13.01 years | 200 bp | 26.03% |

Source: http://www.bis.org/publ/bcbs108.pdf?noframes=1

From the duration formula we have the following relationship

$$\frac{\Delta P}{P} = -\frac{D}{(1+r)}\Delta r$$

The weighting factors are calculated as follows. For the time band 6 to 12 months

This relationship implies that when interest rates increase there will be a decrease in the economic value of an asset. The duration weights in column 18a have been entered as positive numbers when in fact as the formula above shows they should be entered as negative numbers to give the right direction of the effect of a change in interest rates. Given that we are concerned about the magnitude of the effect for a positive or negative 200 basis point shift in interest rates, the sign is of secondary importance. From our example if interest rates increase there will be a decrease in economic value of 16 HKD. Likewise, if interest rates increase there will be a decrease in earnings of 5 HKD.
For the solutions from the workshop, the resulting impact on economic value is 10.67% which under the definitions above would be deemed acceptable.

Column 17a in the solutions is derived as the fraction of a year remaining times the interest rate change. This measures the impact on earnings over the remainder of the year if interest rates change. For example row A is $(364.5/365) \times 2\% = 1.997\%$. Row F is $(3/12) \times 2\% = 0.5\%$.

The Basel Committee is of the view that interest rate risk on the balance sheet is a potentially significant risk and should be dealt with under Pillar 2 of the New Accord, particularly represented in Principles 12 to 15 and Annexes 3 and 4 of "Principles for the Management and Supervision of Interest Rate Risk" (July 2004)

**Principle 12:** Banks must hold capital commensurate with the level of interest rate risk they undertake.
**Principle 13:** Banks should release to the public information on the level of interest rate risk and their policies for its management.
**Principle 14:** Supervisory authorities must assess whether the internal measurement systems of banks adequately capture the interest rate risk in their banking book. If a bank's internal measurement system does not adequately capture the interest rate risk, the bank must bring the system to the required standard. To facilitate supervisors' monitoring of interest rate risk exposures across institutions, banks must provide the results of their internal measurement systems, expressed in terms of the threat to economic value, using a standardised interest rate shock.
**Principle 15:** If supervisors determine that a bank is not holding capital commensurate with the level of interest rate risk in the banking book, they should consider remedial action, requiring the bank either to reduce its risk or hold a specific additional amount of capital, or a combination of both.

**Interest rate risk exposure**
**Banking book**

| INTEREST BEARING ASSETS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **1. Total interest bearing assets** | | **2. Fixed rate assets** | | **3. Variable rate assets** | | **4. Managed rate assets** | |
| | | a. Total | b. Residential mortgage loans | a. Total | b. Residential mortgage loans | a. Total | b. Residential mortgage loans | a. Total | b. Residential mortgage loans |
| | | 2a+3a+4a | 2b+3b+4b | | | | | | |
| | **Time Band** | | | | | | | | |
| **A** | Next day or less | | | | | | | | |
| **B** | 2 to 7 days | | | | | | | | |
| **C** | 8 days to 1 month | | | | | | | | |
| **D** | 1 to 3 months | 1400 | | 400 | 2A 400 | | | 1000 | 1A 1000 |
| **E** | 3 to 6 months | | | | | | | | |
| **F** | 6 to 12 months | | | | | | | | |
| **G** | 1 to 2 years | | | | | | | | |
| **H** | 2 to 3 years | 500 | | 500 | 3A 500 | | | | |
| **I** | 3 to 4 years | | | | | | | | |
| **J** | 4 to 5 years | | | | | | | | |
| **K** | 5 to 7 years | | | | | | | | |
| **L** | 7 to 10 years | | | | | | | | |
| **M** | 10 to 15 years | | | | | | | | |
| **N** | 15 to 20 years | | | | | | | | |
| **O** | More than 20 years | | | | | | | | |
| | **Total Book Value** (total A to O) | | | | | | | | |
| **P** | **Non-interest bearing assets** | 1A 100 | | | | | | | |
| | **Total Assets** (total A to P) | 2000 | | | | | | | |

## INTEREST BEARING LIABILITIES

| | | 5. Total interest bearing liabilities | | 6. Fixed rate liabilities | | 7. Variable rate liabilities | | 8. Managed rate liabilities | |
|---|---|---|---|---|---|---|---|---|---|
| | | a. Total | b. Deposits | a. Total | b. Deposits | a. Total | b. Deposits | a. Total | b. Deposits |
| | | 6a+7a+8a | 6b+7b+8b | | | | | | |
| | **Time Band** | | | | | | | | |
| **A** | Next day or less | 1000 | | | | | | | |
| **B** | 2 to 7 days | | | | | | | | |
| **C** | 8 days to 1 month | | | | | | | | |
| **D** | 1 to 3 months | 250 | | | | 250 | 4L 250 | | |
| **E** | 3 to 6 months | 300 | | 300 | 2L 300 | | | | |
| **F** | 6 to 12 months | | | | | | | | |
| **G** | 1 to 2 years | 300 | | 300 | 3L 300 | | | | |
| **H** | 2 to 3 years | | | | | | | | |
| **I** | 3 to 4 years | | | | | | | | |
| **J** | 4 to 5 years | | | | | | | | |
| **K** | 5 to 7 years | | | | | | | | |
| **L** | 7 to 10 years | | | | | | | | |
| **M** | 10 to 15 years | | | | | | | | |
| **N** | 15 to 20 years | | | | | | | | |
| **O** | More than 20 years | | | | | | | | |
| | **Total Book Value** (total A to O) | | | | | | | | |
| | **Non-interest bearing liabilities** (P+Q) | | | | | | | | |
| **P** | Equity capital | | | | | | | | |
| **Q** | Others | 5L 150 | | | | | | | |
| | **Total liabilities** (total A to Q) | 2000 | | | | | | | |

| IMPACT/SCENARIO ANALYSIS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 17. Earnings perspective | | 18. Economic value perspective | | 19. Basis risk for both on and off balance sheet positions | | |
| | Time Band | 16. Net positions | a. Time weight on earnings | b. Impact on earnings over the next 12 months if interest rates rise by 200 basis points | a. Weighting factor for standardised interest rate shock | b. Impact on economic value if interest rates rise by 200 basis points | Period for which changes in interest rates last | Impact on Earnings | |
| | | | | | | | | Scenario (i) All rates except for fixed and managed rates on interest bearing assets rise by 200 basis points | Scenario (ii) Managed rates on interest bearing assets drop by 200 basis points while all other rates remain unchanged |
| | | 1a-5a | | | | | | | |
| **A** | Next day or less | (1000) | 1.997% | (20) | 0.0000% | 0 | 1 mth | | |
| **B** | 2 to 7 days | | 1.975% | 0 | 0.0200% | 0 | 3 mths | | |
| **C** | 8 days to 1 month | | 1.896% | 0 | 0.0100% | 0 | 6 mths | | |
| **D** | 1 to 3 months | 1150 | 1.667% | 19 | 0.3200% | 4 | 12 mths | | |
| **E** | 3 to 6 months | (300) | 1.250% | (4) | 0.7200% | (2) | | | |
| **F** | 6 to 12 months | | 0.500% | 0 | 1.4300% | 0 | | | |
| **G** | 1 to 2 years | (300) | | | 2.7700% | (8) | | | |
| **H** | 2 to 3 years | 500 | | | 4.4900% | 22 | | | |
| **I** | 3 to 4 years | | | | 6.1400% | | | | |
| **J** | 4 to 5 years | | | | 7.7100% | | | | |
| **K** | 5 to 7 years | | | | 10.1500% | | | | |
| **L** | 7 to 10 years | | | | 13.2600% | | | | |
| **M** | 10 to 15 years | | | | 17.8400% | | | | |
| **N** | 15 to 20 years | | | | 22.4300% | | | | |
| **O** | More than 20 years | | | | 26.0300% | | | | |
| | | | Total (A to F) | (5) | Total (A to O) | 16 | | | |
| | **Total capital base at reporting date** | | | | (P) | 150 | | | |
| | **Impact on economic value as % of total capital base** | | | | (Total(A to O))/(P) | 10.67% | | | |