IFRS 17 & Solvency II Workshop

General Measurement Model

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SOCIETY OF ACTUARIES®

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Agenda

Monday, 15 July	Tuesday, 16 July	Wednesday 17 July
• Recap of IFRS 17 Background • **General Measurement Model** • Reinsurance Held and Contracts Acquired • Implementing IFRS 17	• Measurement of direct participation contracts • Illustrative examples of the Premium Allocation Approach • Presentation of IFRS 17 Results • Data management and calculation engines • Background and Scope of Solvency II • Quantitative Aspects of Solvency II	• Quantitative Aspects of Solvency II (cont'd) • Governance under Solvency II • The Risk Management & Reporting Processes

Model Components

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Initial recognition—cash flows

Contractual service margin

Non-financial risk adjustment

Time-value of money

Cash flows

Cash flow estimates must consider all inflows and outflows directly related to the insurance portfolio:

- Current and explicit income and expenses
- All available information, unbiased, and probability-weighted
- All cash flows within contract boundaries
- Entity's perspective (assuming market observable prices)

Income

- Premiums

Expenses

- Commissions and other acquisition expenses
- Administrative expenses
- Premium taxes
- Claim payments, including claims adjustment expenses

Cash flow elements

INCLUDE

- Premiums and premium adjustments
- Incurred and reported claims, expected claims, and claim adjustment expenses
- Payments that vary according to an index
- Fixed and variable expenses directly related to the Insurance contracts
- Cash flows of embedded options and guarantees, if they are not seggregated
- Commissions and other direct acquisition expenses
- Administrative expenses and recurrent commissions
- Taxes related to Insurance contract transactions

EXCLUDE

- Investment returns
- Cash flows from seggregated contract components
- Cash flows outside of contract boundaries
- Reinsurance cash flows
- Acquisition expenses that arise from sales or underwriting not directly attributable to the contracts
- Cash flows that arise from abnormal processes, even if they can be directly attributed to the contracts
- Cash flows not directly attributable to the contracts (e.g., product design & development, training, etc.)
- Income taxes

Initial recognition—time-value of money

Contractual service margin

Non-financial risk adjustment

Time-value of money

Cash flows

Cash flow estimates must reflect time-value of money and financial risk. This is achieved through discount rates.

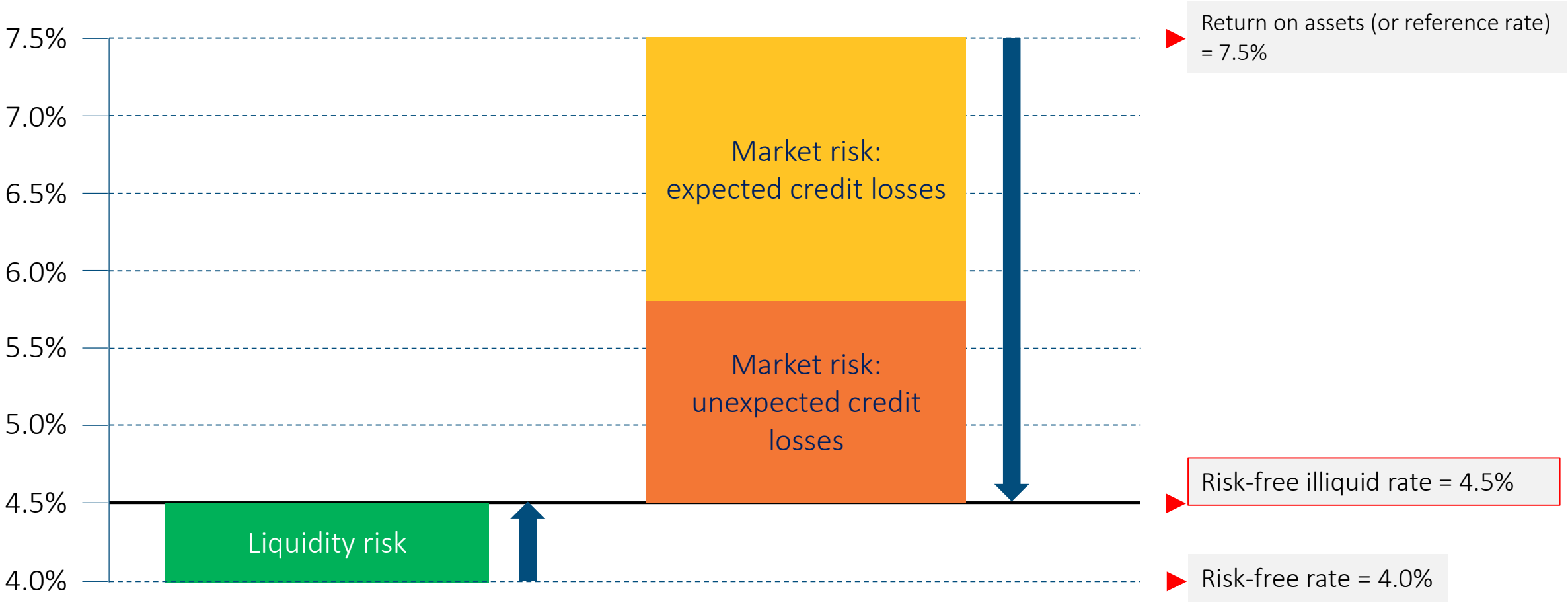
Discount rates should

- reflect the features of the fulfilment cash flows, including liquidity considerations
- be consistent with observable market prices of instruments whose cash flows are similar to those of the insurance contracts
- adjust observable market prices to relevant characteristics of the insurance contracts (i.e., should ignore non-material risks)

- IFRS 17 does not prescribe any methodologies, but indicates two approaches
  - top down
  - bottom up

- It is not necessary to discount cash flows occurring within a one-year time horizon

Determining discount rates



Initial recognition—risk adjustment for non-financial risk

Contractual service margin

Non-financial risk adjustment

Time-value of money

Cash flows

Compensation required by the entity for assuming the uncertainty related to timing and amount of cash flows

The risk adjustment for non-financial risk should

- be included explicitly in the assessment
- reflect favorable and unfavoragle events, incorpoating in the process the entity's risk appetite
- assume a diversification element

IFRS 17 does not prescribe a calculation methodology

Initial recognition—contractual service margin

Contractual service margin

Non-financial risk adjustment

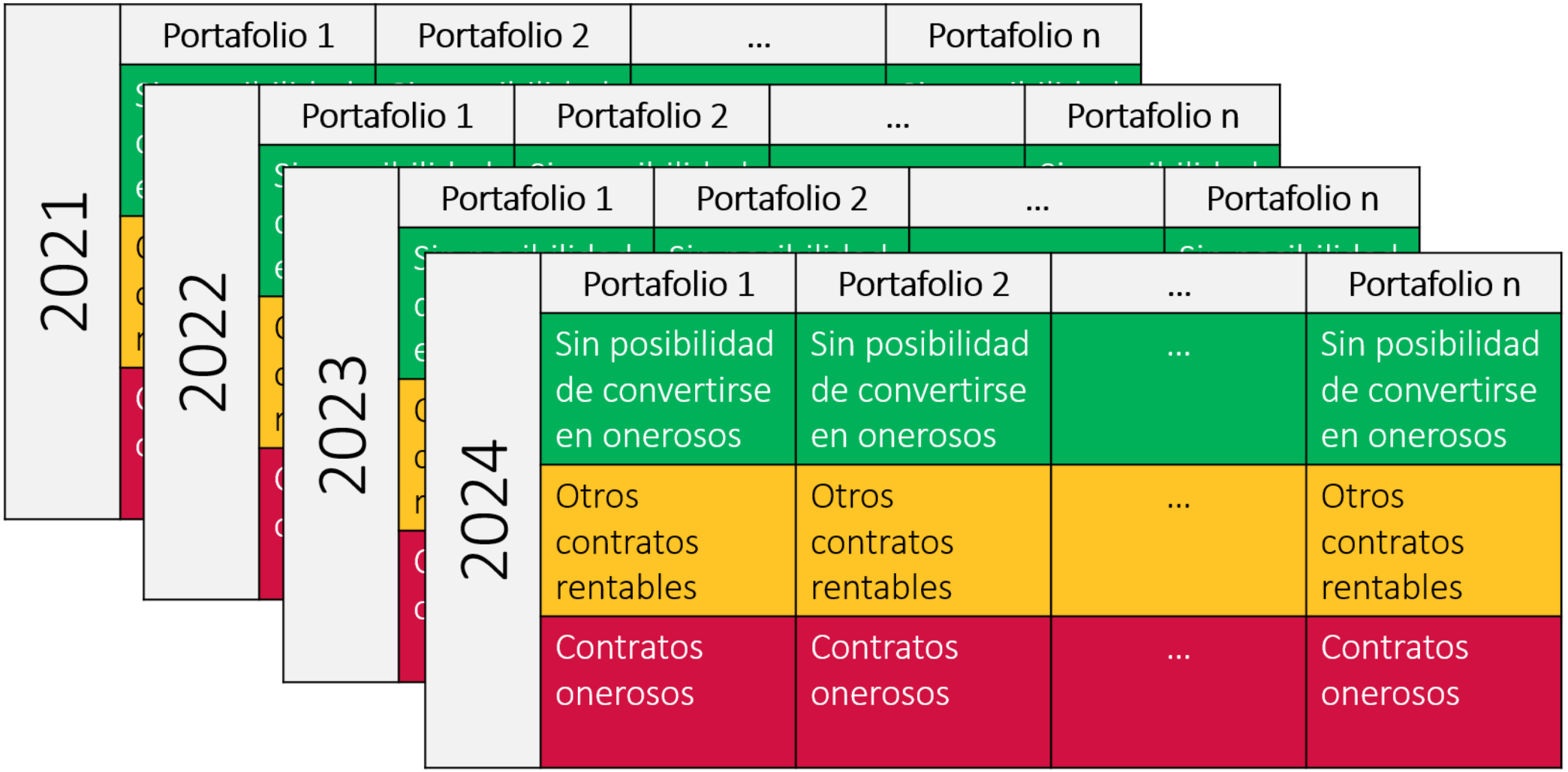
Time-value of money

Cash flows

On initial recognition, the contractual service margin is defined as the net difference of cash inflos and outflows, but it cannot be negative

- Its objective is to report earned profit with the passage of time, and according to the coverage units serviced during the reporting period
- If losses emerge on initla recognition, they should be immediately recognized
- The CSM account is accreted with interest
  - interest rates are locked at initial recognition

Portfolio aggregation



Illustrative Examples

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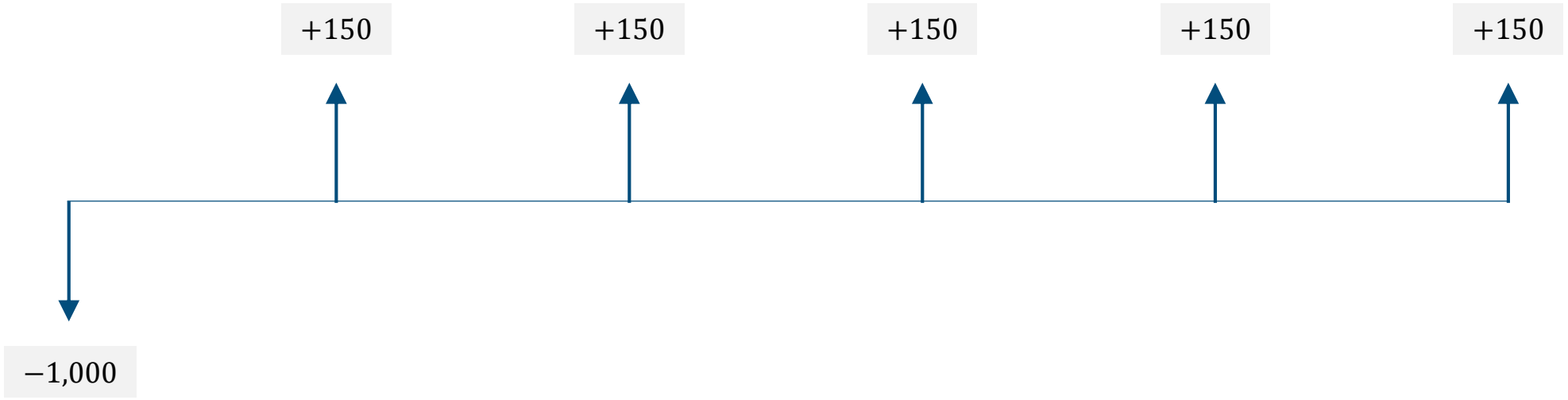
Layout

Base example

Favorable experience	Changes that increase profit
Unfavorable experience	Changes that make the group of contracts onerous

Term insurance

GROUP OF CONTRACTS	ASSUMPTIONS
• Portfolio of 1000 5-year term single-premium insurance contracts • Outflows are constant throughout the five years	• Discount rate: 5% • Risk adjustment: 75 to be recognized linearly over five years



Cash flows and contractual service margin

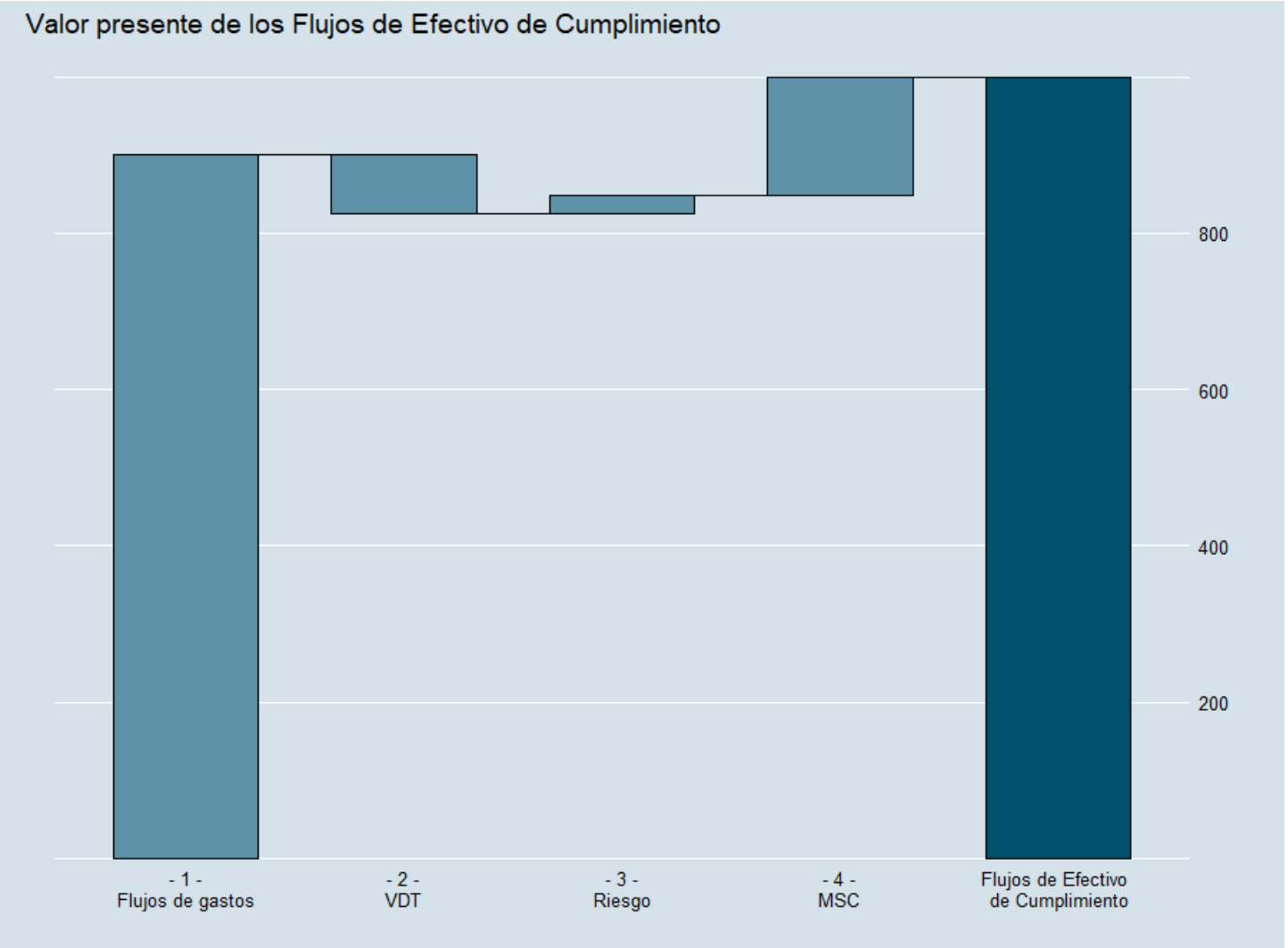
Cash flows					
t	**Inflows**	**Outflows**	**Interest rate**	**PV inflows**	**PV outflows**
0	–1,000.00	0.00	5.0%	–1,000.00	0.00
1	0.00	150.00	5.0%	0.00	649.42
2	0.00	150.00	5.0%	0.00	531.89
3	0.00	150.00	5.0%	0.00	408.49
4	0.00	150.00	5.0%	0.00	278.91
5	0.00	150.00			142.86
	–1,000.00	**750.00**			

← For instance, $\frac{150}{(1.05)^2} + \frac{150}{1.05} = 278.91$

Contractual service margin	
Component	**Amount**
PV outflows	649.42
PV inflows	–1,000.00
Risk adjustment	75.00
CSM	275.58
Total	**0.00**

Fulfilment cash flows

Reconciliation — PV cash flows	
Concept	**Amount**
Cash flows	750.00
Time-value of money	–100.58
Risk adjustment	75.00
CSM	275.58
Fulfilment cash flows	**1,000.00**



Initial recognition—analysis

The measurement of the group of contracts is:

	Before premium is received		After premium is received	
Concept	**Non-onerous contract**	**Onerous contract**	**Non-onerous contract**	**Onerous contract**
Estimates of the present value of cash inflows	–1,000.00	–1,000.00	0.00	0.00
Estimates of the present value of cash outflows	649.42	1,082.37	649.42	1,082.37
Estimates of the present value of cash flows	–350.58	82.37	649.42	1,082.37
Risk adjustment for non-financial risk	75.00	75.00	75.00	75.00
Fulfilment cash flows	–275.58	157.37	724.42	1,157.37
Contractual service margin	275.58	0.00	0.00	0.00
Insurance contract (asset) / liability on initial recognition	**0.00**	**157.37**	**724.42**	**1,157.37**

For the onerous contract columns shown above we assume a 250 addition to the cash outflows

Initial recognition—projections

Assumptions:

- The entity does not change assumptions
- There are no new contracts in the group
- Cash flows occur as expected

Concept	Initial	Year 1	Year 2	Year 3	Year 4	Year 5
Estimates of the present value of cash inflows	–1,000.00	-	-	-	-	-
Estimates of the present value of cash outflows	649.42	531.89	408.49	278.91	142.86	-
Estimates of the present value of cash flows	–350.58	531.89	408.49	278.91	142.86	-
						-
Risk adjustment for non-financial risk	75.00	60.00	45.00	30.00	15.00	-
Fulfilment cash flows	–275.58	591.89	453.49	308.91	157.86	-
Contractual service margin	275.58					
Contract (asset) / liability on initial recognition	0.00					

Reconciliation per paragraph 101

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Analysis—first year

Assumptions:

- The entity does not change assumptions
- There are no new contracts in the group
- Cash flows occur as expected

Concept	PV cash flows	Risk adjustment	CSM	Insurance liability
Opening balance	-	-	-	-
Changes related to future service: new contracts	–350.58	75.00	275.58	-
Cash inflows	1,000.00			1,000.00
Insurance finance expenses	32.47		13.78	46.25
Changes related to current service	-	–15.00	–57.87	–72.87
Cash outflows	–150.00			–150.00
Closing balance	**531.89**	**60.00**	**231.49**	**823.38**

Analysis—second year

Assumptions:

- The entity does not change assumptions
- Cash flows occur as expected

Concept	PV cash flows	Risk adjustment	CSM	Insurance liability
Opening balance	531.89	60.00	231.49	823.38
Changes related to future service	-	-	-	-
Cash inflows	-	-	-	-
Insurance finance expenses	26.59	-	11.57	38.17
Changes related to current service	-	–15.00	–60.77	–75.77
Cash outflows	–150.00	-	-	–150.00
Closing balance	**408.49**	**45.00**	**182.30**	**635.78**

Exercise 1

Using the cash flows of the illustrative example and assuming that there are no changes in assumptions and that experience develops as expected, prepare reconciliations of the insurance contract liability for years 3—5.

Analysis—third year

Assumptions:

- The entity does not change assumptions
- Cash flows occur as expected

Concept	PV cash flows	Risk adjustment	CSM	Insurance liability
Opening balance	408.49	45.00	182.30	635.78
Changes related to future service		-	-	-
Cash inflows	-	-	-	-
Insurance finance expenses	20.42	-	9.11	29.54
Changes related to current service	-	–15.00	–63.80	–78.80
Cash outflows	-150.00	-	-	–150.00
Closing balance	**278.91**	**30.00**	**127.61**	**436.52**

Analysis—fourth year

Assumptions:

- The entity does not change assumptions
- Cash flows occur as expected

Concept	PV cash flows	Risk adjustment	CSM	Insurance liability
Opening balance	278.91	30.00	127.61	436.52
Changes related to future service		-	-	-
Cash inflows	-	-	-	-
Insurance finance expenses	13.95	-	6.38	20.33
Changes related to current service	-	–15.00	–66.99	–81.99
Cash outflows	–150.00	-	-	–150.00
Closing balance	**142.86**	**15.00**	**66.99**	**224.85**

Analysis—fifth year

Assumptions:

- The entity does not change assumptions
- Cash flows occur as expected

Concept	PV cash flows	Risk adjustment	CSM	Insurance liability
Opening balance	142.86	15.00	66.99	224.85
Changes related to future service		-	-	-
Cash inflows	-	-	-	-
Insurance finance expenses	7.14	-	3.35	10.49
Changes related to current service	-	–15.00	–70.34	–85.34
Cash outflows	–150.00	-	-	–150.00
Closing balance	**-**	**-**	**-**	**-**

Progression—present value of cash flows

Assumptions:

- The entity does not change assumptions
- Cash flows occur as expected

Concept	Year 1	Year 2	Year 3	Year 4	Year 5
Opening balance	-	531.89	408.49	278.91	142.86
Changes related to future service	–350.58	-	-		
Cash inflows	1,000.00	-	-	-	-
Insurance finance expenses	32.47	26.59	20.42	13.95	7.14
Changes related to current service	-	-	-	-	-
Cash outflows	–150.00	–150.00	–150.00	–150.00	–150.00
Closing balance	**531.89**	**408.49**	**278.91**	**142.86**	**-**

Progression of the risk adjustment for non-financial risk

Assumptions:

- The entity does not change assumptions
- Cash flows occur as expected

Concept	Year 1	Year 2	Year 3	Year 4	Year 5
Opening balance	-	60.00	45.00	30.00	15.00
Changes related to future service	75.00	-	-	-	-
Changes related to current service	–15.00	–15.00	–15.00	–15.00	–15.00
Closing balance	**60.00**	**45.00**	**30.00**	**15.00**	**-**

Progression of the contractual service margin

Assumptions:

- The entity does not change assumptions
- Cash flows occur as expected

Concept	Year 1	Year 2	Year 3	Year 4	Year 5
Opening balance		231.49	182.30	127.61	66.99
Changes related to future service	275.58	-	-	-	-
Insurance finance expenses	13.78	11.57	9.11	6.38	3.35
Changes related to current service	–57.87	–60.77	–63.80	–66.99	–70.34
Closing balance	**231.49**	**182.30**	**127.61**	**66.99**	**-**

Progression of the insurance liability

Assumptions:

- The entity does not change assumptions
- Cash flows occur as expected

Concept	Year 1	Year 2	Year 3	Year 4	Year 5
Opening balance	-	823.38	635.78	436.52	224.85
Changes related to future service	-	-	-	-	-
Cash inflows	1,000.00	-	-	-	-
Insurance finance expenses	46.25	38.17	29.54	20.33	10.49
Changes related to current service	–72.87	–75.77	–78.80	–81.99	–85.34
Cash outflows	–150.00	–150.00	–150.00	–150.00	–150.00
Closing balance	**823.38**	**635.78**	**436.52**	**224.85**	**-**

-250.00

Simplified balance sheets

The balance sheets are constructed using cash flows and account reconciliations

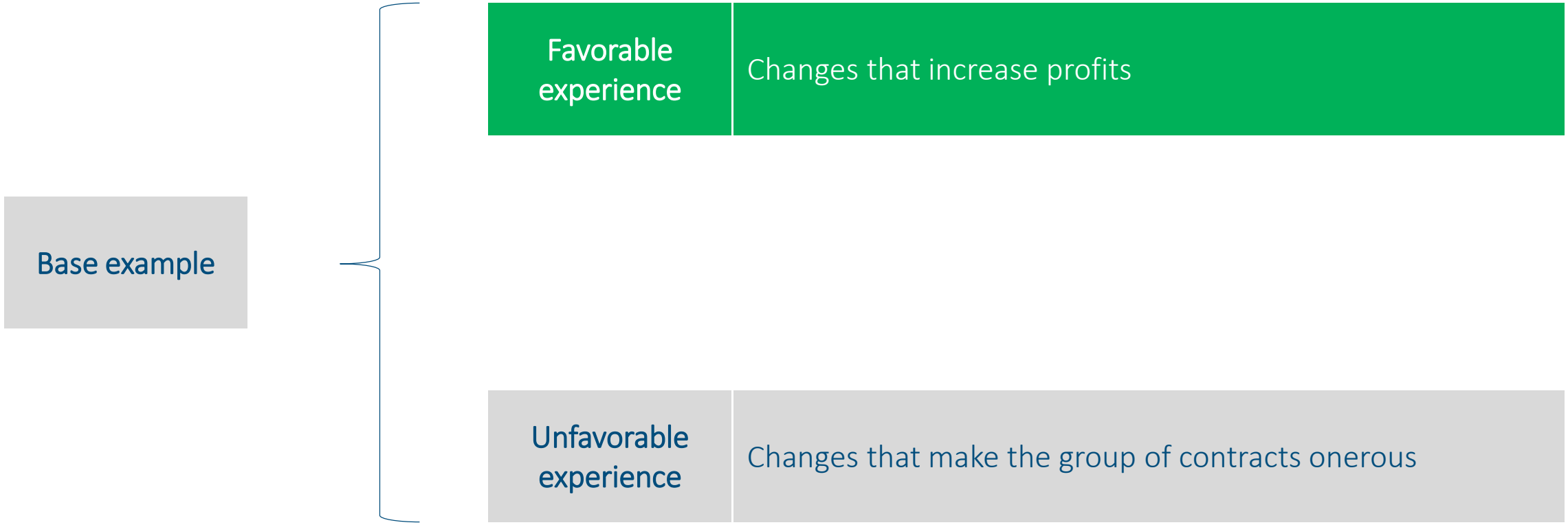
Statement of financial position	Year 1	Year 2	Year 3	Year 4	Year 5
Cash and cash equivalents	850.00	700.00	550.00	400.00	250.00
Insurance contract liability	823.38	635.78	436.52	224.85	-
Equity	26.62	64.32	113.48	175.15	250.00

Simplified statement of profit or loss

The statements of profit or loss are constructed using cash flows and account reconciliations

Statement of profit or loss	Year 1	Year 2	Year 3	Year 4	Year 5
Changes related to current service	72.87	75.77	78.80	81.99	85.34
Loss on onerous group of contracts	-	-	-	-	-
Insurance finance expenses	-46.25	-38.17	-29.54	-20.33	-10.49
Profit / (loss)	**26.62**	**37.60**	**49.26**	**61.67**	**74.85**

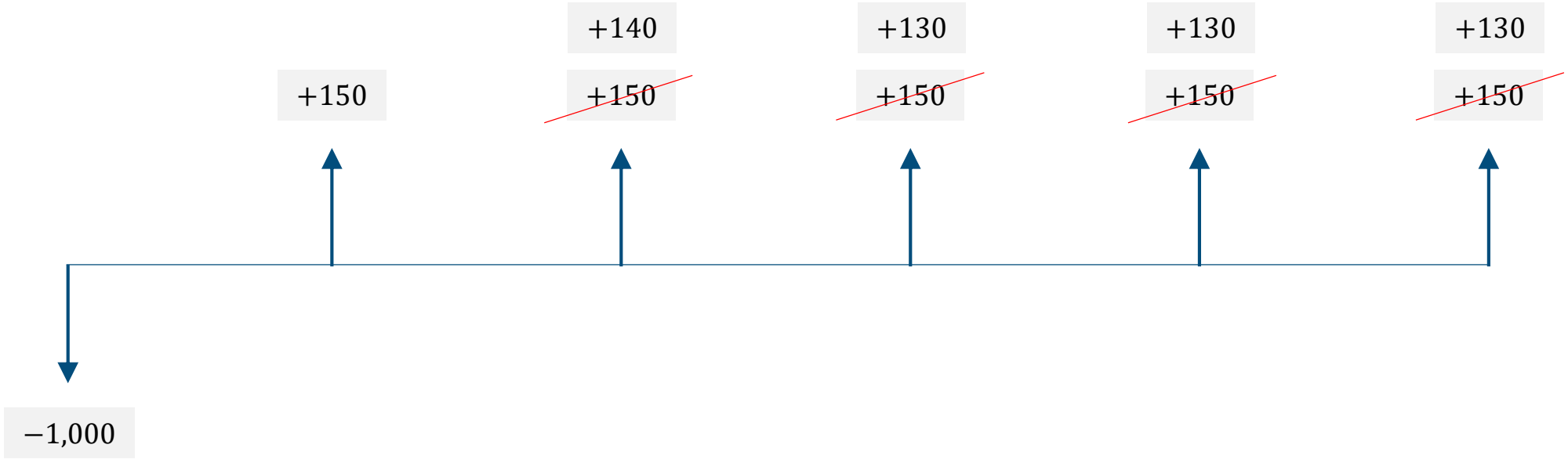
Layout


Base example
Favorable experience
Changes that increase profits
Unfavorable experience
Changes that make the group of contracts onerous

Subsequent recognition—favorable changes to cash flows

Assumptions:

- At the end of the second year, cash outflows were 140 (and not 150), and the entity recalculates all future cash outflows at 130
- The risk adjustment for non-financial risk becomes 40, 25 and 10 for years 3—5



Cash flows

Cash flows					
t	Cash inflows	Cash outflows	Rate	PV cash inflows	PV cash outflows
0	–1,000.00	-			
1	0.00	150.00			
2	0.00	140.00	5.0%	0.00	470.50
3	0.00	130.00	5.0%	0.00	354.02
4	0.00	130.00	5.0%	0.00	241.72
5	0.00	130.00			123.81
	–1,000.00	**680.00**			

This part is no longer relevant

Subsequent recognition—from the second year

Assumptions:

- Favorable fulfilment cash flows
- Lower risk adjustments for non-financial risk

Concept	Initial	Year 1	Year 2	Year 3	Year 4	Year 5
Estimates of the present value of cash inflows	–1,000.00	-	-	-	-	-
Estimates of the present value of cash outflows	649.42	531.89	354.02	241.72	123.81	-
Estimates of the present value of cash flows	–350.58	531.89	354.02	241.72	123.81	-
						-
Risk adjustment for non-financial risk	75.00	60.00	40.00	25.00	10.00	-
Fulfilment cash flows	–275.58	591.89	394.02	266.72	133.81	-
Contractual service margin	275.58					
Contract (asset) / liability on initial recognition	0.00					

Exercise 2

Using the favorable fulfilment cash flows and the new assumptions, create the account reconciliations for year 2.

Analysis—second year

Assumptions:

- At the end of the second year, cash outflows were 140 (and not 150), and the entity recalculates all future cash outflows at 130
- The risk adjustment for non-financial risk becomes 40, 25 and 10 for years 3—5

Concept	PV cash flows	Risk adjustment	CSM	Insurance liability
Opening balance	531.89	60.00	231.49	823.38
Changes related to future service	–54.46	–5.00	59.46	-
Cash inflows	-	-	-	-
Insurance finance expenses	26.59	-	11.57	38.17
Changes related to current service	–10.00	–15.00	–75.63	–100.63
Cash outflows	–140.00	-	-	–140.00
Closing balance	**354.02**	**40.00**	**226.89**	**620.92**

Analysis—third year

Assumptions:

- At the end of the second year, cash outflows were 140 (and not 150), and the entity recalculates all future cash outflows at 130
- The risk adjustment for non-financial risk becomes 40, 25 and 10 for years 3—5

Concept	PV cash flows	Risk adjustment	CSM	Insurance liability
Opening balance	354.02	40.00	226.89	620.92
Changes related to future service		-	-	-
Cash inflows	-	-	-	-
Insurance finance expenses	17.70	-	11.34	29.05
Changes related to current service	-	–15.00	–79.41	–94.41
Cash outflows	-130.00	-	-	–130.00
Closing balance	**241.72**	**25.00**	**158.83**	**425.55**

Analysis—fourth year

Assumptions:

- At the end of the second year, cash outflows were 140 (and not 150), and the entity recalculates all future cash outflows at 130
- The risk adjustment for non-financial risk becomes 40, 25 and 10 for years 3—5

Concept	PV cash flows	Risk adjustment	CSM	Insurance liability
Opening balance	241.72	25.00	158.83	425.55
Changes related to future service		-	-	-
Cash inflows	-	-	-	-
Insurance finance expenses	12.09	-	7.94	20.03
Changes related to current service	-	–15.00	–83.38	–98.38
Cash outflows	–130.00	-	-	–130.00
Closing balance	**123.81**	**10.00**	**83.38**	**217.19**

Analysis—fifth year

Assumptions:

- At the end of the second year, cash outflows were 140 (and not 150), and the entity recalculates all future cash outflows at 130
- The risk adjustment for non-financial risk becomes 40, 25 and 10 for years 3—5

Concept	PV cash flows	Risk adjustment	CSM	Insurance liability
Opening balance	123.81	10.00	83.38	217.19
Changes related to future service		-	-	-
Cash inflows	-	-	-	-
Insurance finance expenses	6.19	-	4.17	10.36
Changes related to current service	-	-10.00	-87.55	-97.55
Cash outflows	-130.00	-	-	-130.00
Closing balance	**-**	**-**	**-**	**-**

Progression of the insurance liability

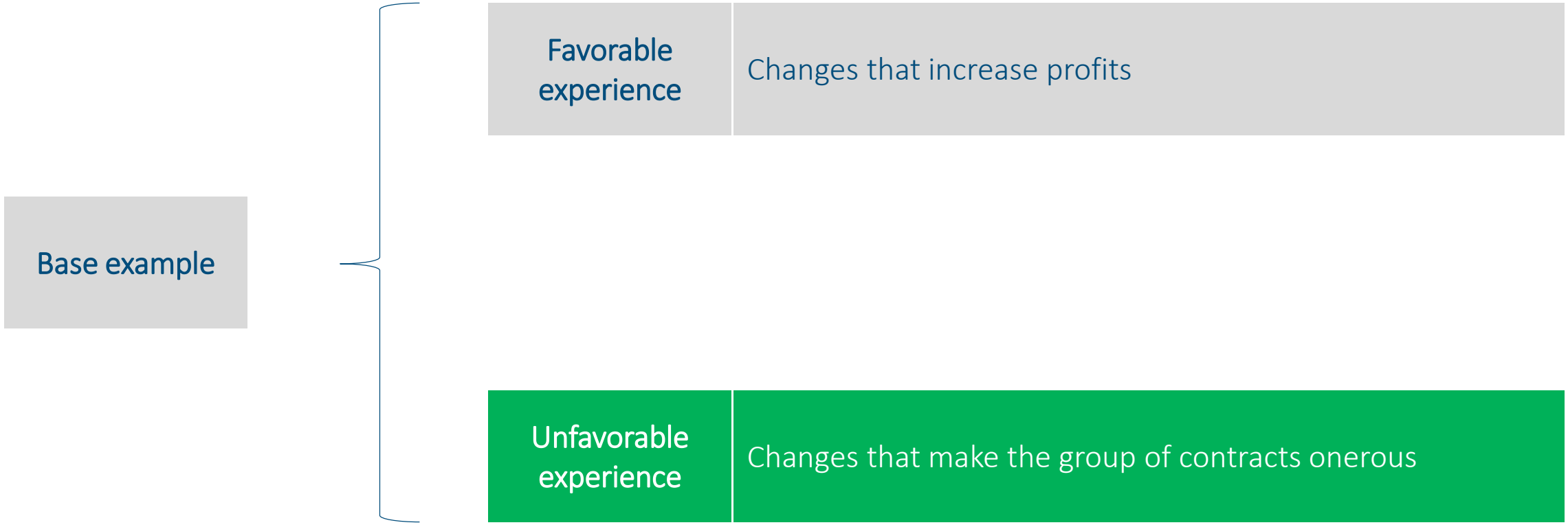
Assumptions:

- At the end of the second year, cash outflows were 140 (and not 150), and the entity recalculates all future cash outflows at 130
- The risk adjustment for non-financial risk becomes 40, 25 and 10 for years 3—5

Concept	Year 1	Year 2	Year 3	Year 4	Year 5
Opening balance	-	823.38	620.92	425.55	217.19
Changes related to future service	-	-	-	-	-
Cash inflows	1,000.00	-	-	-	-
Insurance finance expenses	46.25	38.17	29.05	20.03	10.36
Changes related to current service	–72.87	–100.63	–94.41	–98.38	-97.55
Cash outflows	–150.00	–140.00	–130.00	–130.00	-130.00
Closing balance	**823.38**	**620.92**	**425.55**	**217.19**	**-**

-320.00

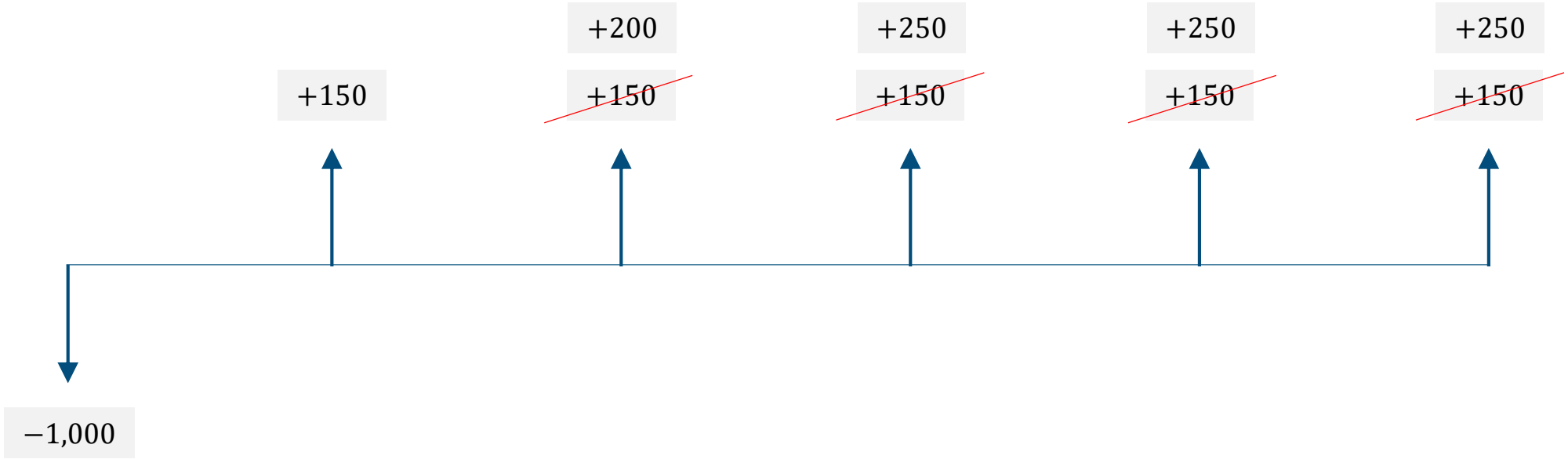
Layout


Base example
Favorable experience
Changes that increase profits
Unfavorable experience
Changes that make the group of contracts onerous

Subsequent recognition—unfavorable changes to cash flows

Assumptions:

- At the end of the second year, cash outflows were 200 (and not 150), and the entity recalculates all future cash outflows at 250
- The risk adjustment for non-financial risk becomes 50, 35 y 20 for years 3—5



Cash flows

Cash flows					
t	Cash inflows	Cash outflows	Rate	PV cash inflows	PV cash outflows
0	–1,000.00	-			
1	-	150.00			
2	0.00	200.00	5.0%	0.00	838.87
3	0.00	250.00	5.0%	0.00	680.81
4	0.00	250.00	5.0%	0.00	464.85
5	0.00	250.00			238.10
	–1,000.00	**1,100.00**			

This part is no longer relevant

Subsequent recognition—second year

Assumptions:

- At the end of the second year, cash outflows were 200 (and not 150), and the entity recalculates all future cash outflows at 250
- The risk adjustment for non-financial risk becomes 50, 35 y 20 for years 3—5

Concept	Initial	Year 1	Year 2	Year 3	Year 4	Year 5
Estimates of the present value of cash inflows	–1,000.00	-	-	-	-	-
Estimates of the present value of cash outflows	649.42	531.89	680.81	464.85	238.10	-
Estimates of the present value of cash flows	–350.58	531.89	680.81	464.85	238.10	-
						-
Risk adjustment for non-financial risk	75.00	60.00	50.00	35.00	20.00	-
Fulfilment cash flows	–275.58	591.89	730.81	499.85	258.10	-
Contractual service margin	275.58					
Insurance contract (asset) / liability on initial recognition	0.00					

Analysis—second year

Assumptions:

- At the end of the second year, cash outflows were 200 (and not 150), and the entity recalculates all future cash outflows at 250
- The risk adjustment for non-financial risk becomes 50, 35 y 20 for years 3—5

Concept	PV cash flows	Risk adjustment	CSM	Insurance liability
Opening balance	531.89	60.00	231.49	823.38
Changes related to future service	272.32	5.00	–243.06	34.26
Cash inflows	-	-	-	-
Insurance finance expenses	26.59	-	11.57	38.17
Changes related to current service	50.00	–15.00	-	35.00
Cash outflows	–200.00	-	-	–200.00
Closing balance	**680.81**	**50.00**	**0.00**	**730.81**

- Given that the group of contracts becomes onerous, the CSM at the end of the second year is zero
- The entity recognizes immediately an insurance liability of 730.81

Comparison of simplified statements of financial position

Statement of financial position—base	Year 1	Year 2	Year 3	Year 4	Year 5
Cash and cash equivalents	850.00	700.00	550.00	400.00	250.00
Insurance contract liability	823.38	635.78	436.52	224.85	-
Equity	26.62	64.22	113.48	175.15	250.00

Statement of financial position—favorable cash flows	Year 1	Year 2	Year 3	Year 4	Year 5
Cash and cash equivalents	850.00	710.00	580.00	450.00	320.00
Insurance contract liability	823.38	620.92	425.55	217.19	-
Equity	26.62	89.08	154.45	232.81	320.00

Statement of financial position—unfavorable cash flows	Year 1	Year 2	Year 3	Year 4	Year 5
Cash and cash equivalents	850.00	650.00	400.00	150.00	–100.00
Insurance contract liability	823.38	730.81	499.85	258.10	-
Equity	26.62	–80.81	–99.85	–108.10	–100.00

Comparison of simplified statements of profit or loss

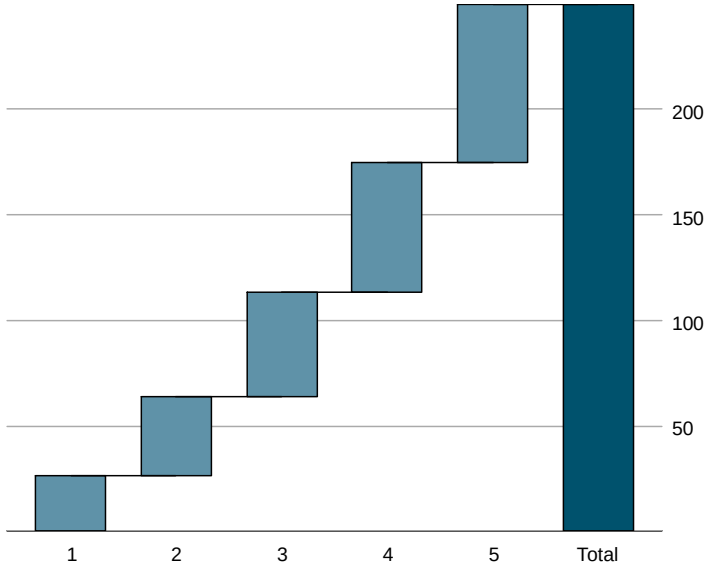
Statement of profit or loss—base	Year 1	Year 2	Year 3	Year 4	Year 5	
Changes related to current service	72.87	75.77	78.80	81.99	85.34	
Loss on onerous group of contracts	-	-	-	-	-	
Insurance finance expenses	–46.25	–38.17	–29.54	–20.33	–10.49	
Profit / (loss)	**26.62**	**37.60**	**49.26**	**61.67**	**74.85**	**250.00**

Statement of profit or loss—Favorable FCF's	Year 1	Year 2	Year 3	Year 4	Year 5	
Changes related to current service	72.87	100.63	94.41	98.38	97.55	
Loss on onerous group of contracts	-	-	-	-	-	
Insurance finance expenses	–46.25	–38.17	–29.05	–20.03	–10.36	
Profit / (loss)	**26.62**	**62.46**	**63.70**	**76.61**	**90.61**	**320.00**

Statement of profit or loss—Unfavorable FCF's	Year 1	Year 2	Year 3	Year 4	Year 5	
Changes related to current service	72.87	–35.00	15.00	15.00	20.00	
Loss on onerous group of contracts	-	–34.26	-	-	-	
Insurance finance expenses	–46.25	–38.17	–34.04	–23.24	–11.90	
Profit / (loss)	**26.62**	**–107.43**	**–19.04**	**–8.24**	**8.10**	**–100.00**

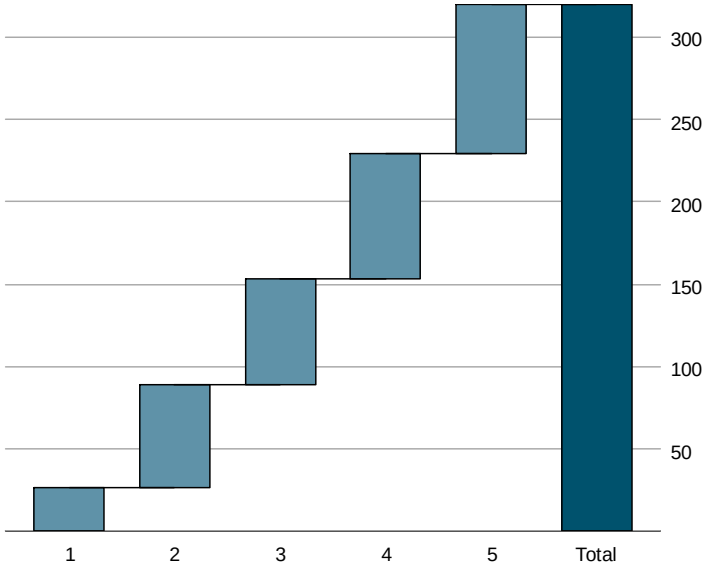
Profit patterns

Annual profit/loss as percentage of 5-year profit/loss



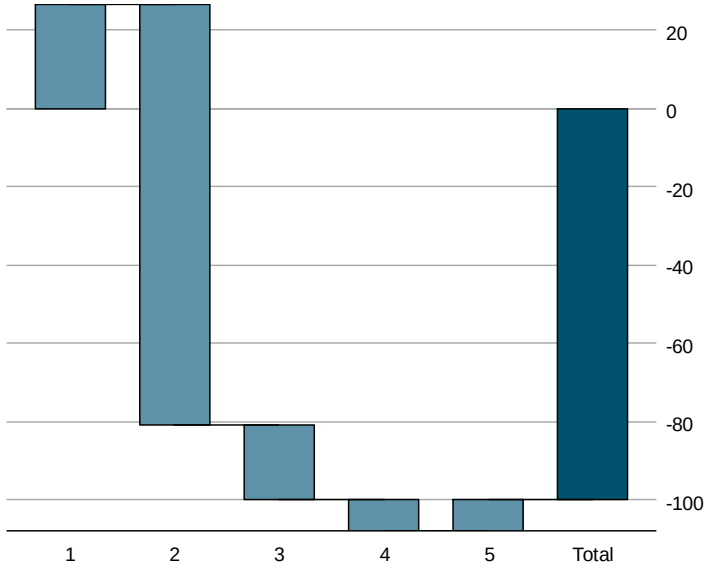
Base example

total profit
250.00



Favorable cash flows

total profit
320.00



Unfavorable cash flows

total profit
−100.00

Reversal of losses in an onerous group of contracts

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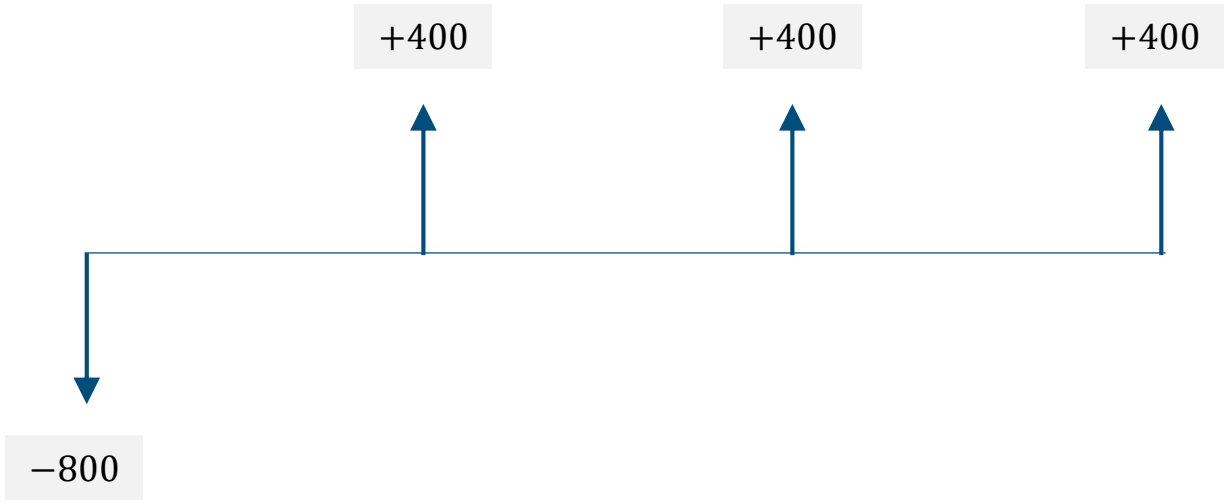
Illustrative example

GROUP OF CONTRACTS	ASSUMPTIONS
• Portfolio of 100 3-year single-premium identical contracts • Constant outflows at the end of each year	• Discount rate: 5% anual • Risk adjustment: 240 on initial recognition, recognized uniformly over three years



Exercise 3

Calculate the fulfilment cash flows and the insurance contract liability on initial recognition and at the end of each year of coverage.

Assume that coverage starts at contract issue and that claims are paid when incurred.

Cash flows

Cash flows					
t	**inflows**	**outflows**	**disct rate**	**pv inflows**	**pv outflows**
0	–800.00	0.00	5.0%	–800.00	0.00
1	0.00	400.00	5.0%	0.00	1,089.30
2	0.00	400.00	5.0%	0.00	743.76
3	0.00	400.00	5.0%	0.00	380.95
	–1,000.00	**1,200.00**			

← For instance, $\frac{400}{(1.05)^2} + \frac{400}{1.05} = 743.76$

Initial recognition

Assumptions:

- coverage starts at contract issue
- claims are paid when incurred

item	initial	year 1	year 2	year 3
Estimates of the present value of inflows	–800.00	-	-	-
Estimates of the present value of outflows	1,089.30	743.76	380.95	-
Estimates of the present value of cash flows	289.30	743.76	380.95	-
Risk adjustment for non-financial risk	240.00	160.00	80.00	-
Fulfilment cash flows	529.30	903.76	460.95	-
Contractual service margin	-			
Insurance contract (asset) / liability at initial recognition	529.30			

Exercise 4

Prepare the following reconciliations at the end of the first year assuming that experience emerged as expected:

- Estimates of the present value of cash flows
- Risk adjustment for non-financial risk
- Contractual service margin
- Insurance contract liability

Reconciliation of the present value of cash flows

Assumptions:

- coverage starts at contract issue
- claims are paid when incurred

item	year 1
Opening balance	
Changes related to future service: new contracts	
Inflows	
Insurance finance expenses	
Changes related to current service	
Outflows	
Closing balance	

Reconciliation of the present value of cash flows

Assumptions:

- coverage starts at contract issue
- claims are paid when incurred

item	year 1
Opening balance	-
Changes related to future service: new contracts	289.30
Inflows	800.00
Insurance finance expenses	54.46
Changes related to current service	-
Outflows	–400.00
Closing balance	**743.76**

Reconciliation of the risk adjustment for non-financial risk

Assumptions:

- coverage starts at contract issue
- claims are paid when incurred

item	year 1
Opening balance	-
Changes related to future service: new contracts	240.00
Changes related to current service	–80.00
Closing balance	**160.00**

Reconciliation of the contractual service margin[1]

Assumptions:

- coverage starts at contract issue
- claims are paid when incurred

item	year 1
Opening balance	-
Changes related to future service: new contracts	-
Insurance finance expenses	-
Changes related to current service	-
Closing balance	**-**

[1] Application of paragraph 44(e): the entity does not recognize the CSM in profit or loss because the CSM is equal to zero.

Reconciliation of the insurance contract liability

Assumptions:

- coverage starts at contract issue
- claims are paid when incurred

item	year 1
Opening balance	
Changes related to future service: new contracts	
Inflows	
Insurance finance expenses	
Changes related to current service	
Outflows	
Closing balance	

Reconciliation of the insurance contract liability

Assumptions:

- coverage starts at contract issue
- claims are paid when incurred

item	year 1
Opening balance	-
Changes related to future service: new contracts	529.30
Inflows	800.00
Insurance finance expenses	54.46
Changes related to current service	–80.00
Outflows	–400.00
Closing balance	**903.76**

Exercise 5

Prepare the analysis of the insurance contract liability with explicit identification of the loss component.

Analysis of the insurance liability of the first year

Assumptions:

- coverage starts at contract issue
- claims are paid when incurred

item	remaining coverage	loss component	incurred claims	insurance liability
Opening balance	-	-	-	-
Inflows	800.00	-	-	800.00
Insurance revenue	–289.30	-	-	–289.30
Insurance service expenses: reversal of loss on onerous contracts	-	529.30	-	529.30
Insurance service expenses: incurred expenses	-	–191.13	400.00	208.87
Insurance finance expenses	32.78	21.68	-	54.46
Outflows	-	-	–400.00	–400.00
Closing balance	**543.38**	**359.85**	**-**	**903.33**

Exercise 6

At the end of the second year, the entity recalculates the estimates of the present value of cash outflows for year 3 at 100 (instead of 400). The risk adjustment for non-financial risk stays the same.

Prepare the second year reconciliation of the insurance contract liability for each account, and analyze the liability with the explicit identification of the loss component.

Reconciliation of the present value of cash flows

Assumptions:

- coverage starts at contract issue
- claims are paid when incurred

item	year 1	year 2
Opening balance	-	743.76
Changes related to future service	289.30	–285.71
Inflows	800.00	-
Insurance finance expenses	54.46	37.18
Changes related to current service	-	-
Outflows	–400.00	–400.00
Closing balance	**743.76**	**95.23**

Reconciliation of the risk adjustment for non-financial risk

Assumptions:

- coverage starts at contract issue
- claims are paid when incurred

item	year 1	year 2
Opening balance	-	160.00
Changes related to future service	240.00	-
Changes related to current service	–80.00	–80.00
Closing balance	**160.00**	**80.00**

Reconciliation of the contractual service margin

Assumptions:

- coverage starts at contract issue
- claims are paid when incurred

item	year 1	year 2
Opening balance	-	-
Changes related to future service	-	102.56
Insurance finance expenses	-	-
Changes related to current service	-	-
Closing balance	**-**	**102.56**

Reconciliation of the insurance contract liability

Assumptions:

- coverage starts at contract issue
- claims are paid when incurred

item	year 1	year 2
Opening balance	-	903.76
Changes related to future service	529.30	–183.15
Inflows	800.00	-
Insurance finance expenses	54.46	37.18
Changes related to current service	–80.00	–80.00
Outflows	–400.00	–400.00
Closing balance	**903.76**	**277.79**

Analysis of the insurance liability of the second year

Assumptions:

- coverage starts at contract issue
- claims are paid when incurred

item	remaining coverage	loss component	incurred claims	insurance liability
Opening balance	543.38	359.85	-	903.23
Inflows	-	-	-	-
Insurance revenue	–289.30	-	-	–289.30
Insurance service expenses: reversal of loss on onerous contracts	-	–183.15	-	–183.15
Insurance service expenses: incurred expenses	-	–191.13	400.00	208.87
Insurance finance expenses	22.75	14.43	-	37.18
Outflows	-	-	–400.00	–400.00
Closing balance	**276.83**	**-**	**-**	**276.83**

Risk adjustment for non-financial risk

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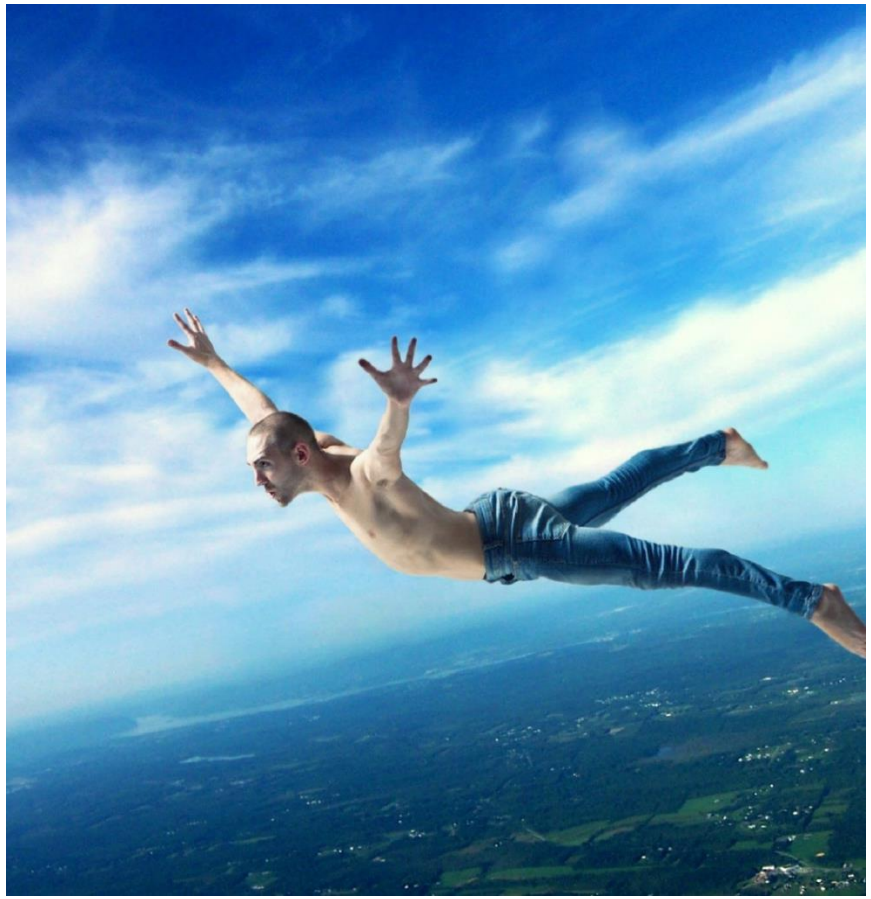
Digression



Risk

- There is no unique definition, but risk is often associated with uncertainty, probability of negative outcomes, hazard, etc.
- In the actuarial context, RISK = PROBABILITY OF LOSS → UNCERTAINTY → CHANCE
- In 1933 Kolmogorov postulated the concept of probability space, $(\Omega, \mathcal{F}, \wp)$
  - Ω is the sample space that contains realizations $\omega \, \epsilon \, \Omega$ of an experiment
  - $\mathcal{F}$ is a σ-algebra that contains all sets to which probabilities can be assigned
  - $\wp$ is a probability measure
- Risk can be modeled with a random vector $\boldsymbol{X}: \Omega \longrightarrow \mathbb{R}^d$
  - Modeling is achieved thorugh distribution functions $F_X(x) = \Pr[X \leq x]$, $x \, \epsilon \, \mathbb{R}$ and $F_{\boldsymbol{X}}(\boldsymbol{x}) = \Pr[\boldsymbol{X} \leq \boldsymbol{x}]$, $\boldsymbol{x} \, \epsilon \, \mathbb{R}^d$
- The maion focus are insruance, market, credit and operational risks
  - but other types of risks can also be modeled (e.g., liquidity risk, operational risk, model risk, etc.)

Summary of paragraphs 37 and B87

37

An entity shall adjust the estimate of the present value of the cash flows to reflect the expected compensation that requires for bearing the uncertainty about timing and amount of cash flows, that arises from non-financial risk

The risk adjustment can be compared to the risk margin under Solvency II, with a slight difference of context

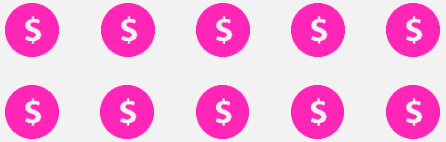
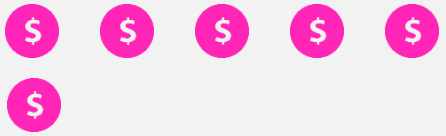
B87

The risk adjustment measures the compensation that the entity requires to be indifferent between:

a) fulfilling a liability that has a range of possible outcomes arising from non-financial risk; and,

b) fulfilling a liability that will generate fixed cash flows with the same expected present value as the insurance contracts

Concept of risk adjustment

	Outcome 1, prob = 50%	Outcome 2, prob = 50%	Weighted outcome
Contract 1	Pay 1000 	Pay 0	Pay 500 
Contract 2	Pay 600 	Pay 400 	Pay 500 

Given the uncertainty of payouts, the entity requires compensation for bearing the non-financial risk. However, contract 1 exhibits higher volatility, hence, it requires a larger risk adjustment.

Estimating the risk adjustment

IFRS 17 does not prescribe any estimation methodology but points out that the risk adjustment should be entity-specific. The methodology and the confidence level of the estimation must be disclosed in the financial statements.

← lower risk adjustment	higher risk adjustment →
• high claim frequency and low claim severity	• low claim frequency and high claim severity
• short-term contracts	• long-term contrtacts
• less skewed probability distributions	• more skewed probability distributions
• more information about trends and current estimates	• less information about trends and current estimates
• emerging claim experience that reduces uncertainty of future estimates	• emerging claim experience that increases uncertainty of future estimates

Possible methodologies[1]

IFRS 17 alludes to a "confidence level", which is often associated with the VaR characteristic (e.g., Solvency II), but a specific level is not prescribed

Metrics	
VaR (*value at risk*)	• $\mathrm{VaR}_\alpha[L] = \inf\{x \in \mathbb{R}: F_L(x) \geq \alpha\}$, where L is a loss random variable with distribution function F and $\alpha \in (0,1)$ (Solvency II → $\alpha = 0.995$)
TVaR (*tail value at risk*)	• $\mathrm{TVaR}_\alpha[L] = \frac{1}{1-\alpha}\int_\alpha^1 \mathrm{VaR}_u(L)du$, where L is a loss random variable with distribution function F, $\mathrm{E}[L] < \infty$ and $\alpha \in (0,1)$
Cost of capital	• Similar to the risk margin notion of Solvency II • Risk adjustment defined as $\mathrm{RA} = \mathrm{CC} \cdot \sum \mathrm{SCR}_t(1+i_t)^{-t}$ where CC is the cost of capital, SCR_t is the solvency capital requirement at time t, and i_t is the risk-free rate at duration t
Assumption margins	• Consideration of explicit loadings to assumptions and assessment of impact

[1] *Non-exhaustive list*

Illustrative example

For a portfolio of $10{,}000$ policies, non-financial risk is calculated through the Central Limit Theorem approximation of a loss function L. $\mathrm{VaR}_{99.5}[L]$ and $\mathrm{TVaR}_{99}[L]$ are then calculated.

no. insured	sum insured	age	${}_5q_x$	expected benefits	variance
1,000	1,000	20	0.0040	3,992	3,976,020
1,000	1,500	25	0.0043	6,425	9,595,904
1,000	1,400	30	0.0047	6,642	9,255,287
1,000	2,400	35	0.0055	13,141	31,365,820
1,000	1,300	40	0.0066	8,622	11,134,811
1,000	1,900	45	0.0085	16,081	30,296,146
1,000	2,300	50	0.0114	26,127	59,408,624
1,000	2,000	55	0.0159	31,862	62,709,248
1,000	1,500	60	0.0231	34,700	50,846,318
1,000	1,700	65	0.0344	58,549	96,105,750

Assumptions

- Five-year single-premium term insurance
- Independent and identically distributed risks
- Only mortality risk is considered
- Expenses are set at 25% of the gross premium

Expected benefit amount	206,143
Standard deviation	19,097
Pure premium	237,555
Gross premium	316,740
$\mathrm{VaR}_{99.5}$	255,333
$\mathrm{VaR}_{99.5}$, shifted	**49,191**
TVaR_{99}	257,040
TVaR_{99}, shifted	**50,897**

Calculations

Expected benefit amount	$E[S] = 206{,}143$
Standard deviation	$sd[S] = 19{,}097$

Pure premium	$E[S] + \Phi^{-1}(0.95) \times sd[S] = 237{,}555$
Gross premium	$\frac{237{,}555}{0.75} = 316{,}740$
$\mathrm{VaR}_{99.5}$	$E[S] + \Phi^{-1}(0.995) \times sd[S] = 255{,}333$
$\mathrm{VaR}_{99.5}$, shifted	$\mathrm{VaR}_{99.5} - E[S] = 49{,}191$
TVaR_{99}	$E[S] + \frac{sd[S]}{1 - 0.99}\left[\frac{\Phi^{-1}(0.99) - E[S]}{sd[S]}\right] = 257{,}040$
TVaR_{99}, shifted	$\mathrm{TVaR}_{99.5} - E[S] = 50{,}897$

Discount rates

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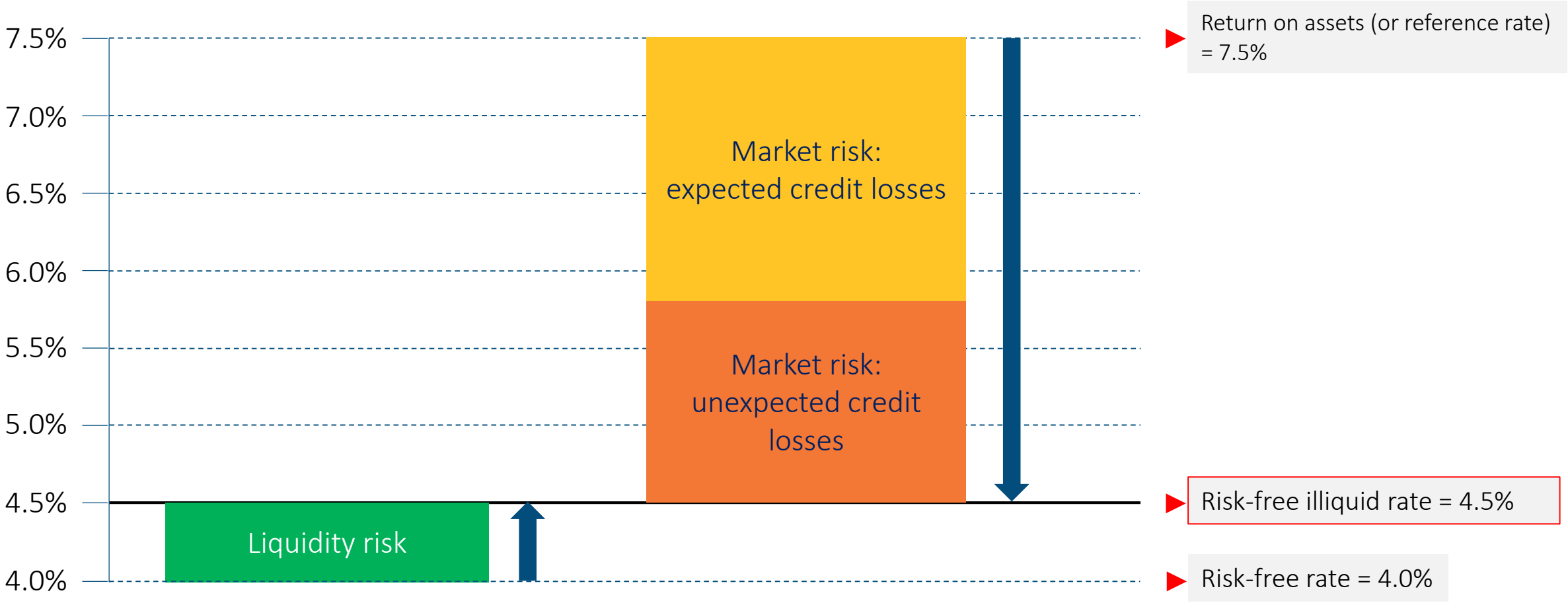
Determining discount rates



Estimation techniques

- If observable market prices with the same characteristics (timing, currency, liquidity) are NOT available; or similar instruments ARE available but do not separately identify factors of the financial instrument that differentiate it from an insurance contract, then estimation techniques must be used
- An entity considers:

Observable inputs	Optimal use of observable market inputs
Non-market variables	Variables that reflect all reasonable and supportable information available, and that do not contradict observable market prices
Expert judgment	Assessment of similarities between insurance contracts and instruments for which observable market prices are available, and adjusting as needed

Possible challenges

- Market illiquidity
  - scarcity of financial instruments
- Difficulty in identifying support for the adjustments
  - complication in assessing liquidity risks
  - lack of prices of corporate debt, swaps, and derivatives to calibrate models
  - justification on using illiquidity premiums of advanced financial markets

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