

GUY CARPENTER

**How to estimate Risk Margins
under Solvency II and IFRS**

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Lead Casualty Specialty Actuary

IFRS Phase II timeline



IFRS Phase II timeline



Discussion
Paper
2007

IFRS Phase II timeline



IFRS Phase II timeline



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1. Overview of IASB's philosophy
2. IFRS cost of capital method
3. IFRS method versus Solvency II method

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Overview of IASB's philosophy

Balance
sheet at
Market Value

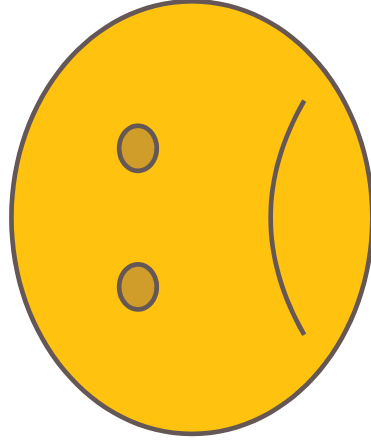
Overview of IASB's philosophy

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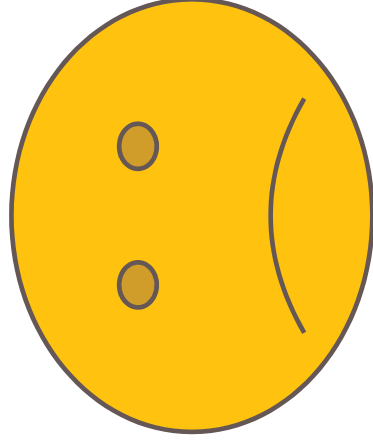
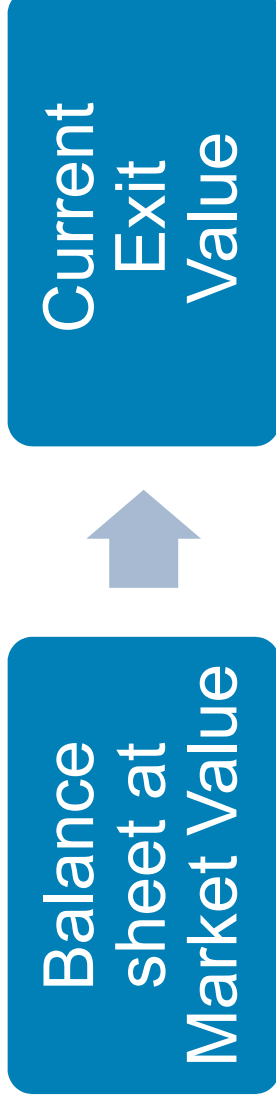


Overview of IASB's philosophy

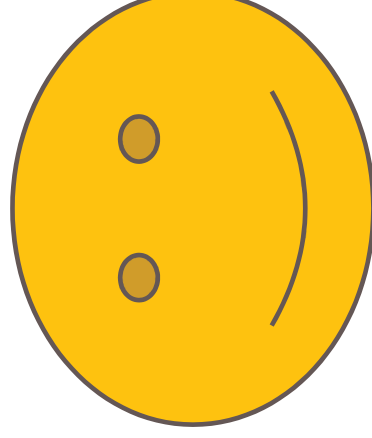
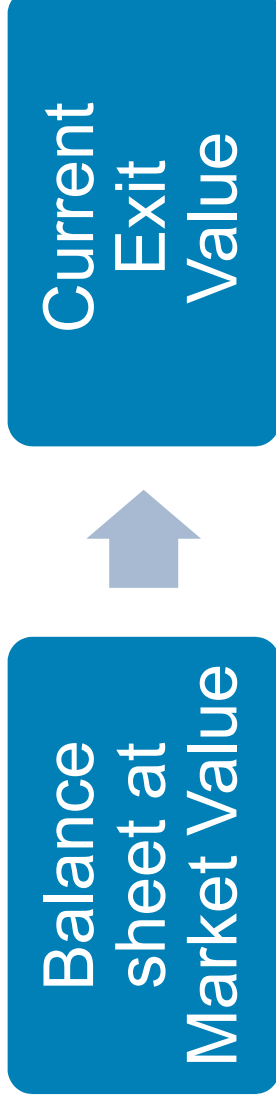
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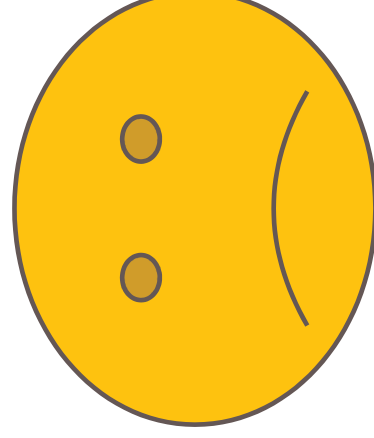
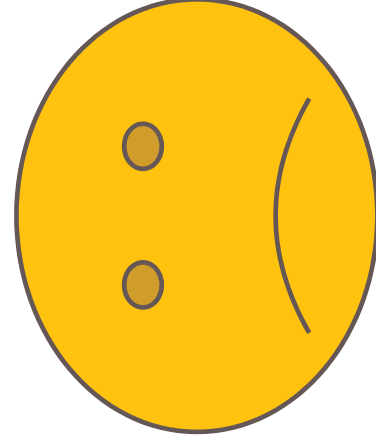
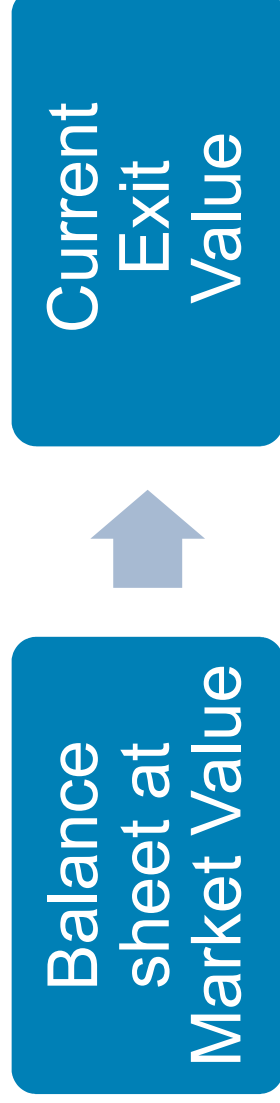
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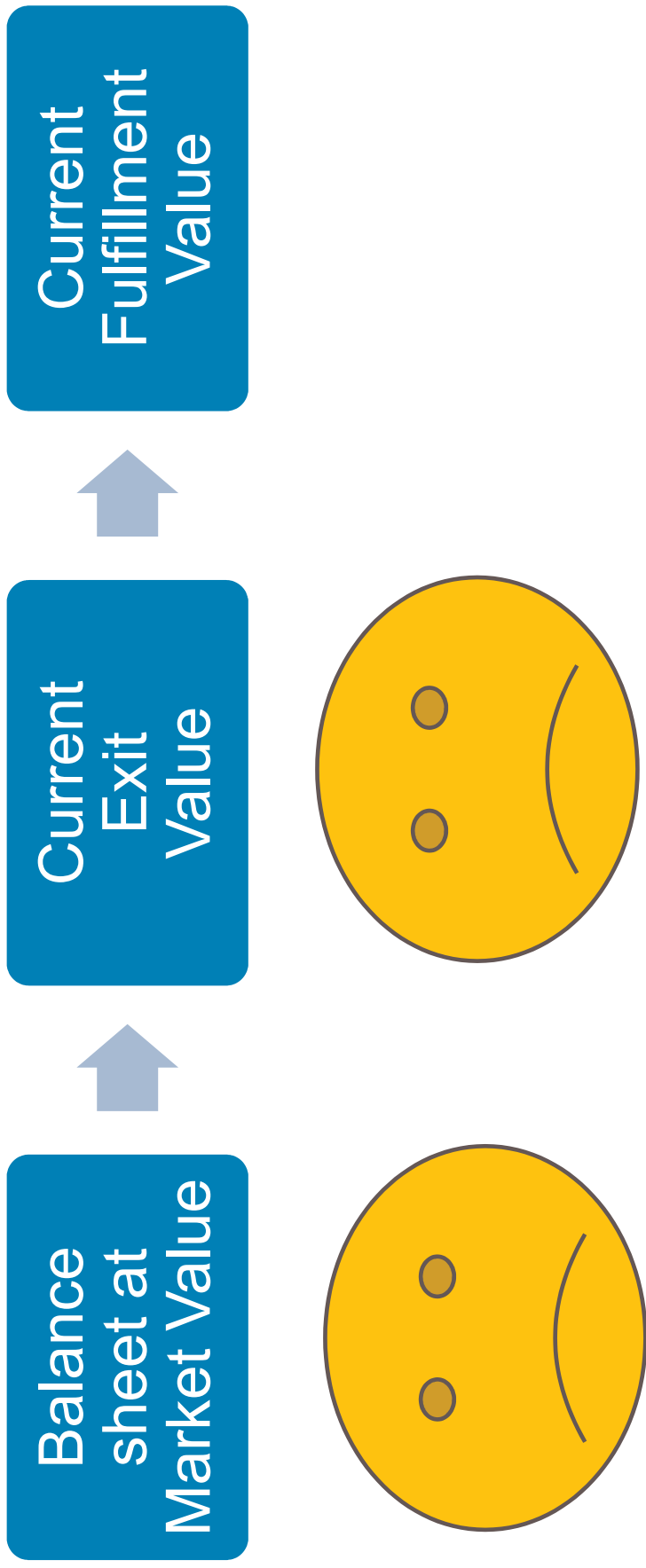
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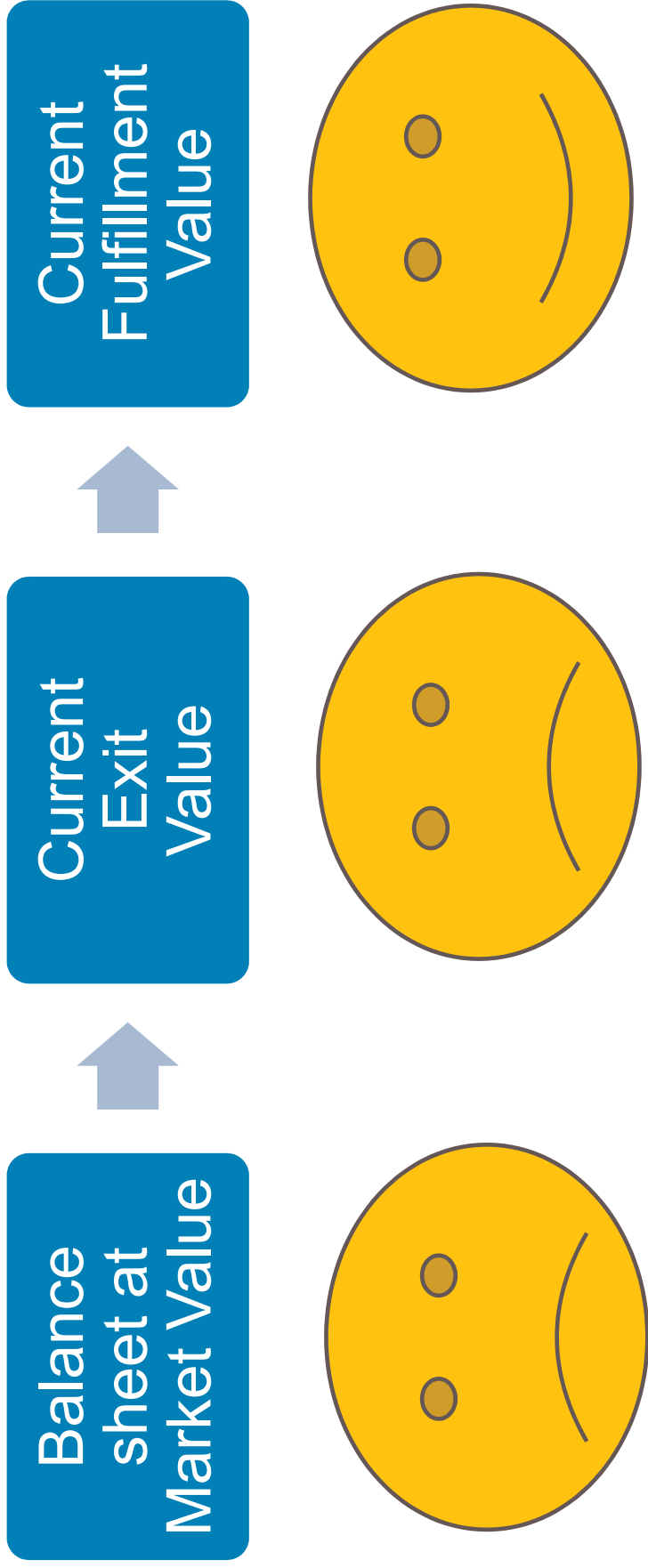
Overview of IASB's philosophy



Overview of IASB's philosophy



Overview of IASB's philosophy



■ Four Components of Current Fulfillment Value

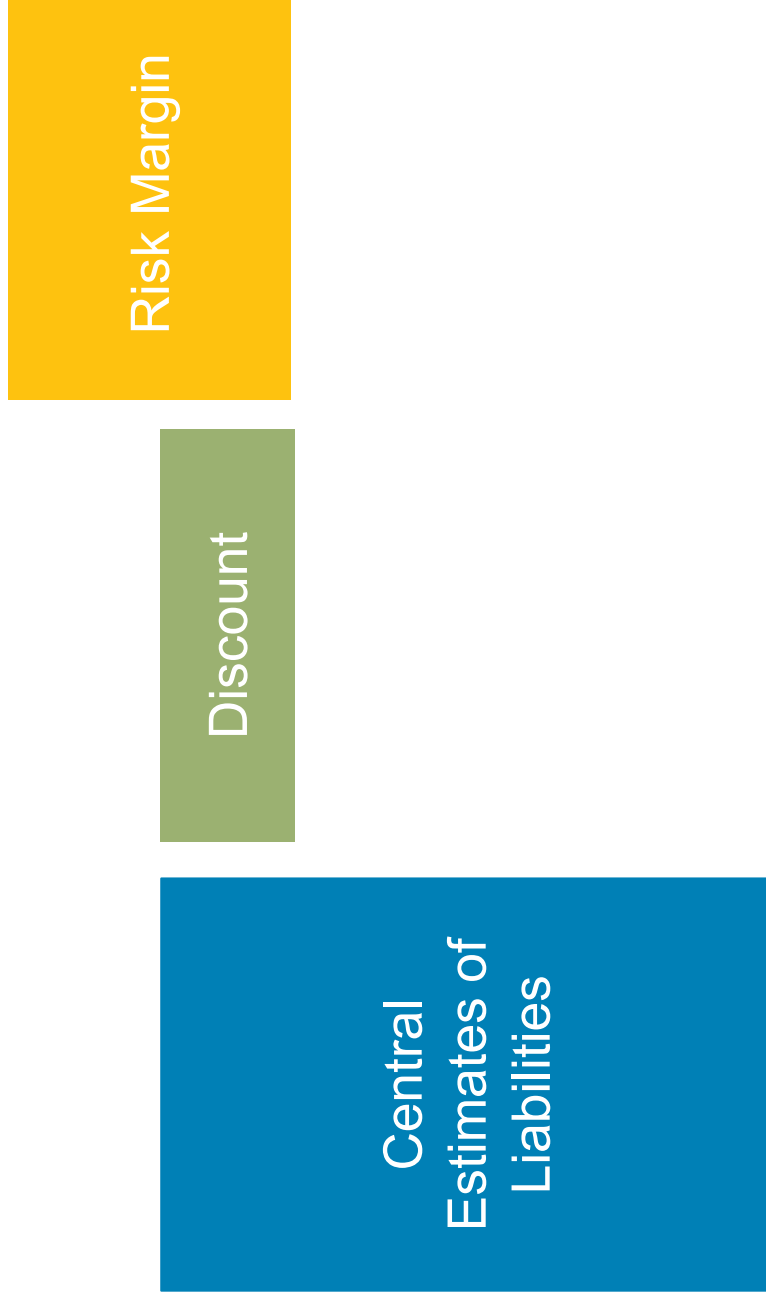
Four Components of Current Fulfillment Value

Central
Estimates of
Liabilities

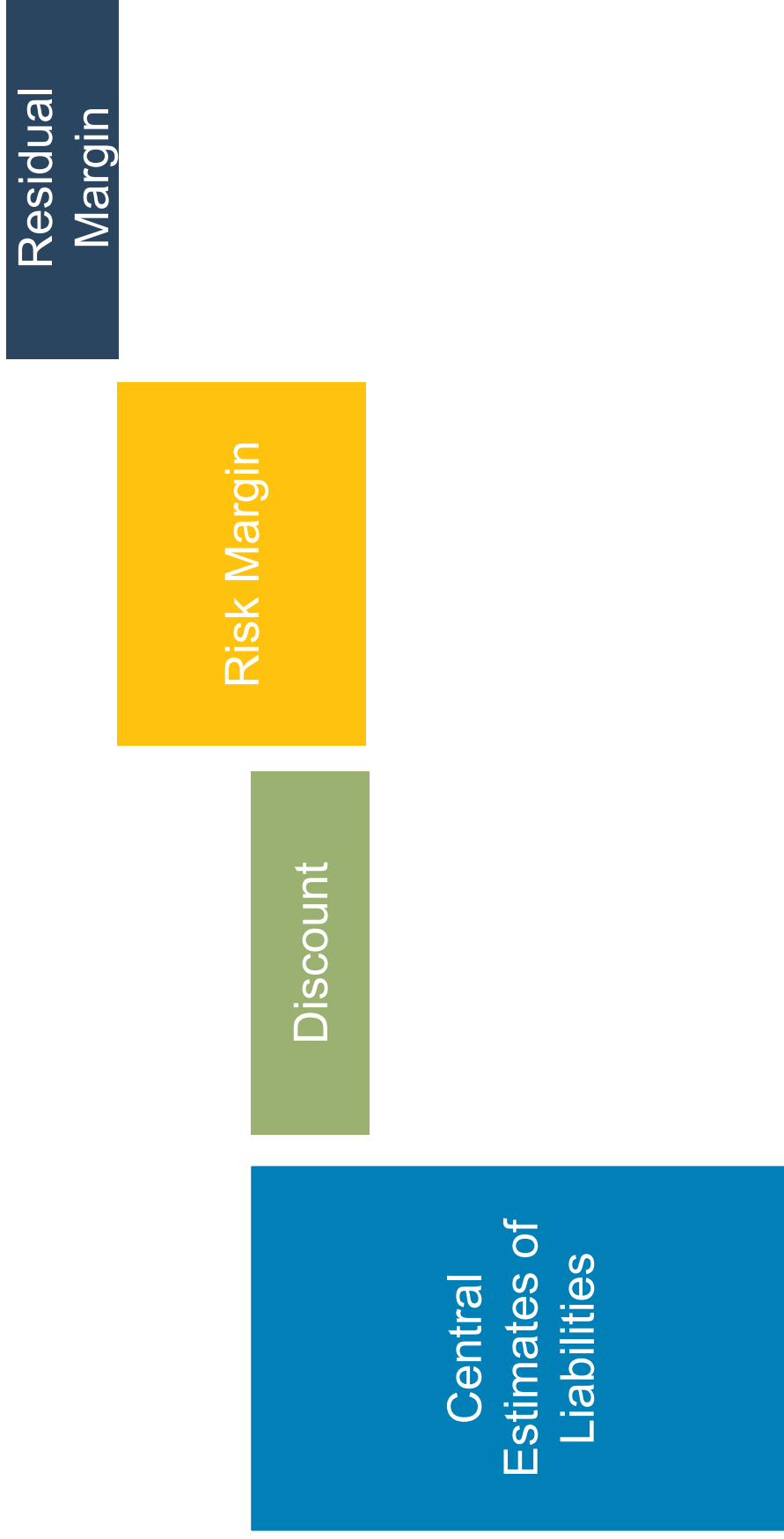
Four Components of Current Fulfillment Value



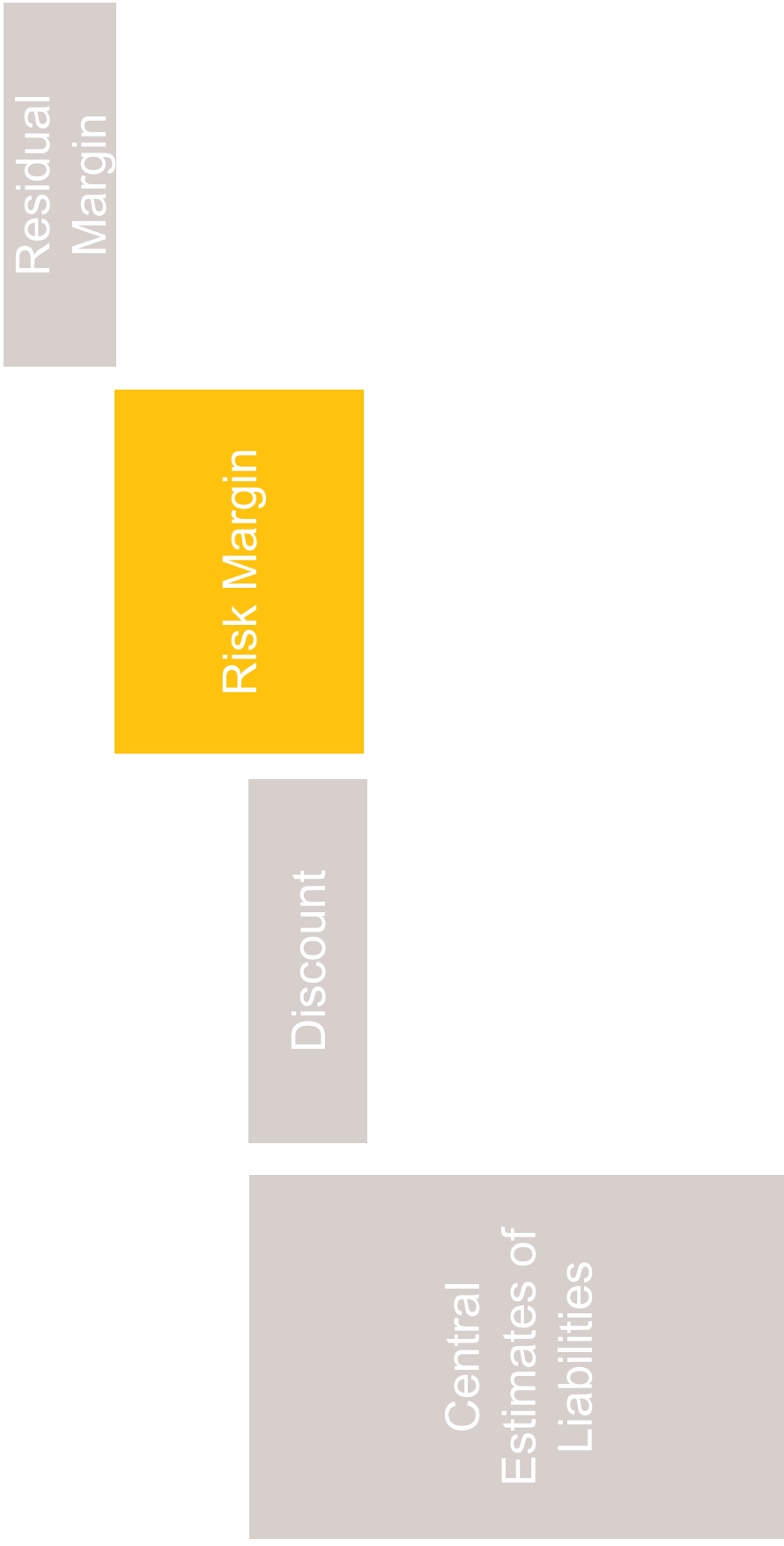
Four Components of Current Fulfillment Value



Four Components of Current Fulfillment Value



Four Components of Current Fulfillment Value



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■ Cost of Capital method

- Market value of liabilities?

■ Cost of Capital method

- Market value of liabilities?
- Market value of an asset

Selling you my General Liability book

Discounted reserves = \$236 million

1st offer: \$236 million

Selling you my General Liability book

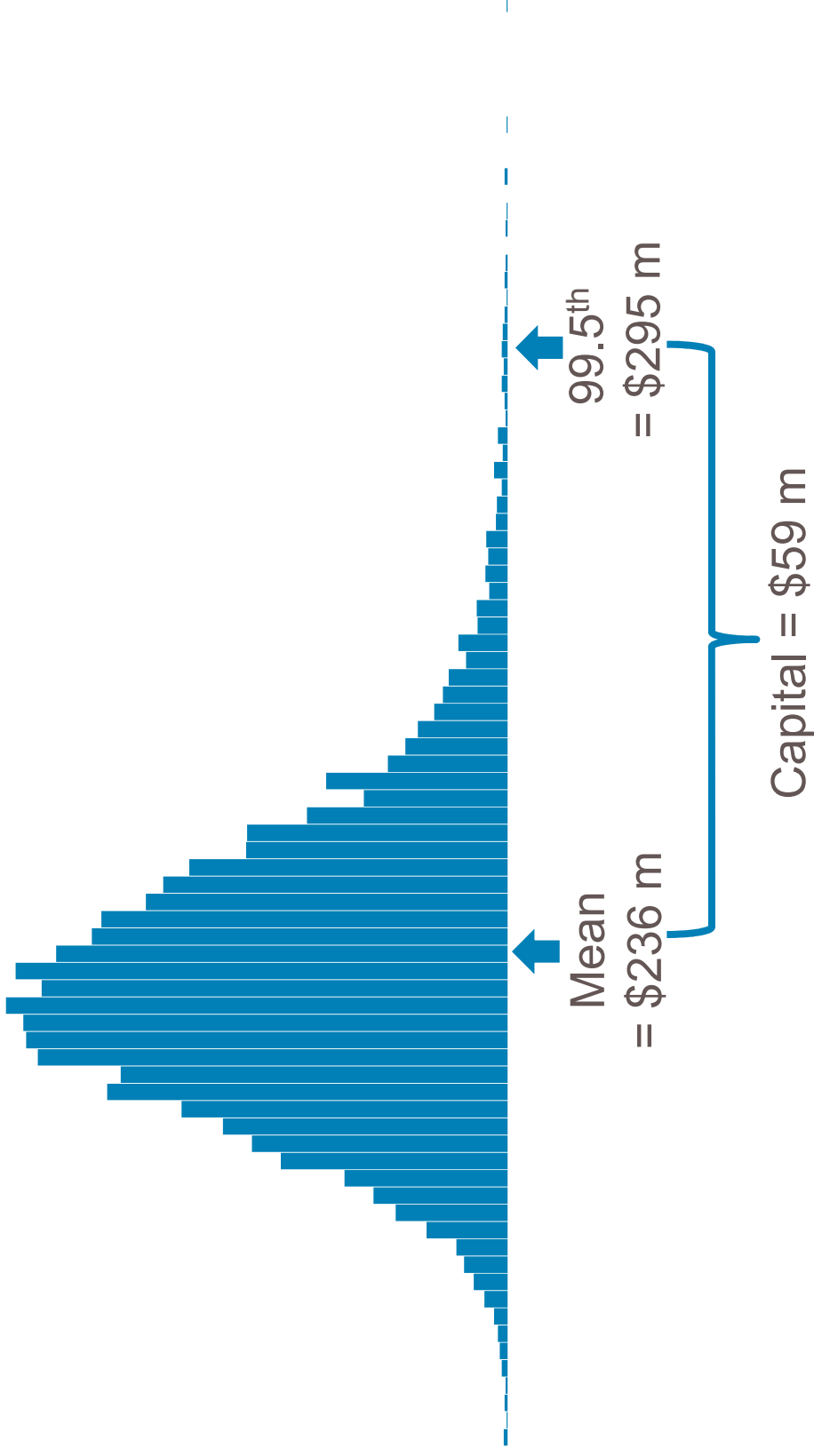
Discounted reserves = \$236 million

1st offer: \$236 million



TOO LOW

How much capital?



Selling you my General Liability book

Discounted reserves = \$236 million

1st offer: \$236 m



TOO LOW

2nd offer: \$236 m + \$59 m

Selling you my General Liability book

Discounted reserves = \$236 million

1st offer: \$236 m



TOO LOW

2nd offer: \$236 m + \$59 m



TOO HIGH

Selling you my General Liability book

Discounted reserves = \$236 million

1st offer: \$236 m



TOO LOW

2nd offer: \$236 m + \$59 m



TOO HIGH

\$236 m + ? = Market Value

Selling you my General Liability book

Discounted reserves = \$236 million

1st offer: \$236 m



TOO LOW

2nd offer: \$236 m + \$59 m



TOO HIGH

\$236 m + Risk Margin = Market Value

Transaction

Seller

\$B risk margin



\$59 m
Capital

Buyer

\$A investment

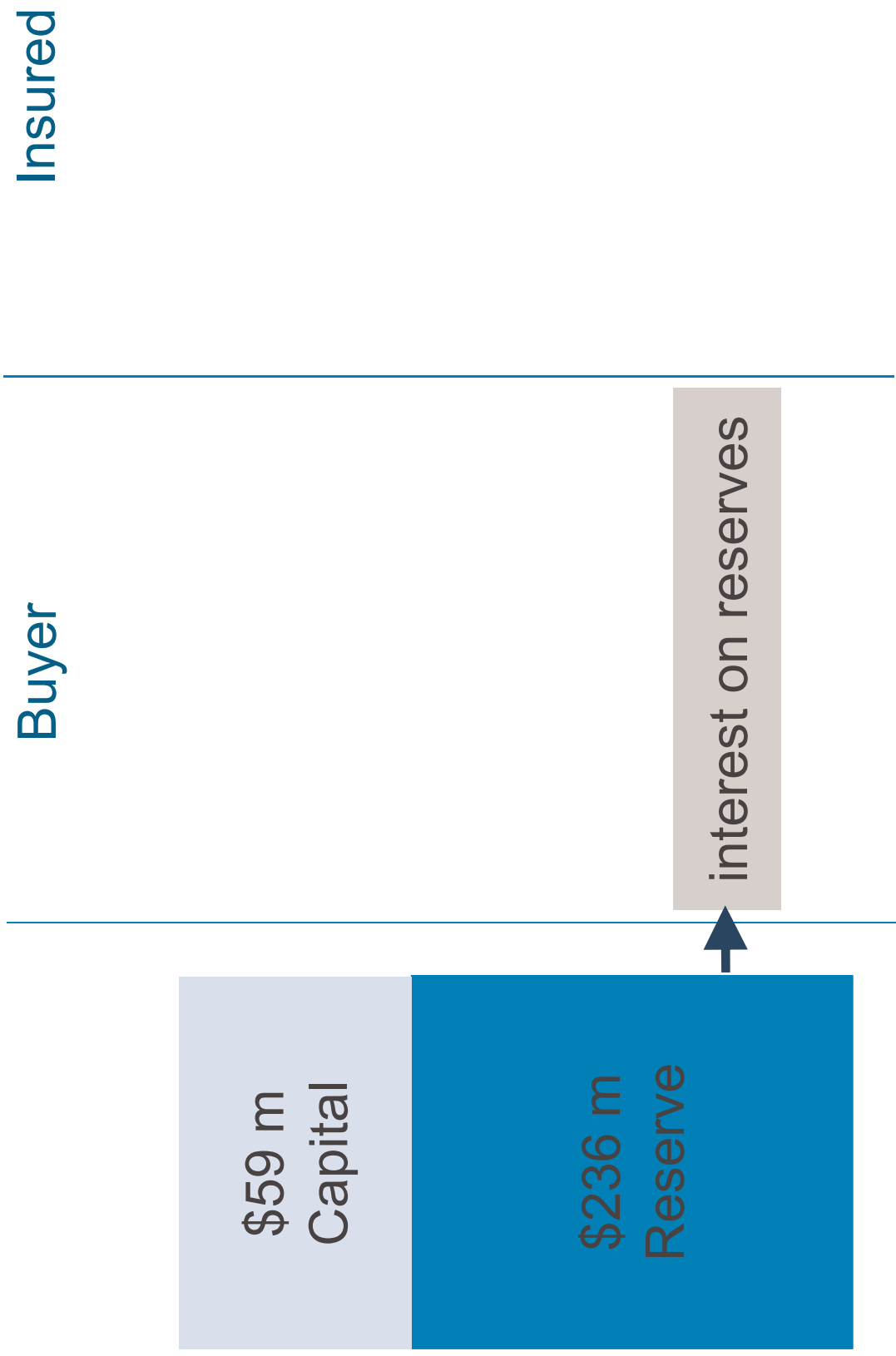


\$236 m
Reserve

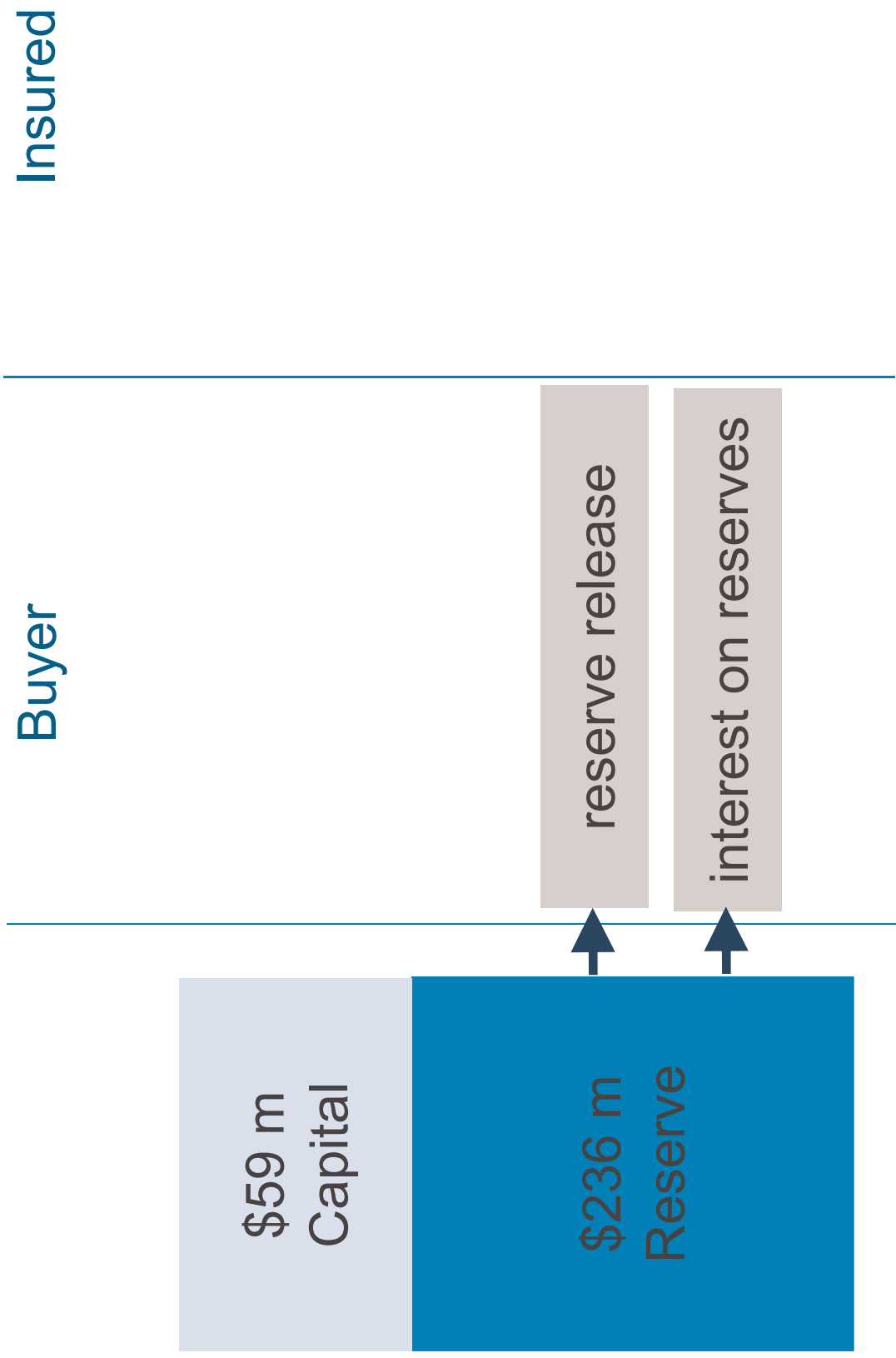


\$236 m

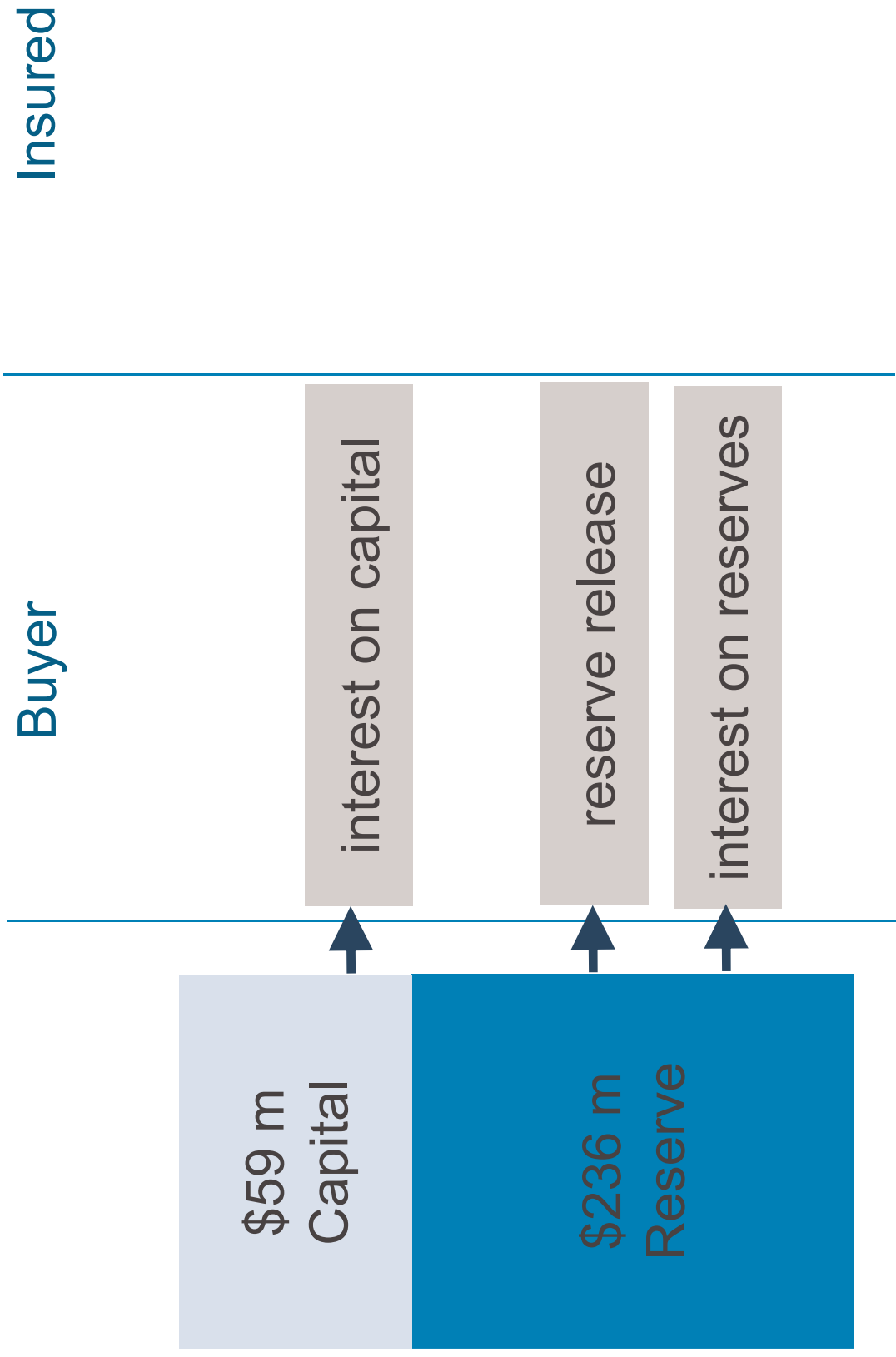
Future Cash Flows



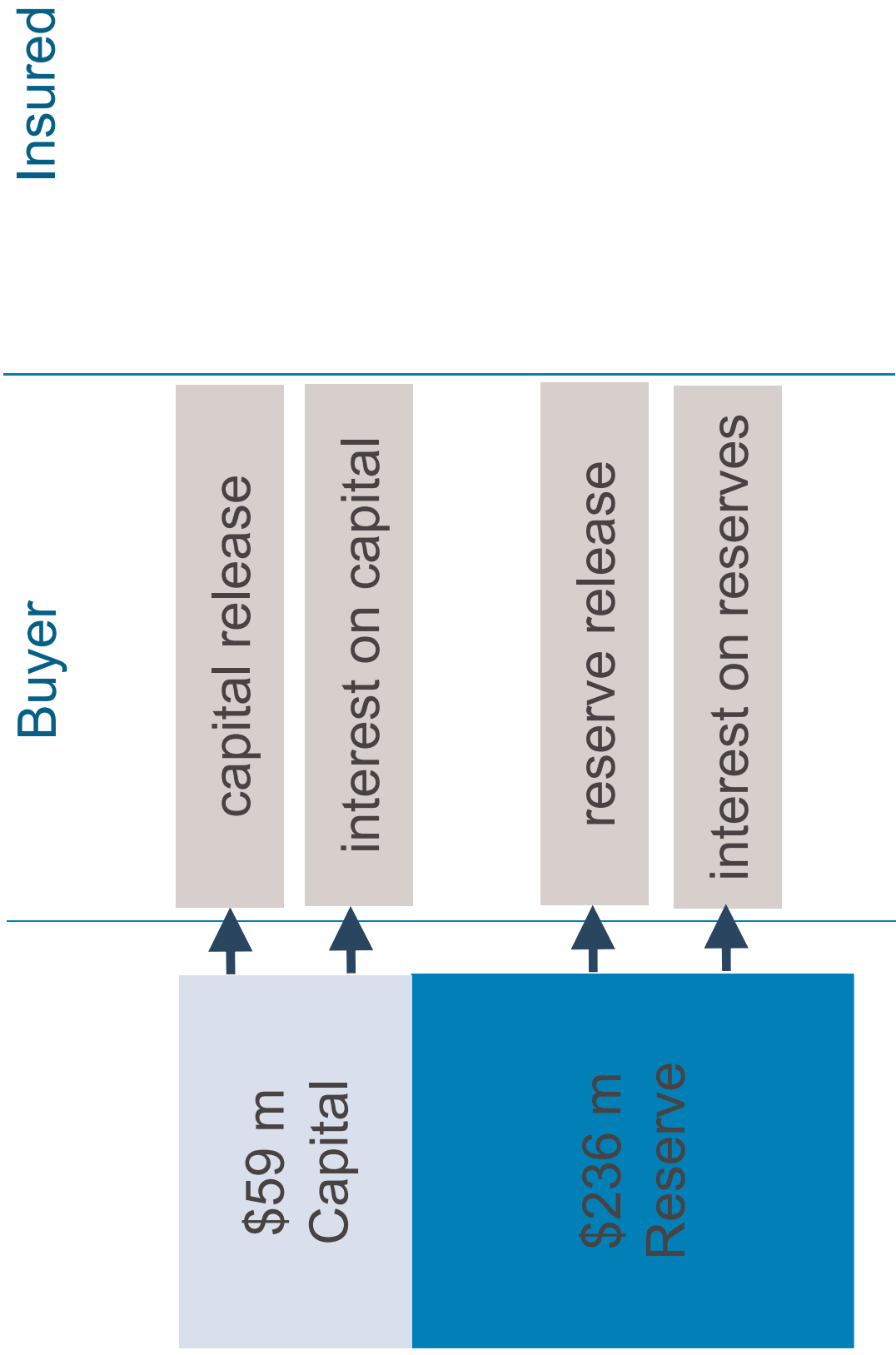
Future Cash Flows



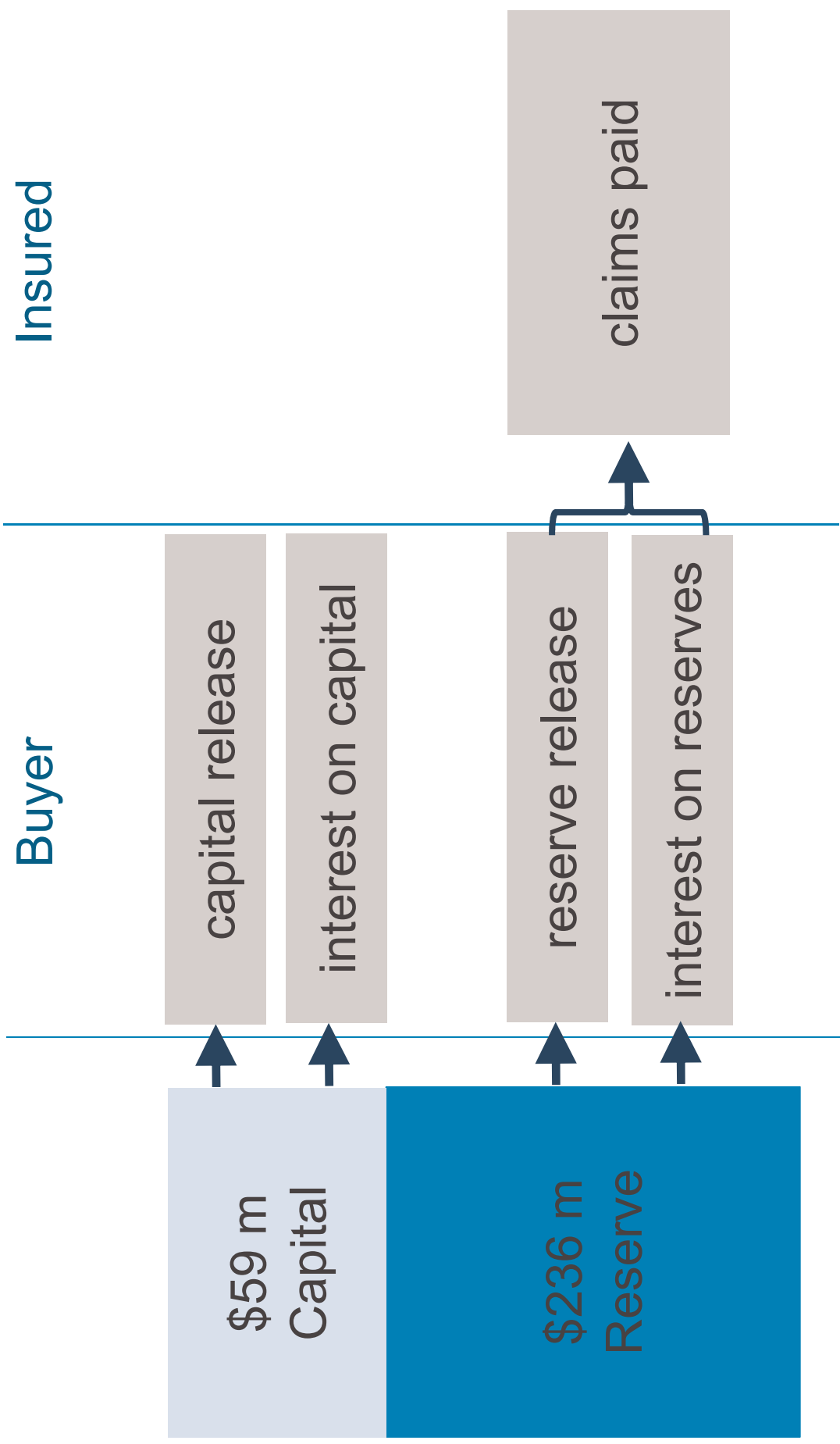
Future Cash Flows



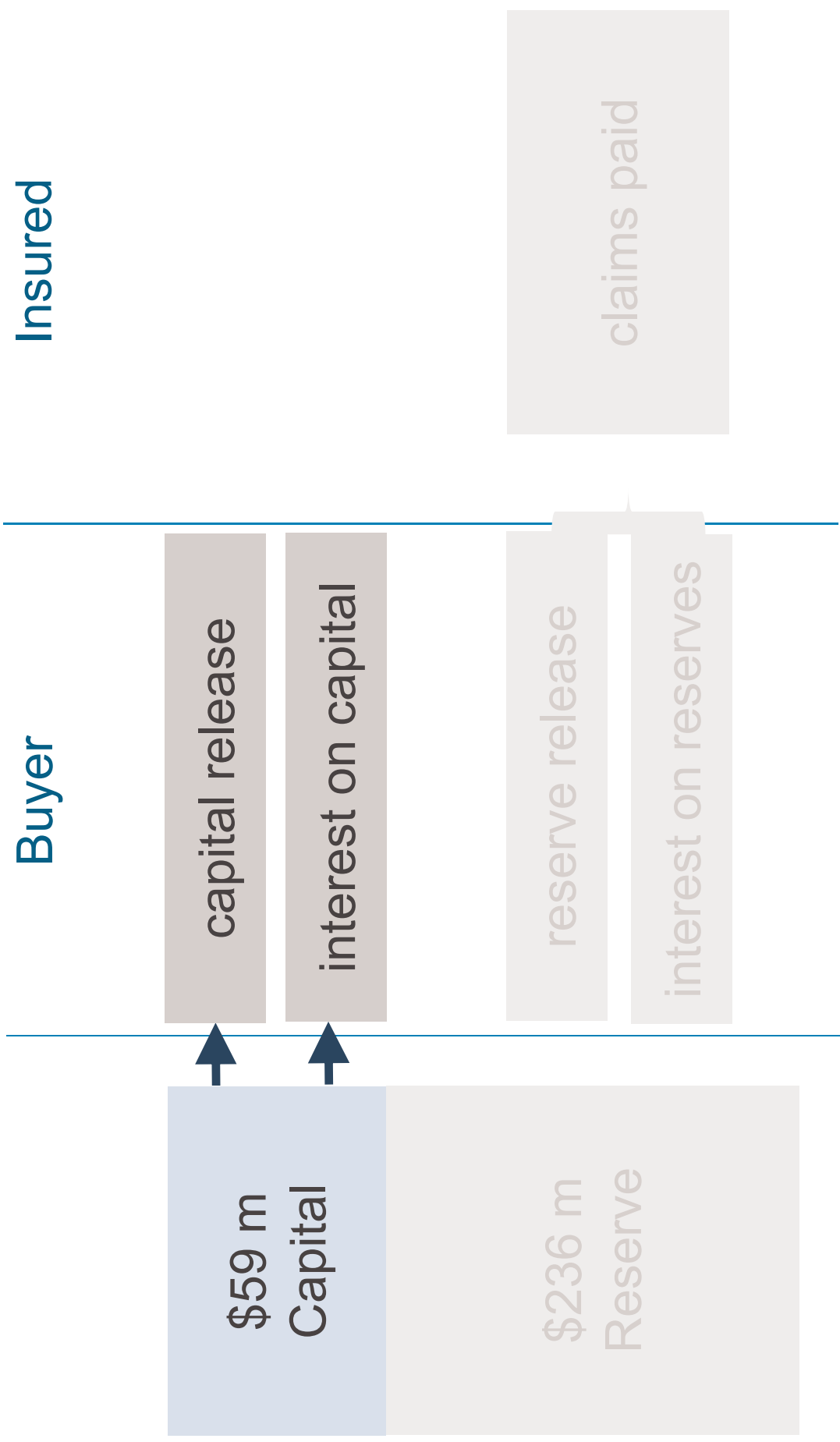
Future Cash Flows



Future Cash Flows



Future Cash Flows



Expected Future Net Cash Flow

Yr	Capital Release	Interest on Capital	Net Cash Flow
1	(1)	(2)	$(3) = (1) + (2)$
2			
...			
34			
35			

Expected Future Net Cash Flow

Yr	Capital Release	Interest on Capital	Net Cash Flow
1	(1)	(2)	(3) = (1) + (2)
2			
...			
34			
35			

Expected Future Net Cash Flow

Yr	Capital Release	Interest on Capital	Net Cash Flow
1	(1)	(2)	(3) = (1) + (2)
2	\$59.0	– Capital (1)	
...			
34			
35			

Expected Future Net Cash Flow

Yr	Capital Release	Interest on Capital	Net Cash Flow
1	(1)	(2)	(3) = (1) + (2)
2	\$59.0	-	\$52.3
...			
34			
35			

Expected Future Net Cash Flow

Yr	Capital Release	Interest on Capital	Net Cash Flow
1	(1)	(2)	(3) = (1) + (2)
2	\$6.7		
...			
34			
35			

Expected Future Net Cash Flow

Yr	Capital Release	Interest on Capital	Net Cash Flow
1	(1)	(2)	(3) = (1) + (2)
2	\$6.7	=Capital (0) * rf	
...			
34			
35			

Expected Future Net Cash Flow

Yr	Capital Release	Interest on Capital	Net Cash Flow
1	(1)	(2)	(3) = (1) + (2)
2	\$6.7	= \$59 * 4%	
...			
34			
35			

Expected Future Net Cash Flow

Yr	Capital Release	Interest on Capital	Net Cash Flow
1	(1)	(2)	(3) = (1) + (2)
2	\$6.7	\$2.3	
...			
34			
35			

Expected Future Net Cash Flow

Yr	Capital Release	Interest on Capital	Net Cash Flow
1	(1)	(2)	(3) = (1) + (2)
2	\$6.7	\$2.3	\$9.0
...			
34			
35			

Expected Future Net Cash Flow

Yr	Capital Release	Interest on Capital	Net Cash Flow
	(1)	(2)	(3) = (1) + (2)
1	\$6.7	\$2.3	\$9.0
2	\$5.9	\$2.1	\$8.0
...		
34			\$0.3
35			\$0.3

Expected Future Net Cash Flow

Yr	Capital Release	Interest on Capital	Net Cash Flow
	(1)	(2)	(3) = (1) + (2)
1	\$6.7	\$2.3	\$9.0
2	\$5.9	\$2.1	\$8.0
...		
34			\$0.3
35			\$0.3

Expected Future Net Cash Flow

Yr	Capital Release	Interest on Capital	Net Cash Flow	Discounted Net Cash Flow
	(1)	(2)	(3) = (1) + (2)	(4)
1	\$6.7	\$2.3	\$9.0	$=\$9.0 * 1.10^{-1}$
2	\$5.9	\$2.1	\$8.0	$=\$8.0 * 1.10^{-2}$
...			
34			\$0.3	$=\$0.3 * 1.10^{-34}$
35			\$0.3	$=\$0.3 * 1.10^{-35}$

Expected Future Net Cash Flow

Yr	Capital Release	Interest on Capital	Net Cash Flow	Discounted Net Cash Flow
	(1)	(2)	(3) = (1) + (2)	(4)
1	\$6.7	\$2.3	\$9.0	$= \$9.0 * 1.10^{-1}$
2	\$5.9	\$2.1	\$8.0	$= \$8.0 * 1.10^{-2}$
...			
34			\$0.3	$= \$0.3 * 1.10^{-34}$
35			\$0.3	$= \$0.3 * 1.10^{-35}$
				= \$35 m

Transaction

Seller

\$ **B** risk margin



\$59 m
Capital

Buyer

\$ **35** investment



\$236 m
Reserve



\$236 m

Transaction

Seller

\$24 risk margin



\$59 m
Capital

Buyer

\$35 investment



\$236 m
Reserve



\$236 m

Selling you my General Liability book

Discounted reserves = \$236 million

1st offer: \$236 m



TOO LOW

2nd offer: \$236 m + \$59 m



TOO HIGH

3rd offer: \$236 m + \$24 m

Selling you my General Liability book

Discounted reserves = \$236 million

1st offer: \$236 m



TOO LOW

2nd offer: \$236 m + \$59 m



TOO HIGH

3rd offer: \$236 m + \$24 m



JUST RIGHT

■ Cost of capital equation

$$\text{\$24} = \text{\$59} - \text{\$35}$$

Cost of capital equation

$$\$24 = \$59 - \$35$$

Risk Margin = Capital₀ – What you will invest

Cost of capital equation

$$\$24 = \$59 - \$35$$

Risk Margin = Capital₀ – What you will invest

$$Risk\ Margin = Capital_0 - \sum \frac{What\ you\ get}{(1 + CoC)^{t+1}}$$

Cost of capital equation

$$\text{\$24} = \text{\$59} - \text{\$35}$$

Risk Margin = Capital₀ – What you will invest

$$\text{Risk Margin} = \text{Capital}_0 - \sum \frac{\text{What you get}}{(1 + \text{CoC})^{t+1}}$$

$$\text{Risk Margin} = \text{Capital}_0 - \sum_{t=0}^{n-1} \frac{(\text{Capital}_t - \text{Capital}_{t+1}) + \text{Capital}_t \times r_f}{(1 + \text{CoC})^{t+1}}$$

Cost of capital equation

$$\text{\$24} = \text{\$59} - \text{\$35}$$

Risk Margin = Capital₀ – What you will invest

$$\text{Risk Margin} = \text{Capital}_0 - \sum_{t=0}^{n-1} \frac{\text{What you get}}{(1 + \text{CoC})^{t+1}}$$

$$\text{Risk Margin} = \text{Capital}_0 - \sum_{t=0}^{n-1} \frac{(\text{Capital}_t - \text{Capital}_{t+1}) + \text{Capital}_t \times r_f}{(1 + \text{CoC})^{t+1}}$$

$$\text{Risk Margin} = \sum_{t=0}^{n-1} \frac{\text{Capital}_t (\text{CoC} - r_f)}{(1 + \text{CoC})^{t+1}}$$

Cost of capital equation

$$Risk\ Margin = \sum_{t=0}^{n-1} \frac{Capital_t (CoC - r_f)}{(1 + CoC)^{t+1}}$$

Cost of capital equation

Cost of Capital:

1. Calculate capital at each year-end
2. Multiply by the cost of capital less the risk-free rate
3. Discount at the cost of capital and sum

$$Risk\ Margin = \sum_{t=0}^{n-1} \frac{Capital_t(CoC - r_f)}{(1 + CoC)^{t+1}}$$

Simple Example – Cost of Capital Method

$n = 1$, $Capital(0) = \$100$, $Capital(1) = \$0$, $r_f = 4\%$, $CoC = 10\%$

$$Risk\ Margin = \sum_{t=0}^{n-1} \frac{Capital_t (CoC - r_f)}{(1 + CoC)^{t+1}}$$

Simple Example – Cost of Capital Method

$n = 1$, $\text{Capital}(0) = \$100$, $\text{Capital}(1) = \$0$, $r_f = 4\%$, $\text{CoC} = 10\%$

$$\begin{aligned} \text{Risk Margin} &= \sum_{t=0}^{n-1} \frac{\text{Capital}_t (\text{CoC} - r_f)}{(1 + \text{CoC})^{t+1}} \\ &= \frac{\$100 \times (10\% - 4\%)}{1.10} \end{aligned}$$

Simple Example – Cost of Capital Method

$n = 1$, $\text{Capital}(0) = \$100$, $\text{Capital}(1) = \$0$, $r_f = 4\%$, $\text{CoC} = 10\%$

$$\text{Risk Margin} = \sum_{t=0}^{n-1} \frac{\text{Capital}_t (\text{CoC} - r_f)}{(1 + \text{CoC})^{t+1}}$$

$$= \frac{\$100 \times (10\% - 4\%)}{1.10}$$

$$= \$5.45$$

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Solvency II Method

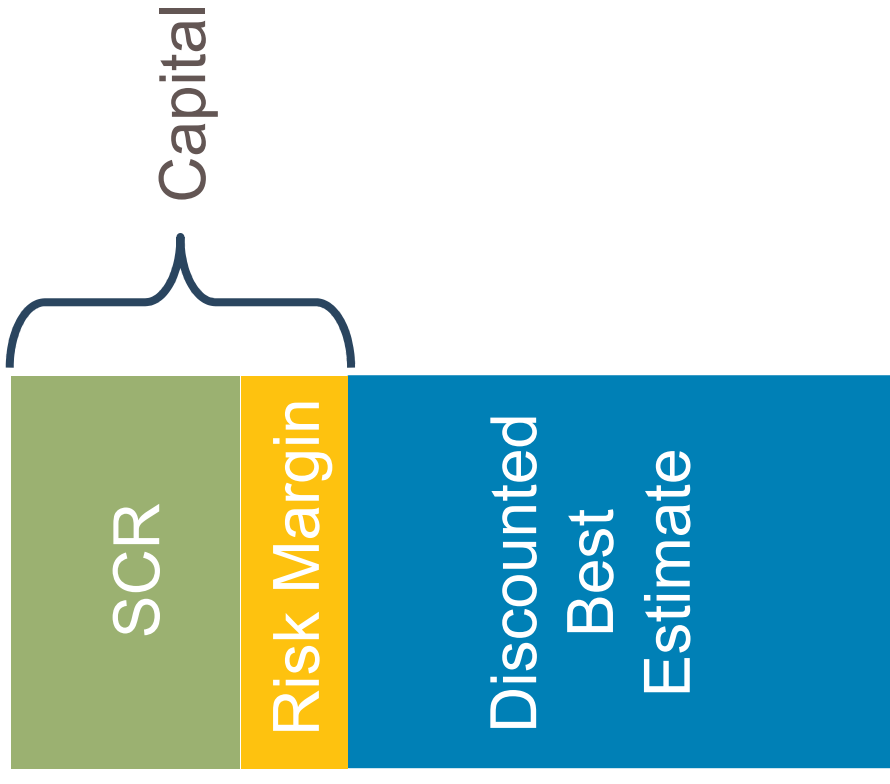
Solvency II:

1. Calculate SCR at each year-end
2. Multiply by the cost of capital less the risk-free rate
3. Discount at the risk-free rate and sum

Solvency II Method

Solvency II:

1. Calculate SCR at each year-end
2. Multiply by the cost of capital less the risk-free rate
3. Discount at the risk-free rate and sum



Solvency II Method

Solvency II:

1. Calculate **SCR** at each year-end
2. Multiply by the cost of capital less the risk-free rate
3. Discount at the **risk-free** rate and sum

IFRS cost of capital:

1. Calculate **capital** at each year-end
2. Multiply by the cost of capital less the risk-free rate
3. Discount at the **cost of capital** and sum

Solvency II Method

Solvency II:

$$Risk\ Margin = \sum_{t=0}^{n-1} \frac{SCR_t (CoC - r_f)}{(1 + r_f)^{t+1}}$$

IFRS cost of capital:

$$Risk\ Margin = \sum_{t=0}^{n-1} \frac{Capital_t (CoC - r_f)}{(1 + CoC)^{t+1}}$$

Simple Example – Solvency II Method

$n = 1$, $\text{Capital}(0) = \$100$, $\text{Capital}(1) = \$0$, $r_f = 4\%$, $\text{CoC} = 10\%$

$$\text{Risk Margin} = \sum_{t=0}^{n-1} \frac{\text{SCR}_t (\text{CoC} - r_f)}{(1 + r_f)^{t+1}}$$

Simple Example – Solvency II Method

$n = 1$, $\text{Capital}(0) = \$100$, $\text{Capital}(1) = \$0$, $r_f = 4\%$, $\text{CoC} = 10\%$

$$\text{Risk Margin} = \sum_{t=0}^{n-1} \frac{\text{SCR}_t (\text{CoC} - r_f)}{(1 + r_f)^{t+1}}$$

$$\text{Risk Margin} = \sum_{t=0}^{n-1} \frac{(\text{Capital}_t - \text{Risk Margin}_t) (\text{CoC} - r_f)}{(1 + r_f)^{t+1}}$$

Simple Example – Solvency II Method

$n = 1$, $\text{Capital}(0) = \$100$, $\text{Capital}(1) = \$0$, $r_f = 4\%$, $\text{CoC} = 10\%$

$$\text{Risk Margin} = \sum_{t=0}^{n-1} \frac{\text{SCR}_t (\text{CoC} - r_f)}{(1 + r_f)^{t+1}}$$

$$\text{Risk Margin} = \sum_{t=0}^{n-1} \frac{(\text{Capital}_t - \text{Risk Margin}_t) (\text{CoC} - r_f)}{(1 + r_f)^{t+1}}$$

$$\text{Risk Margin} = \frac{(\$100 - \text{Risk Margin})(10\% - 4\%)}{1.04}$$

Simple Example – Solvency II Method

$n = 1$, $\text{Capital}(0) = \$100$, $\text{Capital}(1) = \$0$, $r_f = 4\%$, $\text{CoC} = 10\%$

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$$\text{Risk Margin} = \sum_{t=0}^{n-1} \frac{(\text{Capital}_t - \text{Risk Margin}_t)(\text{CoC} - r_f)}{(1 + r_f)^{t+1}}$$

$$\text{Risk Margin} = \frac{(\$100 - \text{Risk Margin})(10\% - 4\%)}{1.04}$$

$$\text{Risk Margin} \times \frac{1.04}{0.06} + \text{Risk Margin} = \$100$$

Simple Example – Solvency II Method

$n = 1$, $\text{Capital}(0) = \$100$, $\text{Capital}(1) = \$0$, $r_f = 4\%$, $\text{CoC} = 10\%$

$$\text{Risk Margin} = \sum_{t=0}^{n-1} \frac{\text{SCR}_t (\text{CoC} - r_f)}{(1 + r_f)^{t+1}}$$

$$\text{Risk Margin} = \sum_{t=0}^{n-1} \frac{(\text{Capital}_t - \text{Risk Margin}_t)(\text{CoC} - r_f)}{(1 + r_f)^{t+1}}$$

$$\text{Risk Margin} = \frac{(\$100 - \text{Risk Margin})(10\% - 4\%)}{1.04}$$

$$\text{Risk Margin} \times \frac{1.04}{0.06} + \text{Risk Margin} = \$100$$

$$\text{Risk Margin} = \$5.45$$

Solvency II Method

Solvency II:

$$Risk\ Margin = \sum_{t=0}^{n-1} \frac{SCR_t (CoC - r_f)}{(1 + r_f)^{t+1}}$$

IFRS cost of capital:

$$Risk\ Margin = \sum_{t=0}^{n-1} \frac{Capital_t (CoC - r_f)}{(1 + CoC)^{t+1}}$$

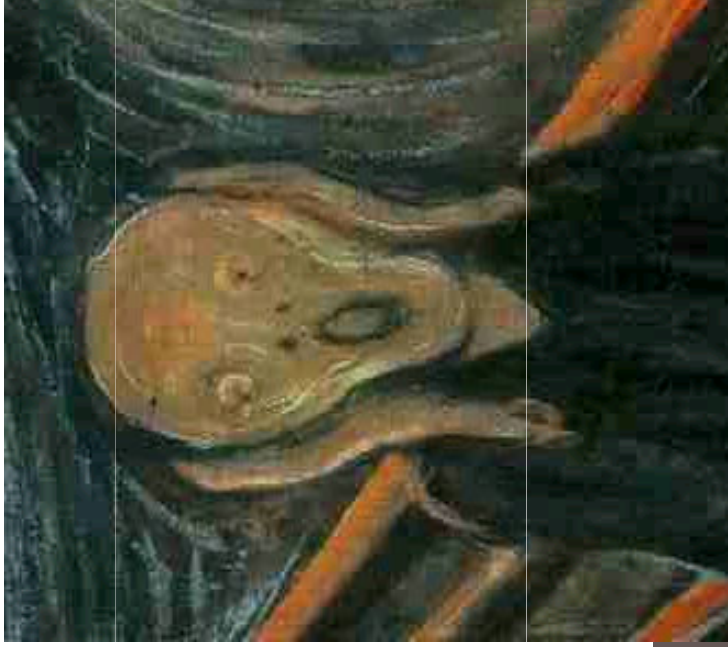
Solvency II Method

Solvency II:

$$Risk\ Margin = \sum_{t=0}^{n-1} \frac{SCR_t (CoC - r_f)}{(1 + r_f)^{t+1}}$$

IFRS cost of capital:

$$Risk\ Margin = \sum_{t=0}^{n-1} \frac{Capital_t (CoC - r_f)}{(1 + CoC)^{t+1}}$$



■ Solvency II Method & IFRS method

$$\text{Risk Margin} = \frac{SCR_0 \times (CoC - r_f)}{1 + r_f}$$

Solvency II

Solvency II Method & IFRS method

$$\text{Risk Margin} = \frac{SCR_0 \times (CoC - r_f)}{1 + r_f} \quad \text{Solvency II}$$

$$\text{Risk Margin} = \frac{(\text{Capital} - \text{Risk Margin})(CoC - r_f)}{1 + r_f}$$

Solvency II Method & IFRS method

$$\text{Risk Margin} = \frac{SCR_0 \times (CoC - r_f)}{1 + r_f} \quad \text{Solvency II}$$

$$\text{Risk Margin} = \frac{(\text{Capital} - \text{Risk Margin})(CoC - r_f)}{1 + r_f}$$

$$\text{Risk Margin} \times (1 + r_f) = (\text{Capital}_0 - \text{Risk Margin})(CoC - r_f)$$

Solvency II Method & IFRS method

$$\text{Risk Margin} = \frac{SCR_0 \times (CoC - r_f)}{1 + r_f} \quad \text{Solvency II}$$

$$\text{Risk Margin} = \frac{(\text{Capital} - \text{Risk Margin})(CoC - r_f)}{1 + r_f}$$

$$\text{Risk Margin} \times (1 + r_f) = (\text{Capital}_0 - \text{Risk Margin})(CoC - r_f)$$

$$\text{Risk Margin} \times (1 + r_f + CoC - r_f) = \text{Capital}_0(CoC - r_f)$$

Solvency II Method & IFRS method

$$\text{Risk Margin} = \frac{SCR_0 \times (CoC - r_f)}{1 + r_f} \quad \text{Solvency II}$$

$$\text{Risk Margin} = \frac{(\text{Capital} - \text{Risk Margin})(CoC - r_f)}{1 + r_f}$$

$$\text{Risk Margin} \times (1 + r_f) = (\text{Capital}_0 - \text{Risk Margin})(CoC - r_f)$$

$$\text{Risk Margin} \times (1 + r_f + CoC - r_f) = \text{Capital}_0(CoC - r_f)$$

$$\text{Risk Margin} = \frac{\text{Capital}_0 \times (CoC - r_f)}{1 + CoC}$$

Solvency II Method & IFRS method

$$\text{Risk Margin} = \frac{\text{SCR}_0 \times (\text{CoC} - r_f)}{1 + r_f} \quad \text{Solvency II}$$

$$\text{Risk Margin} = \frac{(\text{Capital} - \text{Risk Margin})(\text{CoC} - r_f)}{1 + r_f}$$

$$\text{Risk Margin} \times (1 + r_f) = (\text{Capital}_0 - \text{Risk Margin})(\text{CoC} - r_f)$$

$$\text{Risk Margin} \times (1 + r_f + \text{CoC} - r_f) = \text{Capital}_0(\text{CoC} - r_f)$$

$$\text{Risk Margin} = \frac{\text{Capital}_0 \times (\text{CoC} - r_f)}{1 + \text{CoC}} \quad \text{IFRS}$$

Equation

First principles:

$$\text{Risk Margin} = \text{Capital}_0 - \sum_{t=0}^n \frac{(\text{Capital}_t - \text{Capital}_{t+1}) + \text{Capital}_t \times r_f}{(1 + \text{CoC})^t}$$

Equation

First principles:

$$\text{Risk Margin} = \text{Capital}_0 - \sum_{t=0}^n \frac{(\text{Capital}_t - \text{Capital}_{t+1}) + \text{Capital}_t \times r_f}{(1 + \text{CoC})^t}$$

Cost of Capital Method (IFRS):

$$\text{Risk Margin} = \sum_{t=0}^{n-1} \frac{\text{Capital}_t (\text{CoC} - r_f)}{(1 + \text{CoC})^{t+1}}$$

Equation

First principles:

$$\text{Risk Margin} = \text{Capital}_0 - \sum_{t=0}^n \frac{(\text{Capital}_t - \text{Capital}_{t+1}) + \text{Capital}_t \times r_f}{(1 + \text{CoC})^t}$$

Cost of Capital Method (IFRS):

$$\text{Risk Margin} = \sum_{t=0}^{n-1} \frac{\text{Capital}_t (\text{CoC} - r_f)}{(1 + \text{CoC})^{t+1}}$$

Cost of Capital Method (SII):

$$\text{Risk Margin} = \sum_{t=0}^{n-1} \frac{\text{SCR}_t (\text{CoC} - r_f)}{(1 + r_f)^{t+1}}$$

Solvency II Method & IFRS method: Differences

Solvency II:

- Capital at a one-year time horizon

IFRS

- Capital at an ultimate time horizon (?)

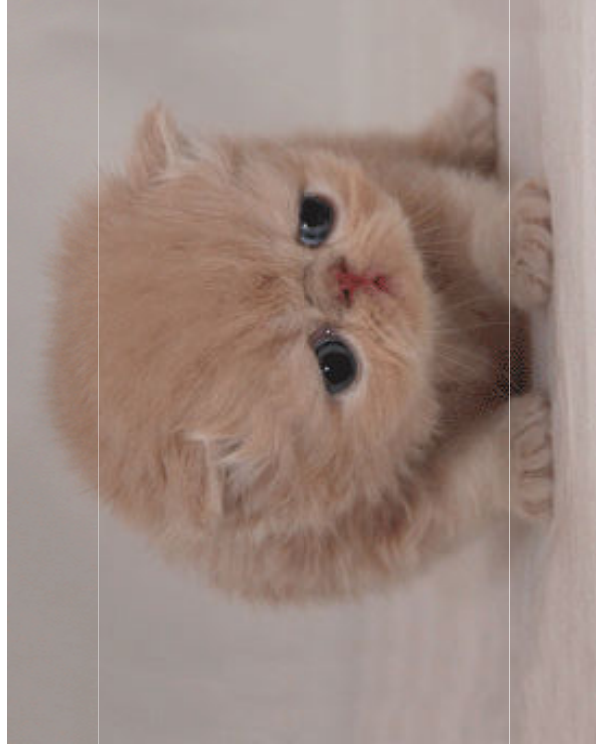
Solvency II Method & IFRS method: Differences

Solvency II:

- Capital at a one-year time horizon

IFRS

- Capital at an ultimate time horizon (?)



GUY CARPENTER

1. Overview of IASB's philosophy
2. IFRS cost of capital method
3. IFRS method versus Solvency II method