



ACTUARIAL SOCIETY
S O U T H A F R I C A

Leveraging ALM and IRRBB frameworks to build resilient balance sheets for Banks

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27th August, 2024



ACIES



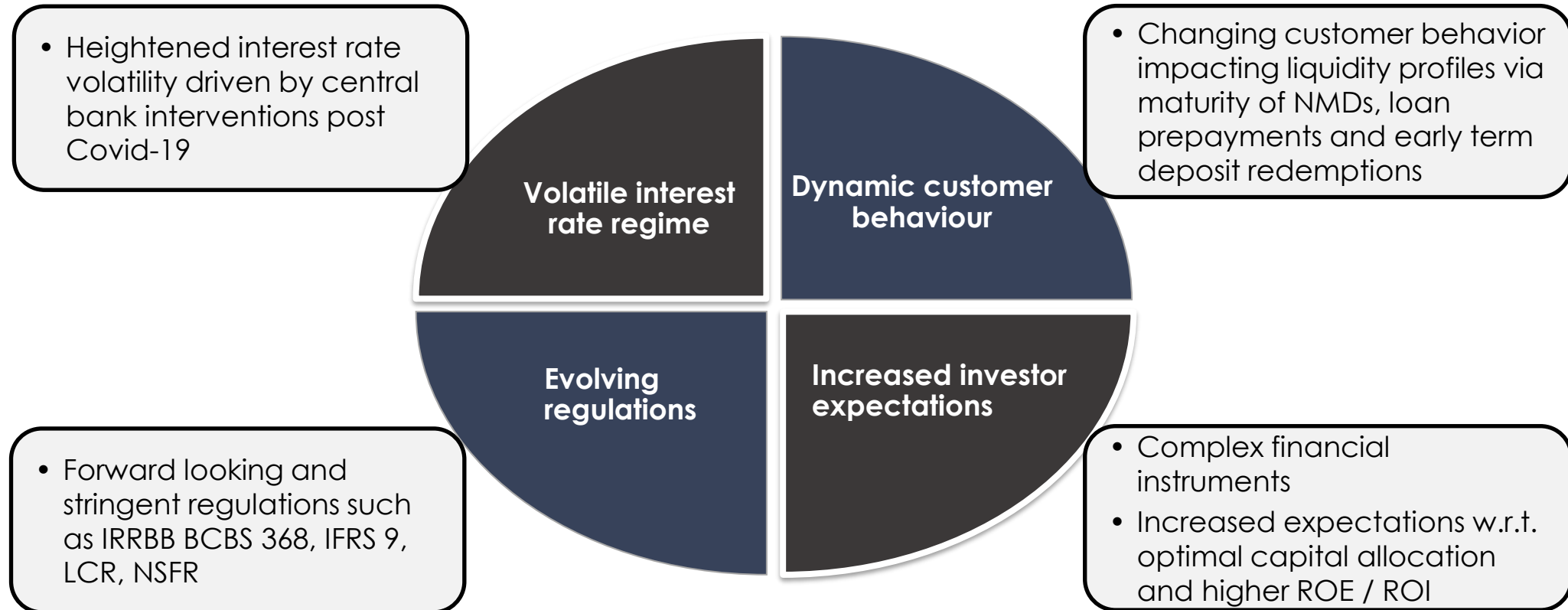
**Claxon Actuaries
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Insurance | Banking | Investments | Impact
Investing | Infrastructure | Real Estate | ERM

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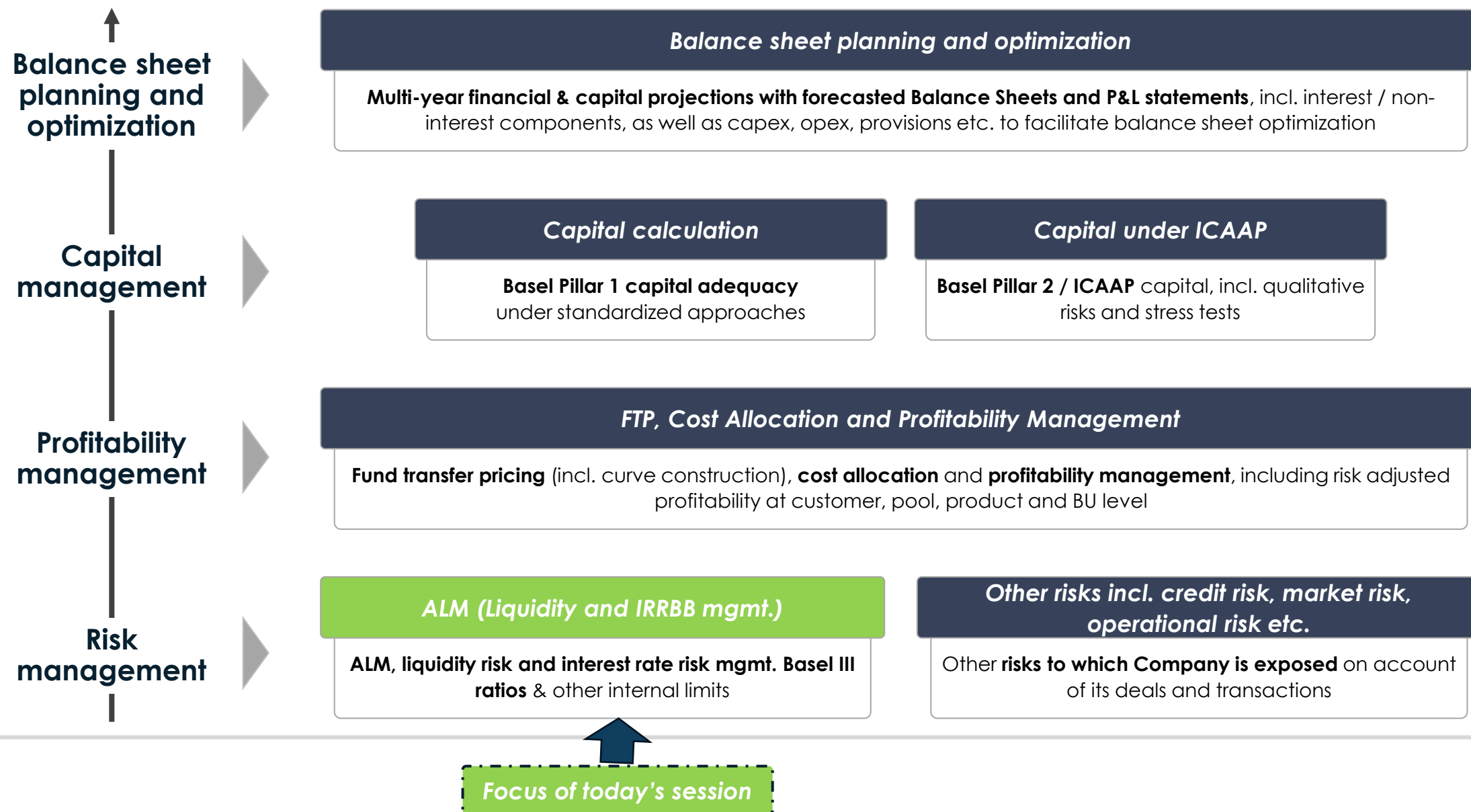
- Increasing need for resilient balance sheets across the global banking industry
 - Contours of an end-state balance sheet management framework
 - Exploring interlinkages between Liquidity risk and IRRBB
 - Evolution of Liquidity risk and IRRBB frameworks
 - Practical case studies – ALM and IRRBB modelling and mgmt.
 - Industry insights and best practices
 - Summarizing key-takeways
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Increasing need for resilient balance sheets across the global banking industry



The increased need for resilient balance sheets driven by the factors mentioned above has led to an evolution of frameworks, metrics and methodologies adopted by Banks across the globe for Balance sheet management

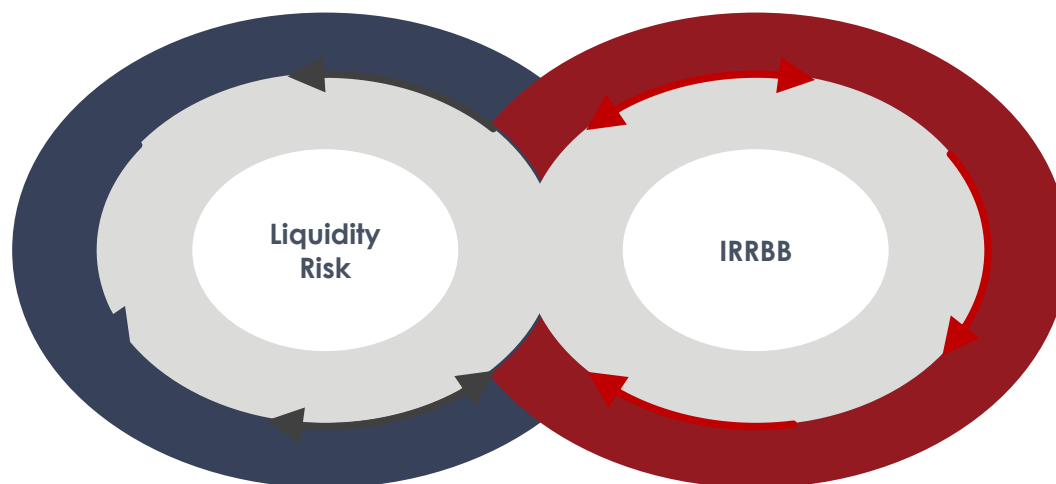
Contours of an end-state balance sheet management framework



Exploring interlinkages between ALM, liquidity risk and IRRBB



Changes in interest rates environments can significantly impact the overall liquidity position of the bank. The level of interaction between the two risks can differ across various shock scenarios and balance sheet projection assumptions



Illustrative examples that demonstrate linkages between ALM, liquidity risk and IRRBB

Impact on NMDs

Volatility in interest rates can lead to an impact on movement of non-maturity deposits (CASA) impacting EVE, NII and liquidity profiles

Impact on HQLA valuations

Sudden increases in interest rates can lead to higher discount rates i.e. reduction in HQLA valuations and adverse impact on EVE and LCR

Impact on prepayments

Inverse relationship between interest rates and prepayment rates on fixed-rate loans impacting EVE, NII and liquidity profiles

Impact on early redemptions

Direct relationship between interest rates and early redemption rates on fixed-rate term deposits impacting EVE, NII and liquidity profiles

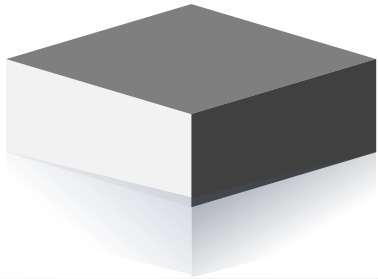
Evolution of ALM, liquidity risk and IRRBB mgmt. and modelling practices



Evolution of ALM and liquidity risk measurement and modelling practices

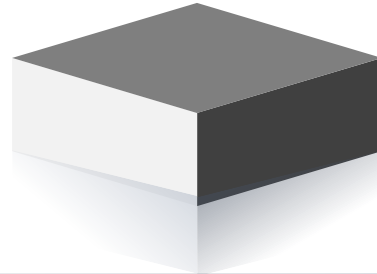
Cashflow profiles and BS ratios

Traditional contractual maturity mismatches and balance sheet ratios



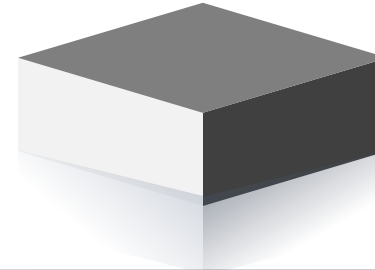
Basel III – LCR & NSFR

Extensive focus on short-term liquidity and stability of long-term funding



EWIs, stress testing and CFP

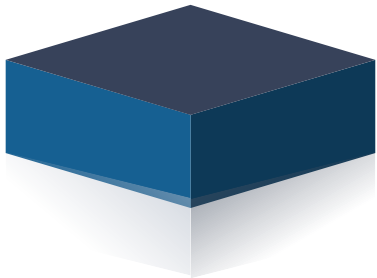
Pro-active early warning indicators and stress testing driven contingency funding plans



Evolution of interest rate risk measurement and modelling practices

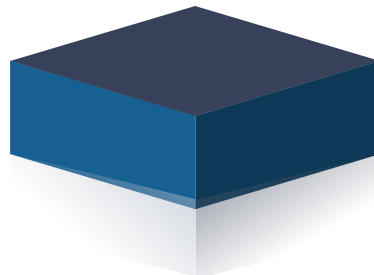
Repricing gap analysis

Traditional repricing gap report and bucket level IR shocks for NII simulations



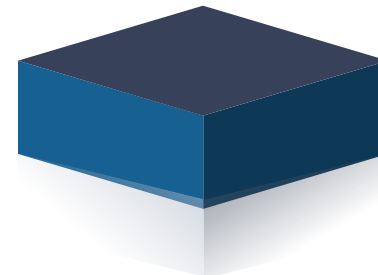
Duration gap analysis

Modified duration gap between RSA and RSL along with parallel shocks on MVE



IRRBB – BCBS 368

EVE and NII simulations across scenarios based on behavioral assumptions and non-parallel IR shocks



BS Projection assumptions

Run-off

Existing assets and liabilities run-off over time and not replaced on maturity

Constant

Instantaneous and identical replacement of assets and liabilities as they mature

Dynamic

Balance sheet evolves over time as per future business strategy and expectations

Evolution of ALM and liquidity risk management frameworks and methodologies



Metric	Description	Complexity
Contractual cashflow mismatch analysis	Projection and bucketing of cash inflows and outflows across various time buckets to find bucket level mismatches using contractual cashflows on a static balance sheet	
Behavioural cashflow mismatch analysis	Projection and bucketing of cash inflows and outflows across various time buckets to find bucket level mismatches using behavioral adjusted cashflows (derived based on behavioral models) on a static balance sheet	
LCR and NSFR (Basel III)	Computation of liquidity coverage ratio and net stable funding ratios as per Basel III requirement to assess and analyze short-term and long-term liquidity risk respectively	
Dynamic liquidity analysis	Measuring all of the above-mentioned metrics on a dynamic and forward-looking balance sheet derived based on balance sheet forecasting models and budgeting / planning exercise	
Optimization of contingency funding plans	- Usage of above methodologies along with market-wide and bank-specific stress testing on a dynamic basis to pro-actively identify early warning and potential liquidity risk signals - Simulate and identify optimal contingency funding plans covering aspects such as available liquid assets, order of liquidation, estimated haircuts, time horizon etc.	

Evolution of interest rate risk management frameworks and methodologies

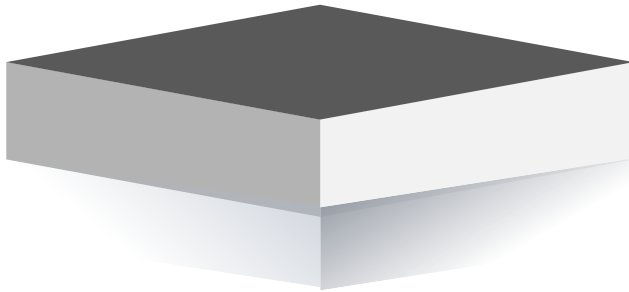


Metric	Description	Complexity
Repricing gap analysis and approx. EaR	Identification of repricing gaps at a bucket level based on a static balance sheet wherein floating rate positions are assumed to mature on the next reset date (full repricing). Approximate estimation of Earnings at Risk (EaR)	
Duration gap analysis and approx. EVE	- Estimation of duration gap between assets and liabilities across all rate-sensitive line items of the balance sheet. - Approximate estimation of Economic value of equity (EVE) using duration gap as an input and parallel shock scenarios	
PV01 and Partial PV01 analysis	Interest rate sensitivity in amount terms of the present value of cash flows for a 1 basis point change in interest rates. Estimated both at a position level and tenor level for each interest rate curve	
Convexity-adjusted duration analysis	Measures the rate of change of duration. Duration only provides an approximation of the price sensitivity to changes in interest rates. The precision of the approximation deteriorates as the change in interest rates increases. Including convexity improves the approximation.	
Full-revaluation based EVE Simulations (IRRBB BCBS 368)	Full revaluation-based approach using non-parallel shock scenarios, macro-economic driven behavioral assumptions and AIRO estimation to derive worst-case change in EVE for the Bank (As per BCBS 368 guidelines)	
Dynamic NII Simulations (IRRBB BCBS 368)	Full revaluation-based approach using parallel / non-parallel shock scenarios and macro-economic driven behavioral assumptions and dynamic balance sheet projections to derive worst-case change in NII for the Bank (As per BCBS 368 guidelines)	

Evolution of balance sheet projection assumptions for ALM and IRRBB mgmt.



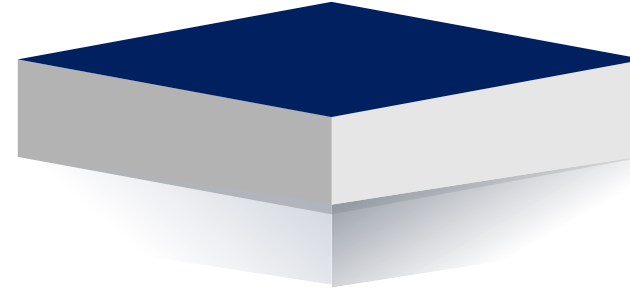
Traditional ALM



- Focus on short-term earnings and not on economic value
- Subjective and deterministic scenarios based on manual judgement
- Does not capture correlation between various risk factors
- Assumption of static portfolio which does not capture growth forecasts and reinvestment assumptions
- Asset allocation is independent of liability cashflow profiles



Dynamic ALM



- Focus on earnings and economic value
- Objective scenarios based on statistical and stochastic modelling
- Captures correlation between various risk factors
- Dynamic evolution of balance sheet covering growth forecasts, reinvestment and hedging strategies
- Forward looking balance sheet projections linked to forecasted macro-economic factors

Practical case study 1– Liquidity stress testing and optimal contingency funding



“The cashflow maturity mismatch profile identifies the gaps between the inflows and outflows of liquidity for defined time bands. These maturity gaps indicate how much liquidity a bank would potentially need to raise in each of these timebands if all outflows occurred at the earliest possible date.” – Basel Committee on Banking Supervision

SNo	Particulars	1 to 14 days	14 days to one month	One month to 2 months	2 months to 3 months	3 Months up to 6 months	6 Months up to 1 year	1 year and up to 3 years	3 years and up to 5 years	Over 5 years
1	Total outflows(A)	11,615	9,746	25,003	5,145	6,804	11,590	43,737	7,427	2,10,653
2	Cumulative Outflows(B)	11,615	21,361	28,499	33,644	40,448	52,038	95,775	1,03,203	3,13,856
3	Total inflows(C)	11,365	4,698	283	246	17,942	44,590	2,66,647	2,626	6,367
4	Mismatch (Total Inflows - Total Outflows)	-250	-5,049	-24,720	-4,899	11,138	33,000	2,22,909	-4,801	-2,04,286
5	Mismatch as % to Outflows	-0.02%	-0.52%	-98.87%	-95.22%	163.70%	284.72%	509.65%	-64.64%	-96.98%
6	Cumulative Mismatch (Cumm. Inflows - Cumm. Outflows)	-250	-5,299	-12,153	-17,052	-5,914	27,086	2,49,995	2,45,194	40,908
7	Cumulative Mismatch as a % to Cumulative Outflows	-2.15%	-24.81%	-42.64%	-50.68%	-14.62%	52.05%	261.02%	237.58%	13.03%

Generate stressed liquidity gap profile

Universe of funding sources available

Funding source ID	Funding Type	Cost (%)	Lead Time	Lead Time Unit	Haircut (%)	Maximum Limit
CM_03	Capital Market Borrowings	0.00	10	Days	10%	30
INV_01	Investments	0.00	3	Days	15%	50
CM_04	Capital Market Borrowings	0.00	20	Days	20%	500
BL_03	Bank lines	0.25	25	Days	0%	250
BL_02	Bank lines	0.50	2	Days	0%	25
BL_01	Bank lines	0.75	2	Days	0%	10
BL_07	Bank lines	1.00	2	Days	0%	15
BL_06	Bank lines	1.50	2	Days	0%	10
CM_01	Capital Market Borrowings	2.00	10	Days	0%	25
BL_04	Bank lines	2.50	2	Days	0%	25
CM_02	Capital Market Borrowings	2.75	20	Days	0%	500
BL_05	Bank lines	3.00	30	Days	0%	750

Practical case study 1 – Liquidity stress testing and optimal contingency funding



*Identifying
funding
requirements to
fill-up short term
liquidity gaps*

Particulars	Bucket 1	Bucket 2
	1 to 14 days	Over 14 days to one month
Total inflows	11,365	4,698
Total Outflows	11,615	9,746
Cumulative Outflows	11,615	21,361
Mismatch (1-2)	-250	-5,049
Cumulative Mismatch	-250	-5,299
Negative Cumulative Mismatch	-250	-5,299
Cumulative Mismatch as % of Cumulative Outflows	-2.15%	-24.81%
Risk Appetite (%)	-15.00	-20.00
Maximum Negative Cumulative Shortfall allowed	-1,742	-4,272
Shortfall to be bridged	1,492	-1,027
Funding Requirement	0	-1,027

Optimal Funding Strategy			
Funding Type	Opening Balance	Amount utilized	Closing Balance
CM_03	27	27	0
INV_01	43	43	0
BL_02	25	25	0
BL_01	10	10	0
BL_07	15	15	0
BL_06	10	10	0
CM_01	25	25	0
BL_04	25	25	0
CM_04	400	400	0
BL_03	250	250	0
CM_02	500	197	303
BL_05	750	00	750
Total	2,079	1,027	1,052

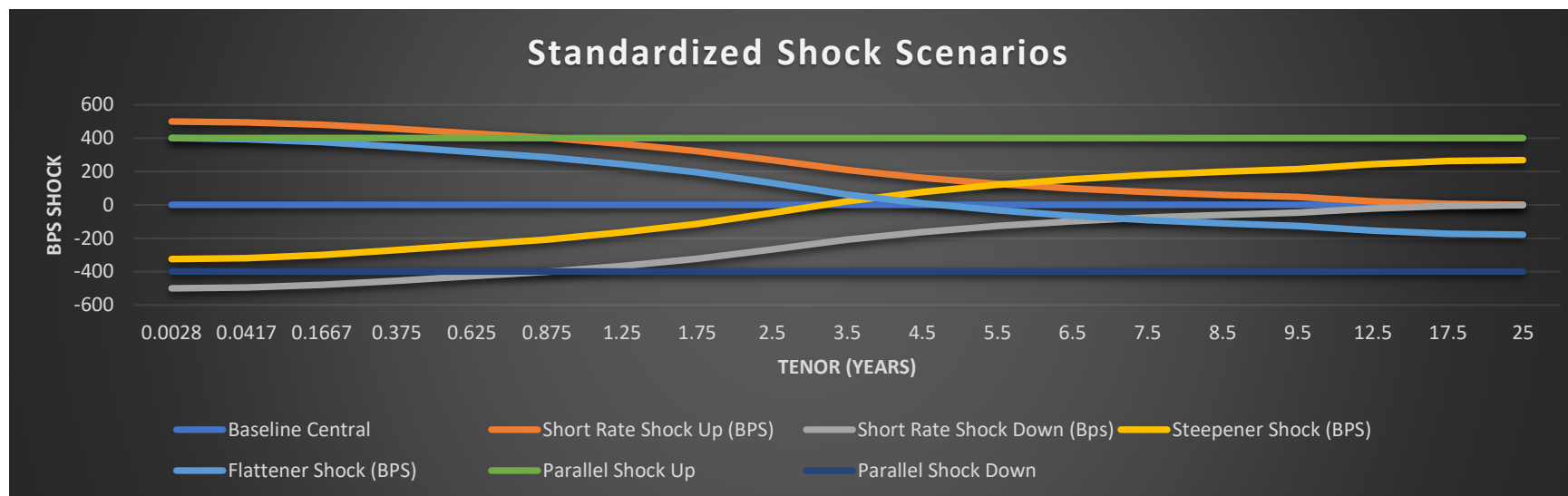
*Optimal
Funding
Strategy
Identification*

Practical case study 2 – IRRBB modelling and hedging



“Interest rate risk in the banking book (IRRBB) refers to the current or prospective risk to a bank’s capital and to its earnings, arising from the impact of adverse movements in interest rates on its banking book.” – Basel Committee on Banking Supervision

Interest rate
shock
scenarios
prescribed by
BCBS



Scenario	Δ EVE (USD Millions)	NII (USD Millions)
Parallel-Up	-1670	230
Parallel-Down	230	-178
Steepener	-450	245
Flattener	1050	-160
Max (Standardized EVE Measure)	-1670	Used for determination of Add-on capital buffer
15% of Tier 1 Capital	1500	
Breach / No Breach	Breach	

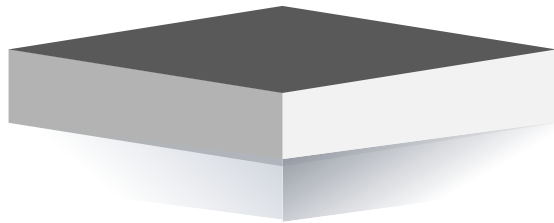
**Illustrative
materiality
test result =
Outlier Bank
!**

Practical case study 2 – IRRBB modelling and hedging



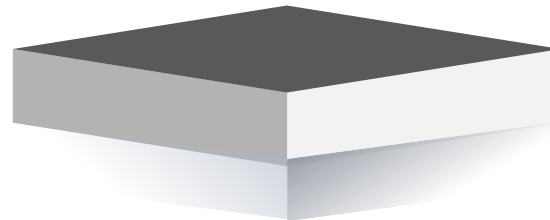
Frameworks typically used to manage and mitigate IRRBB

Raise Additional Capital



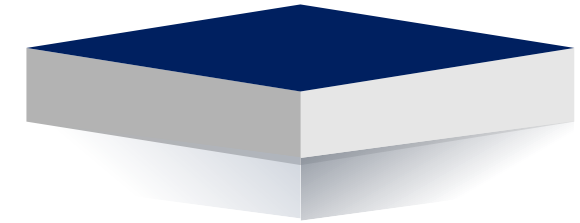
- Raise additional Tier 1 capital to absorb potential of additional losses arising due to interest rate risk
- This could lead to deterioration of ROE / ROC

Balance sheet restructuring



- Re-structure balance sheet by identifying weak areas leading to EVE/NII sensitivity
- Long-term mitigation approach that requires significant revision of business strategy and product design

Interest rate risk hedging



- Usage of exchange traded and / or OTC derivatives for hedging IRRBB
- Involves cost of hedging and associated operational risks associated with complexity of derivative instruments

Interest rate derivatives commonly used by Banks to hedge IRRBB

Forward rate agreements

Interest rate futures

Interest rate swaps

Cross currency swaps

Caps and floors

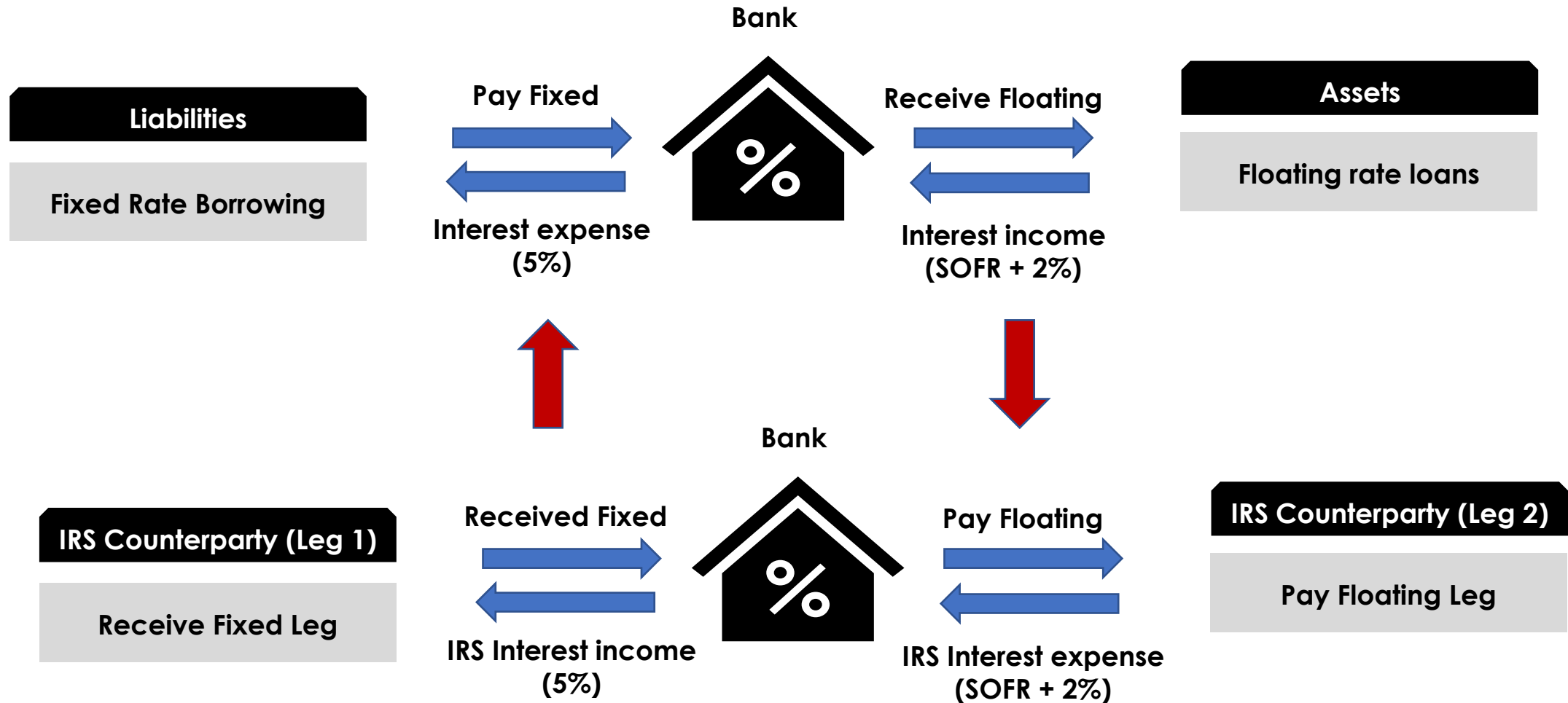
Swaptions

Practical example on subsequent slide

Practical case study 2 – IRRBB modelling and hedging



Illustrative example on how interest rate risk in the banking book due to gap and basis risk can be hedged using IRS



Industry insights and best practices



Provided below are high-level industry insights and best practices based on our past experience of working with Banks, insurance companies and financial intuitions on ALM, liquidity risk, IRRBB and balance sheet management across the globe

Non-parallel interest rate shock scenarios

Extensive set of non-parallel shock scenarios used to assess impact on both earnings and economic value

Macro-economic behavioral modelling

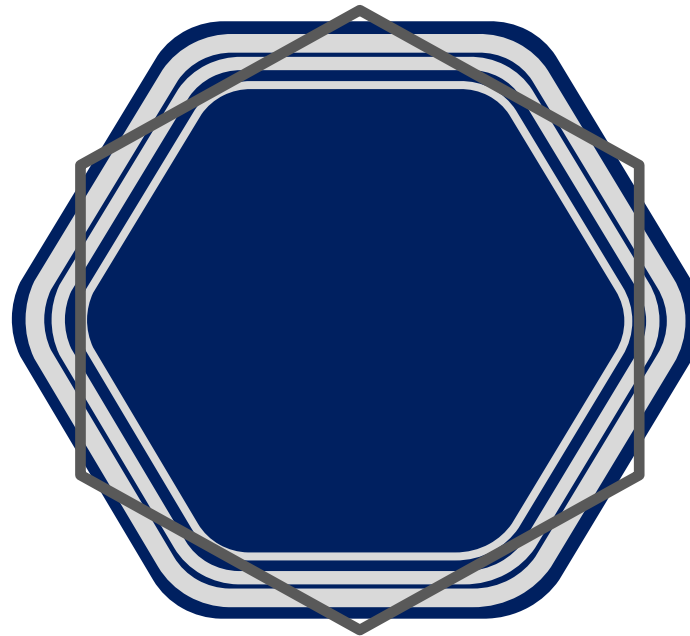
Macro-economic and econometric models used for behavioral modelling for NMDs and optionality

Convexity adjustments

Duration computations adjusted with convexity adjustments for greater degree of accuracy

ALM driven budgeting & planning

Forward looking budgeting plans consider impact of ALM mismatches and hedging strategies



Optimization of contingency funding plans

Stress testing scenarios and intelligent optimization algorithms to fine-tune contingency funding plans

AIRO Optionality modelling

Extensive focus on AIRO models calibrated specifically for wholesale behavioral options

Dynamic NII simulations

Usage of dynamic NII simulations and integration with budgeting and planning process

Usage of interest rate derivatives

Usage of vanilla and exotic interest rate derivatives to manage interest rate risk in the banking book

Summarizing key-take aways





Questions ?

Comments



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Thank you !



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