How to estimate Risk Adjustments under IFRS

2010 CAMAR Fall Meeting

Jessica Leong, FCAS, FIAA, MAAA
Consulting Actuary
December 2, 2010

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UNITED STATES OF AMERICA
IN GOD WE TRUST
LIBERTY
S
QUARTER DOLLAR

$0

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$0

-$200

Milliman

$0

-$200

Best Estimate -$100

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Milliman

+$9,800

Milliman

+$9,800

-$10,000

Milliman

+$9,800

-$10,000

Best Estimate -$100

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Risk Adjustments under IFRS

1. Liability Valuation under IFRS
2. Valuation from First Principles
3. Valuation using the Cost of Capital Method
4. Valuation using the Solvency II Method

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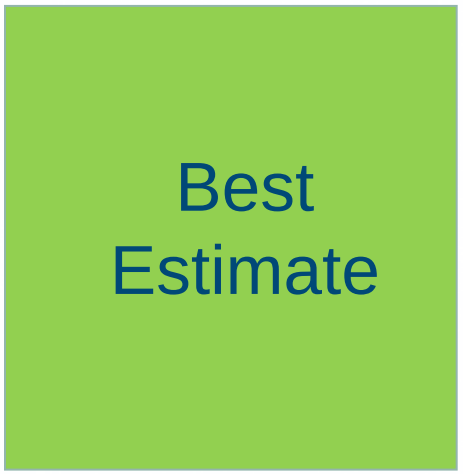
Liability Valuation under IFRS



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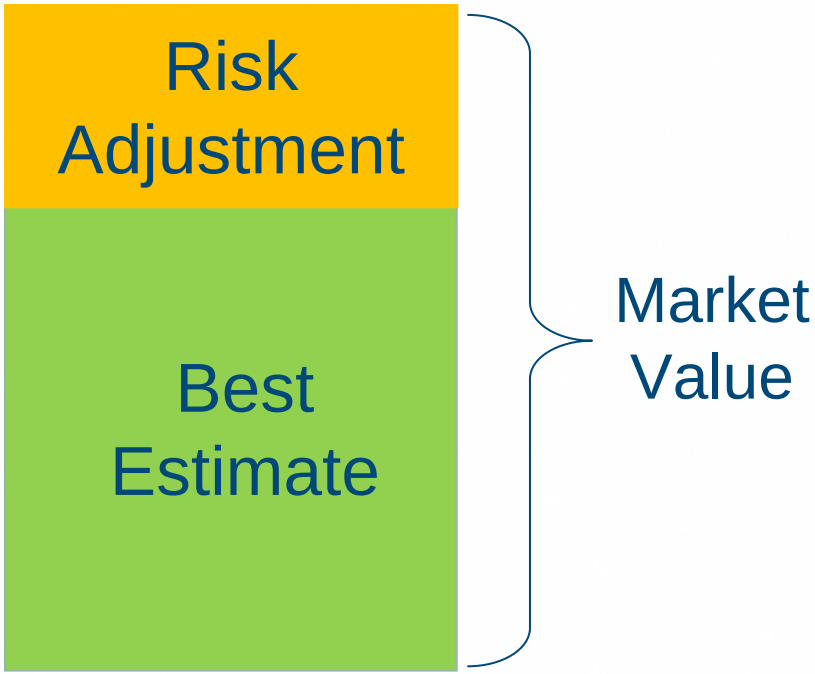
Liability Valuation under IFRS



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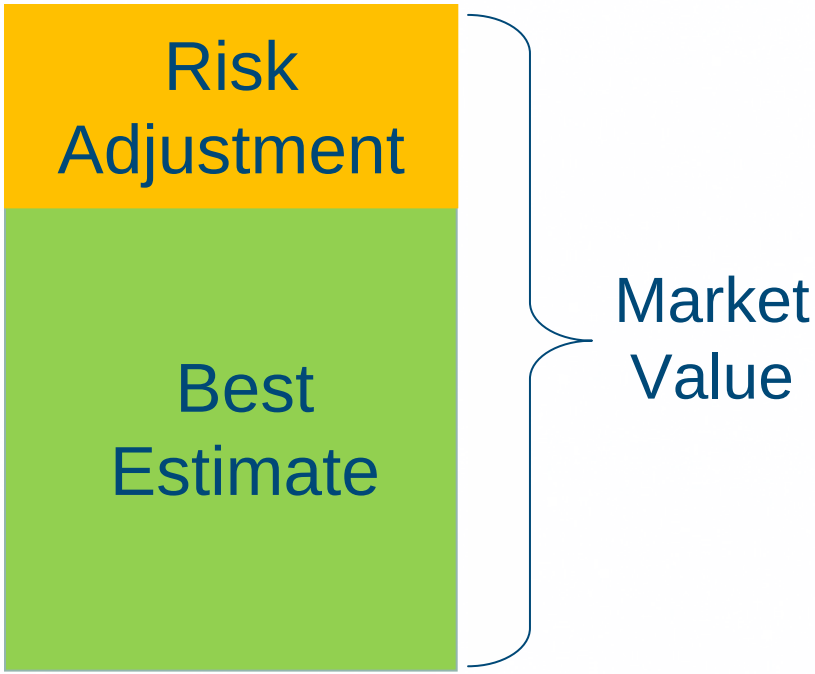
Liability Valuation under IFRS

Market Value



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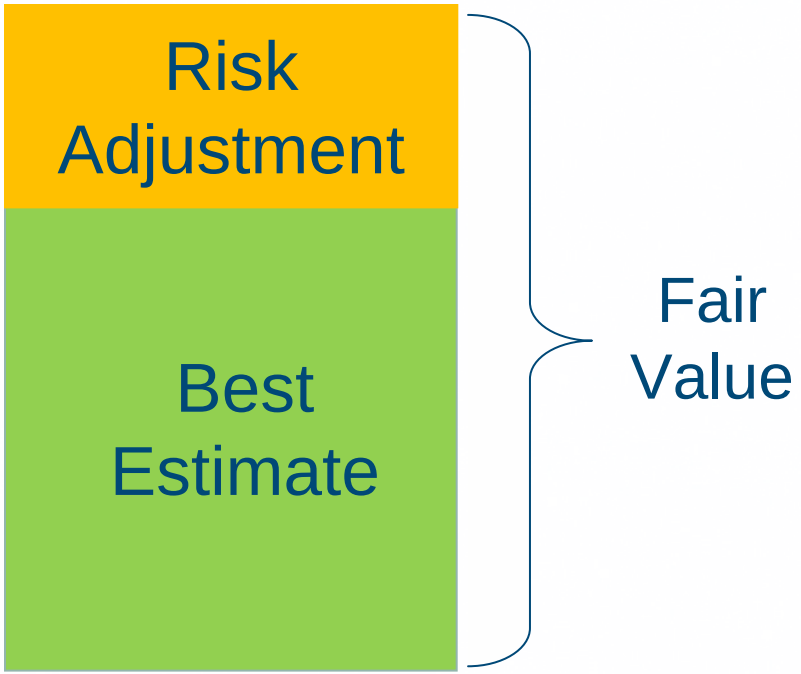
Liability Valuation under IFRS

Market Value

Fair Value



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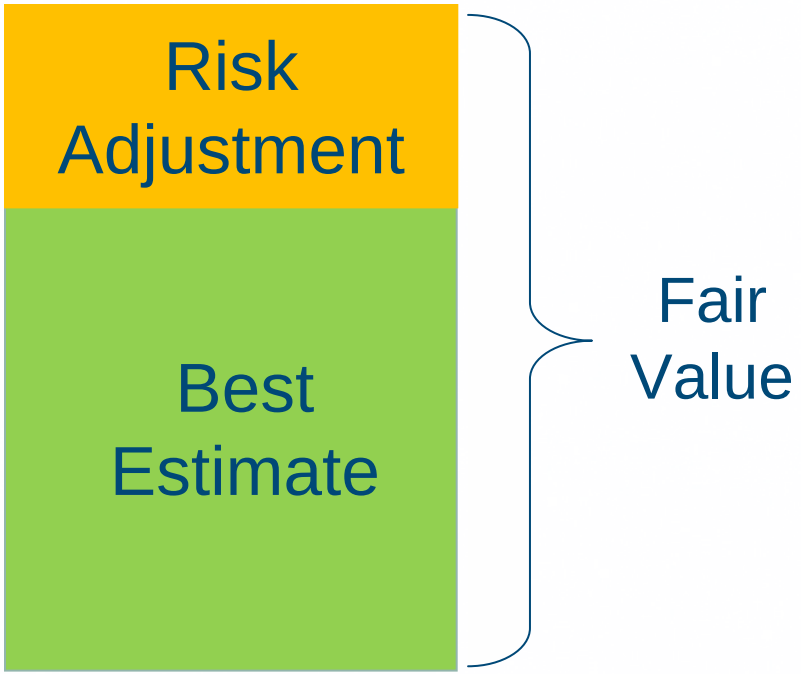
Liability Valuation under IFRS

Market Value

Fair Value (Exit Value)



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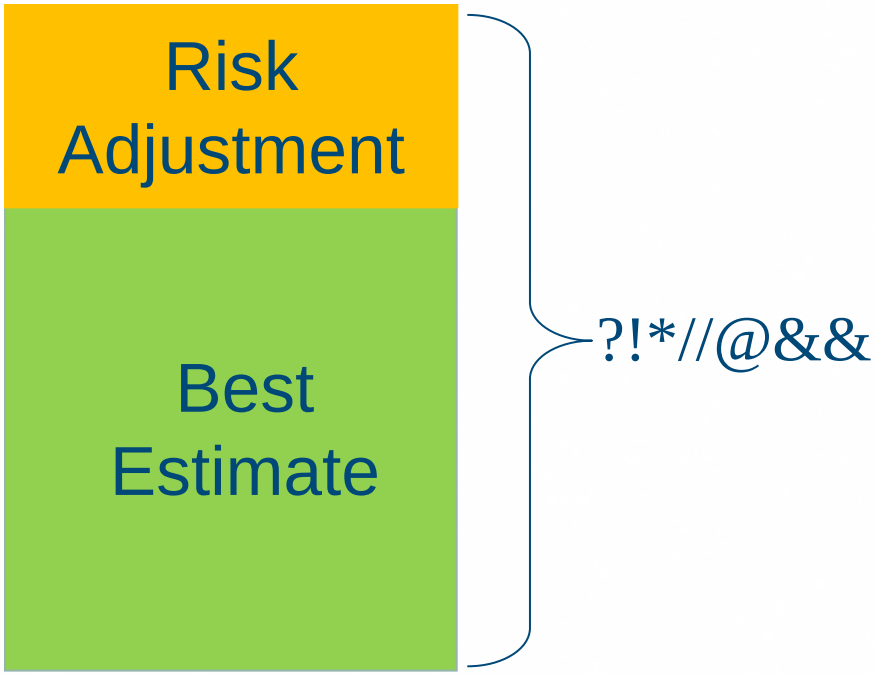
Liability Valuation under IFRS

Market Value

Fair Value (Exit Value)

?!*//@&&&



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Liability Valuation under IFRS

Market Value

Fair Value (Exit Value)

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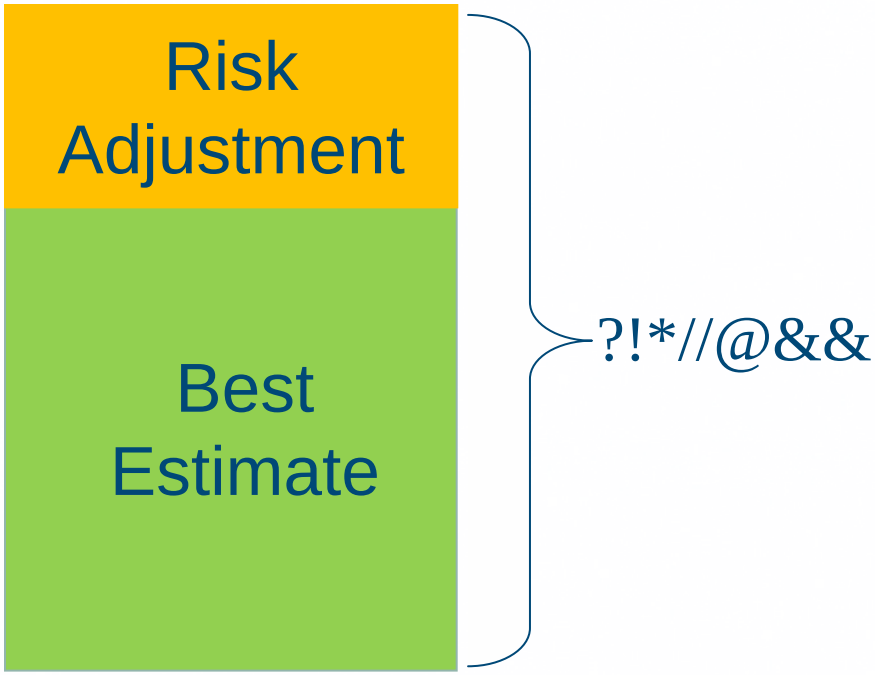

"The risk adjustment represents the maximum amount that an insurer would rationally pay to be relieved of the risk that the ultimate fulfillment cash flows exceed those expected."

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Liability Valuation under IFRS

Market Value

Fair Value (Exit Value)

?!*//@&&&

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How to Estimate Risk Adjustments under IFRS

2010

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What is the market value of a liability?

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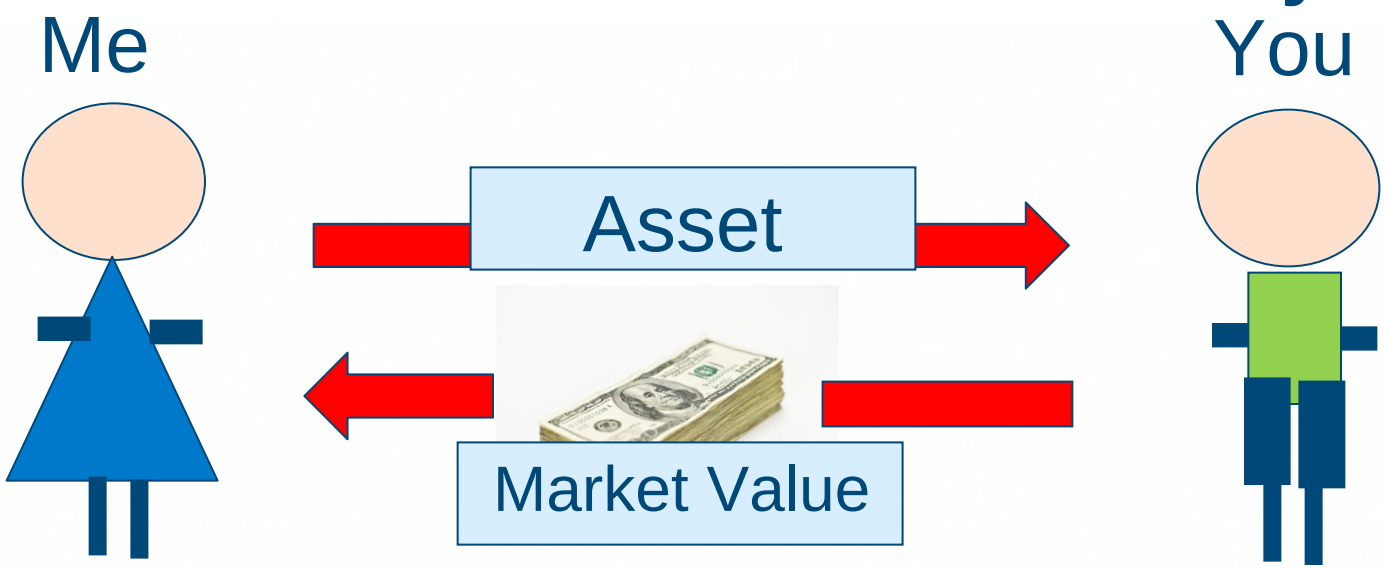
What is the market value of a liability?



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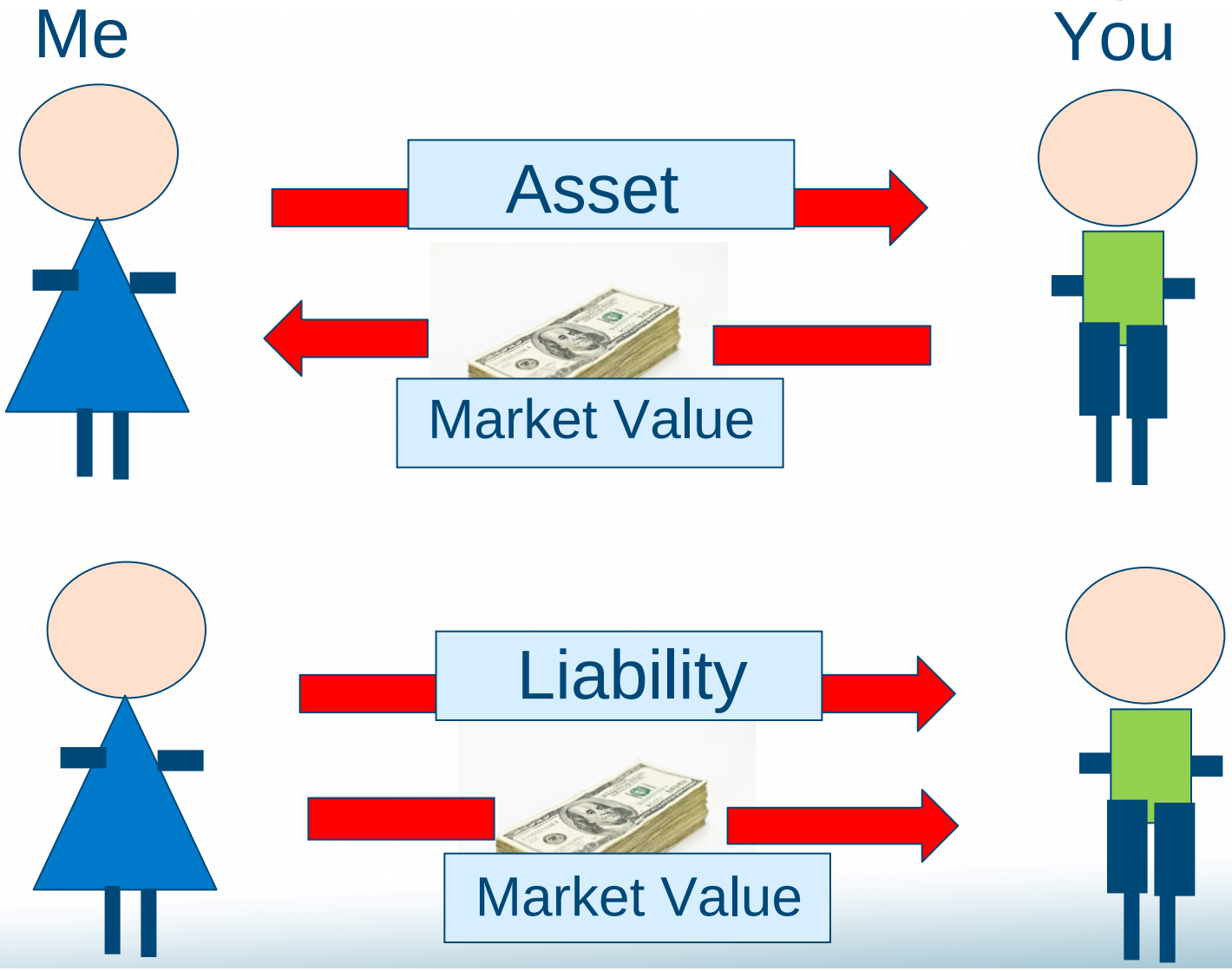
What is the market value of a liability?



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Selling you my GL book

Discounted reserves = $236 million

1st offer: $236 m

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Selling you my GL book

Discounted reserves = $236 million

1st offer: $236 m →

T

OO LOW

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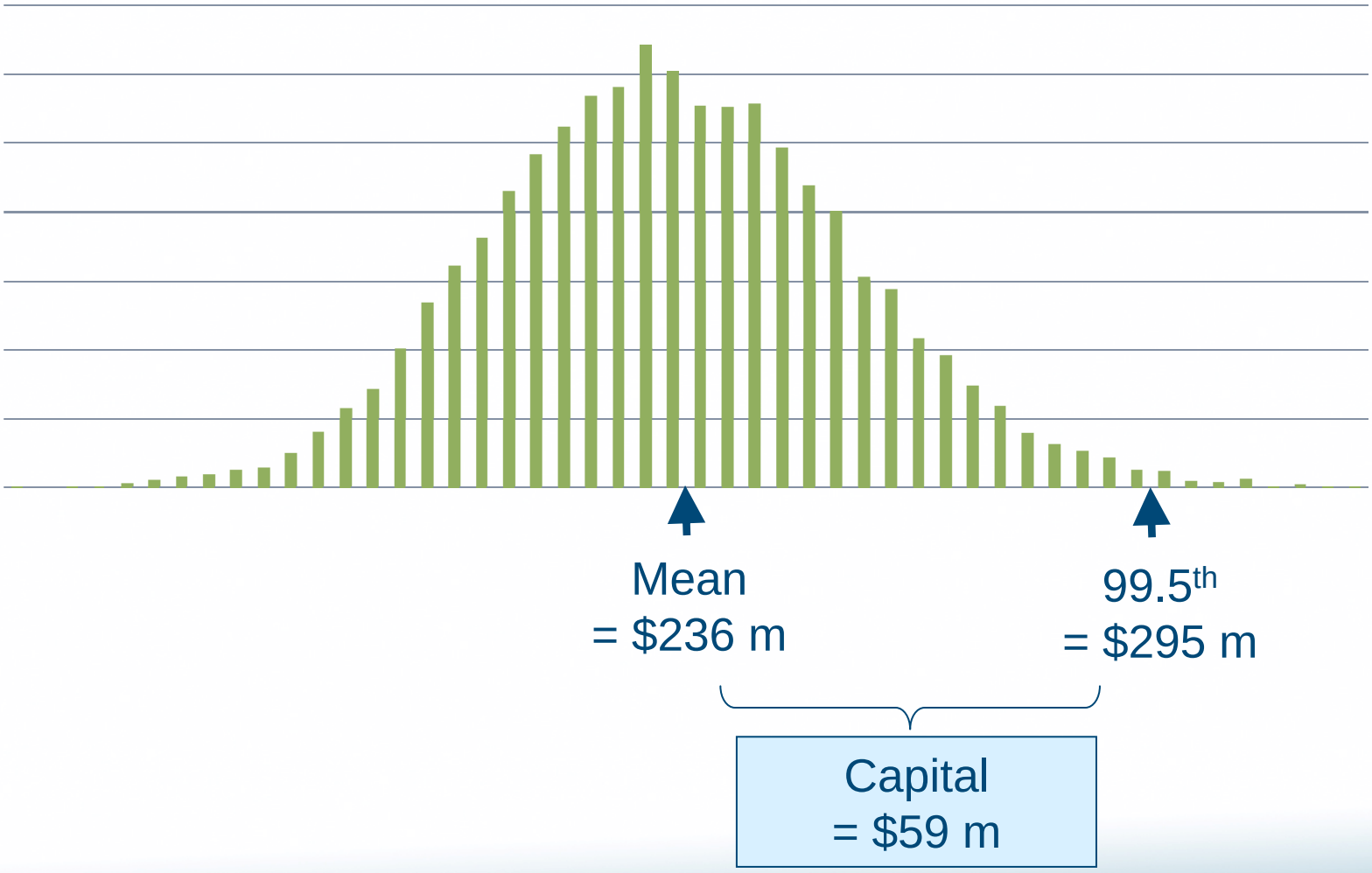
How much Capital?



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Discounted reserves = $236 million

1st offer: $236 m

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2nd offer: $236 m + $59 m

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Selling you my GL book

Discounted reserves = $236 million

1st offer: $236 m →

→ TOO LOW

2nd offer: $236 m + $59 m TOO HIGH

$236 m + ? = Market Value

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Selling you my GL book

Discounted reserves = $236 million

1st offer: $236 m → → TOO LOW

2nd offer: $236 m + $59 m TOO HIGH

$236 m + Risk Adjustment= Market Value

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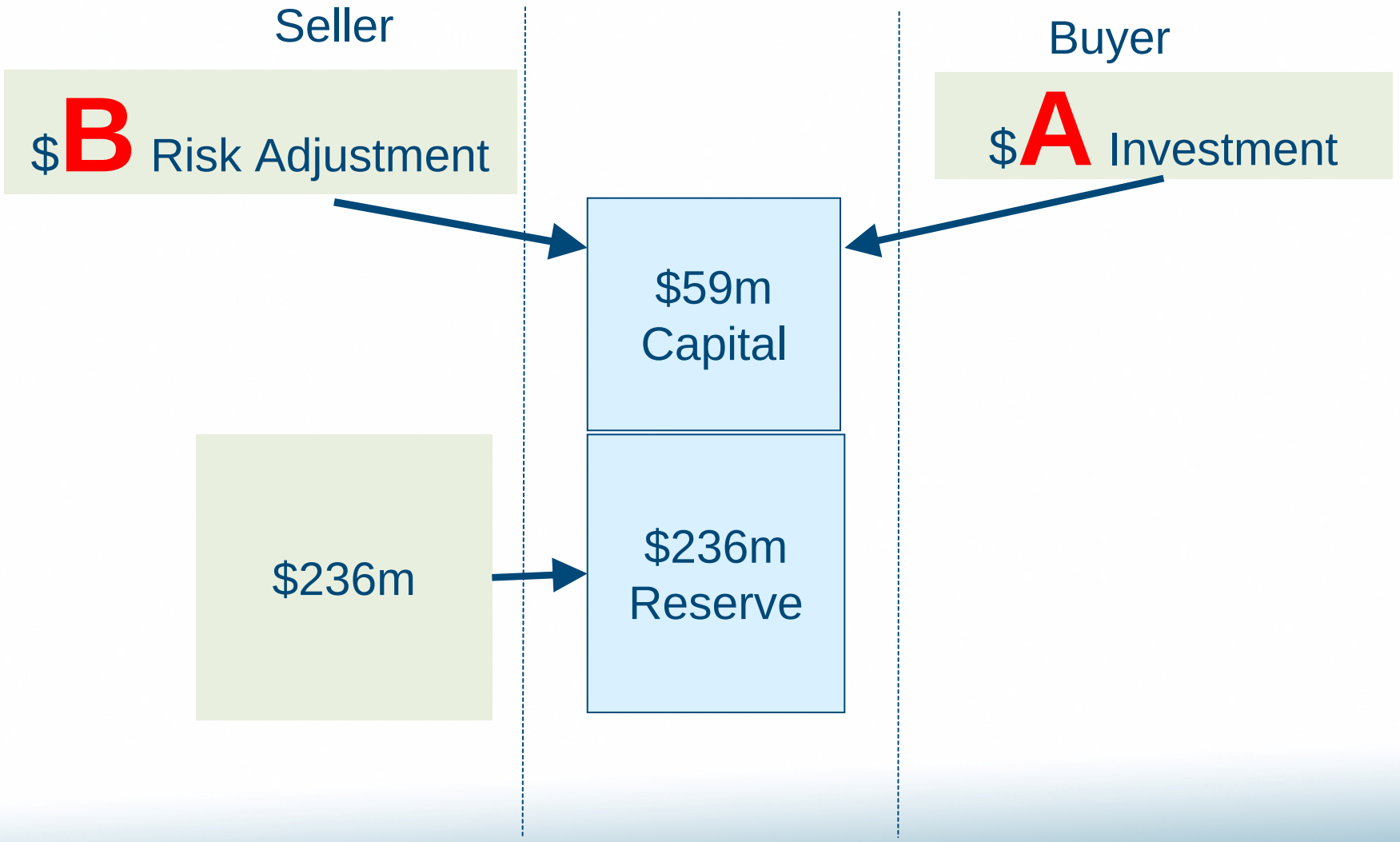
Transaction



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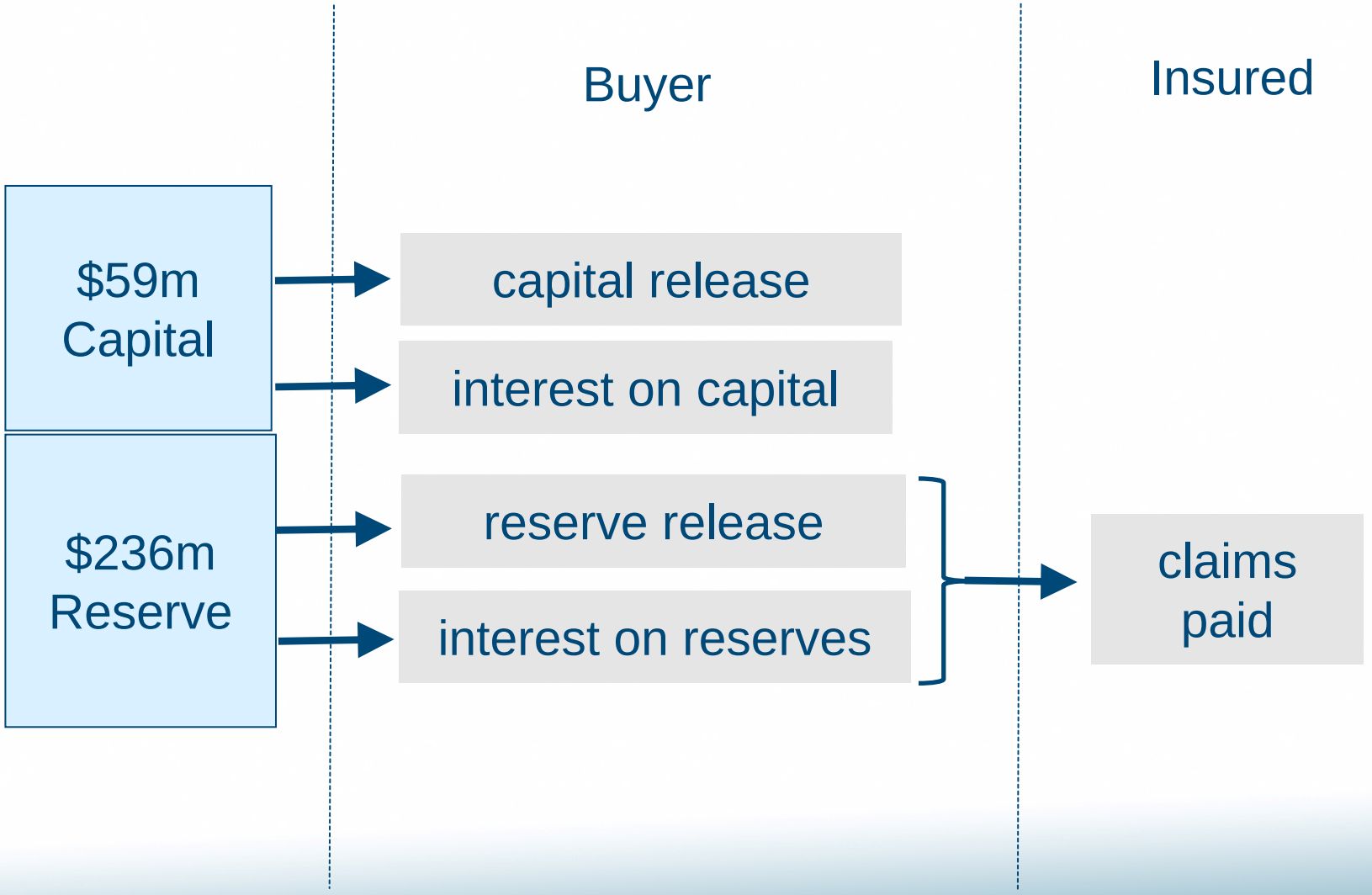
Future Cash Flows at each year-end



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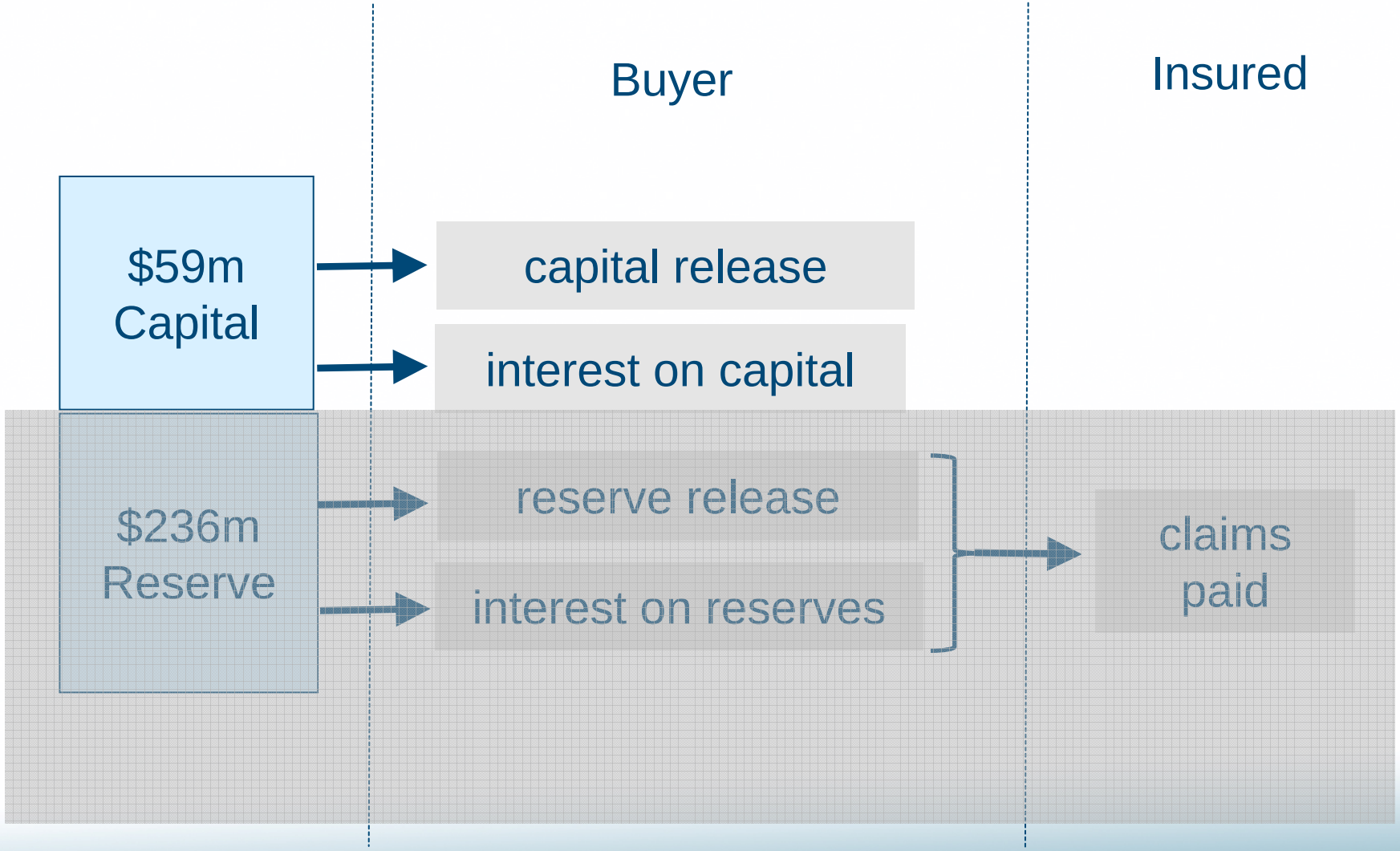
Future Cash Flows



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Expected Future Net Cash Flow Table

Yr	Capital Release	Interest on Capital	Net Cash flow
	(1)	(2)	(3) = (1) + (2)
1			
2			
3			
…			
…			
35			

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Expected Future Net Cash Flow Table

Yr	Capital Release	Interest on Capital	Net Cash flow
	(1)	(2)	(3) = (1) + (2)
1	?		
2			
3			
…			
…			
35			

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Cashflow at t = 1

Capital Release

= Capital at time 0 *less* Capital at time 1

Cashflow at t = 1

Capital Release

= Capital at time 0 *less* Capital at time 1

= $59.0 m *less* 99.5th perc of Reserves *less* Reserves

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Cashflow at t = 1

Capital Release

=	Capital at time 0	*less*	Capital at time 1
=	$59.0 m	*less*	99.5th perc of Reserves *less* Reserves
=	$59.0m	*less*	$52.3m

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Cashflow at t = 1

Capital Release

=	Capital at time 0	*less*	Capital at time 1
=	$59.0 m	*less*	99.5th perc of Reserves *less* Reserves
=	$59.0m	*less*	$52.3m
=	$6.7m		

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Expected Future Net Cash Flow Table

Yr	Capital Release	Interest on Capital	Net Cash flow
	(1)	(2)	(3) = (1) + (2)
1	$6.7		
2			
3			
…			
…			
35			

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Expected Future Net Cash Flow Table

Yr	Capital Release	Interest on Capital	Net Cash flow
	(1)	(2)	(3) = (1) + (2)
1	$6.7	?	
2			
3			
…			
…			
35			

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Cashflow at time 1

Interest on Capital

= Capital at time 0 x Risk free rate

=

$

59.0m x 4%

= $2.3m

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Expected Future Net Cash Flow Table

Yr	Capital Release	Interest on Capital	Net Cash flow
	(1)	(2)	(3) = (1) + (2)
1	$6.7	$2.3	
2			
3			
…			
…			
35			

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Expected Future Net Cash Flow Table

Yr	Capital Release	Interest on Capital	Net Cash flow
	(1)	(2)	(3) = (1) + (2)
1	$6.7	$2.3	$9.0
2			
3			
…			
…			
35			

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Expected Future Net Cash Flow Table

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
3			
…			
…			
35			

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Expected Future Net Cash Flow Table

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
3			…
…			…
34			$0.3
35			$0.3

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Expected Future Net Cash Flow Table

Yr	Net Cash flow	Discounted Net Cash flow at RRoC
1	$9.0	= $9.0 x 1.10^-1 = $8.2
2	$8.0	= $8.0 x 1.10^-2 = $6.6
…	…	…
34	$0.3	= $0.3 x 1.10^-34 = $0.0
35	$0.3	= $0.3 x 1.10^-35 = $0.0

Buyer's Investment = $35.0 m

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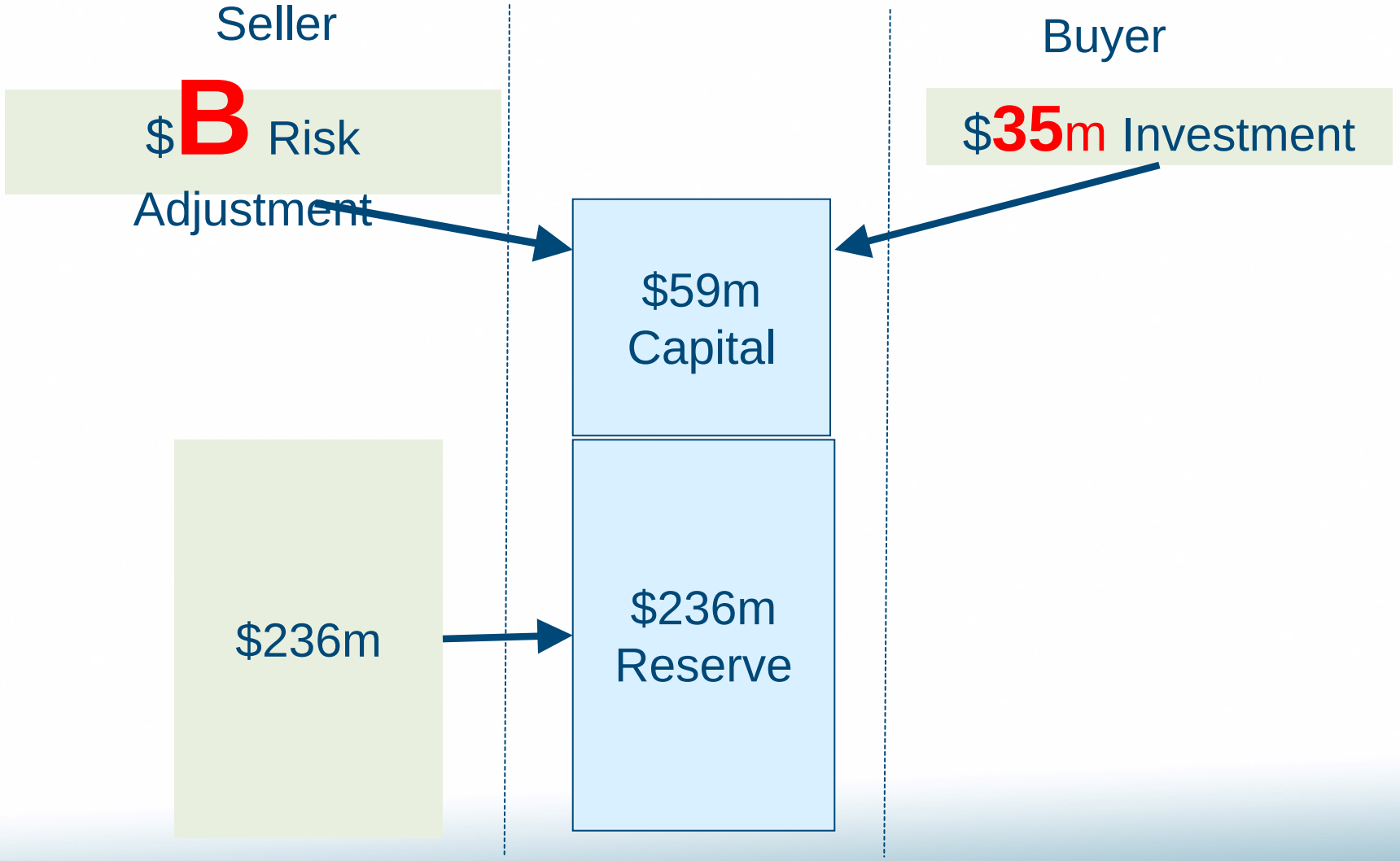
Transaction



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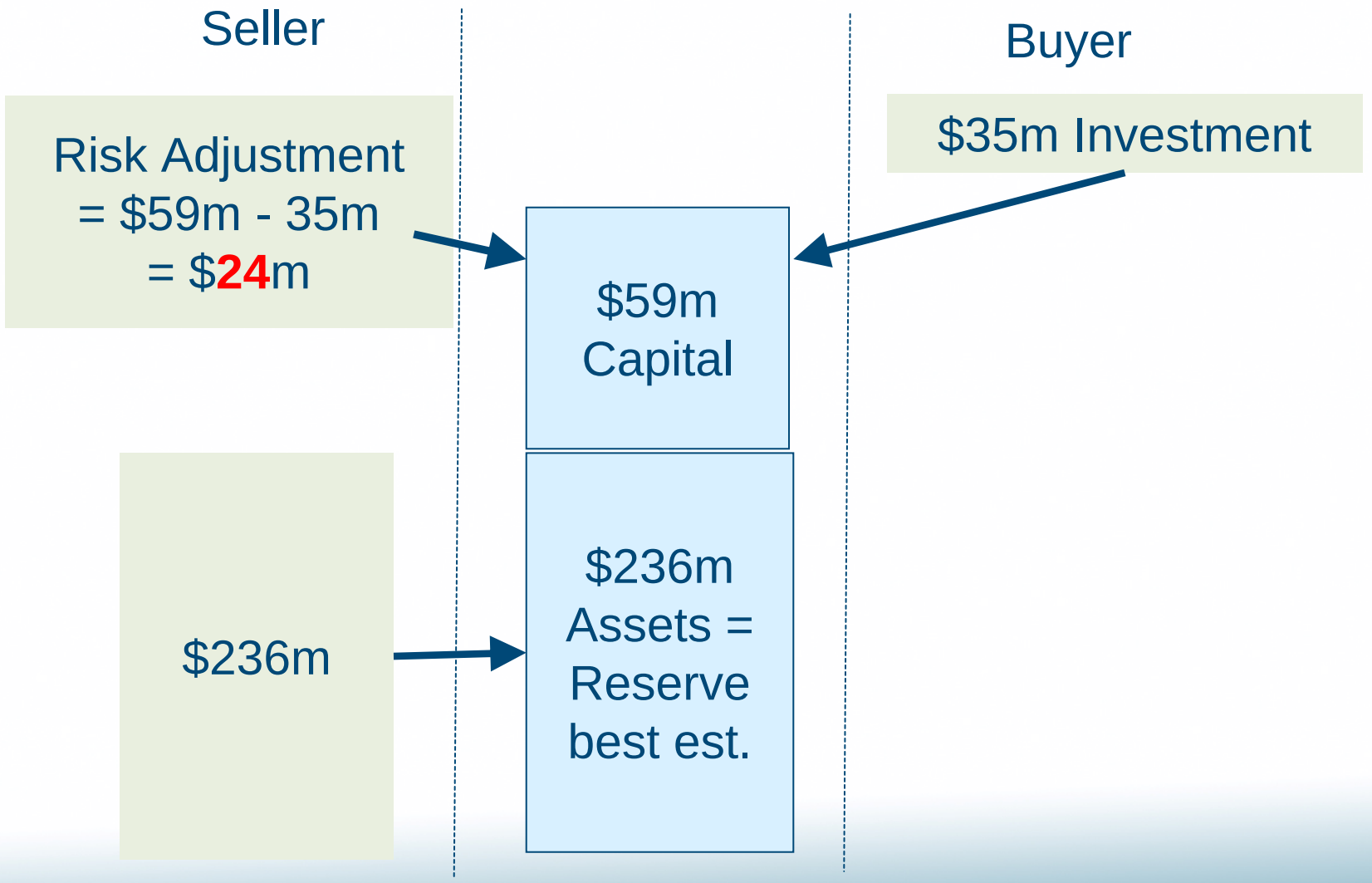
Transaction



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Selling you my GL book

1st offer: $236 m → TOO LOW

2nd offer: $236 m + $59 m → TOO HIGH

3rd offer: $236 m + $24 m

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Selling you my GL book

1st offer: $236 m → TOO LOW

2nd offer: $236 m + $59 m → TOO HIGH

3rd offer: $236 m + $24 m → JUST RIGHT

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Equation

Capital at time 0 = Risk Adjustment + What the Buyer will Invest

Equation

Capital at time 0 = Risk Adjustment + What the Buyer will Invest

Risk Adjustment = Capital(0) - What the Buyer will Invest

Equation

Capital at time 0 = Risk Adjustment + What the Buyer will Invest

Risk Adjustment = Capital(0) - What the Buyer will Invest

Risk Adjustment = Capital(0) – (Discounted capital runoff and interest on capital)

Equation

Capital at time 0 = Risk Adjustment + What the Buyer will Invest

Risk Adjustment = Capital(0) - What the Buyer will Invest

Risk Adjustment = Capital(0) – (Discounted capital runoff and interest on capital)

$$\text{Risk Adjustment} = Capital_0 - \sum_{t=0}^{n} \frac{(Capital_t - Capital_{t+1}) + Capital_t \times r_f}{(1 + CoC)^t}$$

Simple Example

$$t = 1, \quad Capital_0 = \$100 \qquad r_f = 4\%, \quad CoC = 10\%$$

$$\text{Risk Adjustment} = Capital_0 - \sum_{t=0}^{n} \frac{(Capital_t - Capital_{t+1}) + Capital_t \times r_f}{(1 + CoC)^t}$$

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$$= 100 - \left(\frac{100 + 100 \times 4\%}{1 + 10\%} \right)$$

Simple Example

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$$= 100 - 94.54$$

Simple Example

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$$= 100 - \left(\frac{100 + 100 \times 4\%}{1 + 10\%}\right)$$

$$= 100 - 94.54$$

$$= 5.45$$

Risk Adjustments under IFRS

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Equation

Cost of Capital

1. Calculate capital required 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.

Equation

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2. Multiply by the cost of capital less the risk-free rate

3. Discount at the cost of capital and sum.

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

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Simple Example – Cost of Capital Method

$$t = 1, \quad Capital_0 = \$100 \quad r_f = 4\%, \quad CoC = 10\%$$

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

Simple Example – Cost of Capital Method

$$t = 1, \quad Capital_0 = \$100 \quad r_f = 4\%, \quad CoC = 10\%$$

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

$$= \frac{100 \times (0.10 - 0.04)}{1.10}$$

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Simple Example – Cost of Capital Method

$$t = 1, \quad Capital_0 = \$100 \quad r_f = 4\%, \quad CoC = 10\%$$

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

$$= \frac{100 \times (0.10 - 0.04)}{1.10}$$

$$= 5.45$$

Equivalence of Risk Adjustment Formulas

$$Capital_0 - \sum_{t=0}^{n-1} \frac{(Capital_t - Capital_{t+1}) + Capital_t \times r_f}{(1+CoC)^{t+1}}$$

Derivation from First Principles

$$=$$

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

Cost of Capital Method

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Solvency II Method

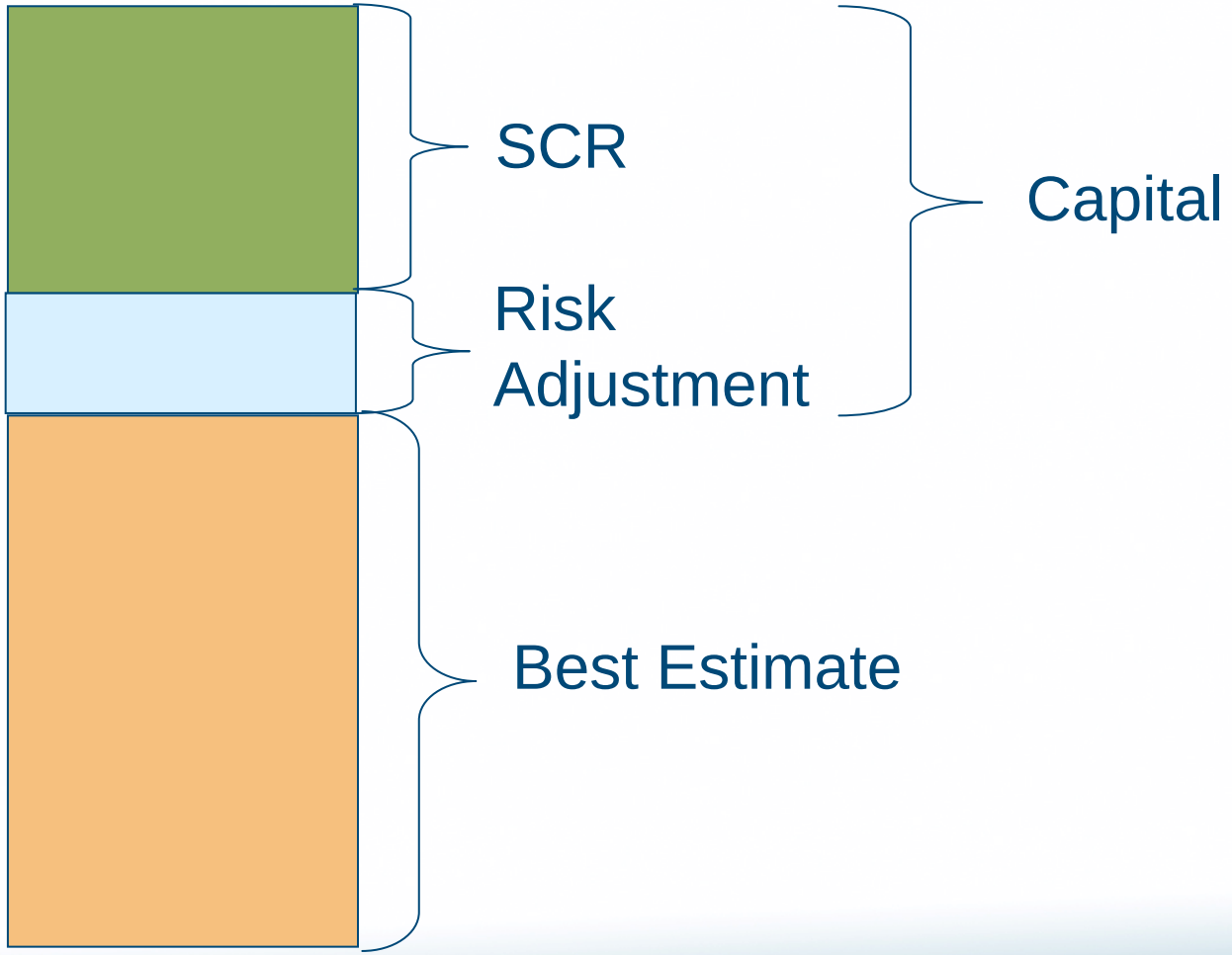
Solvency II

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*



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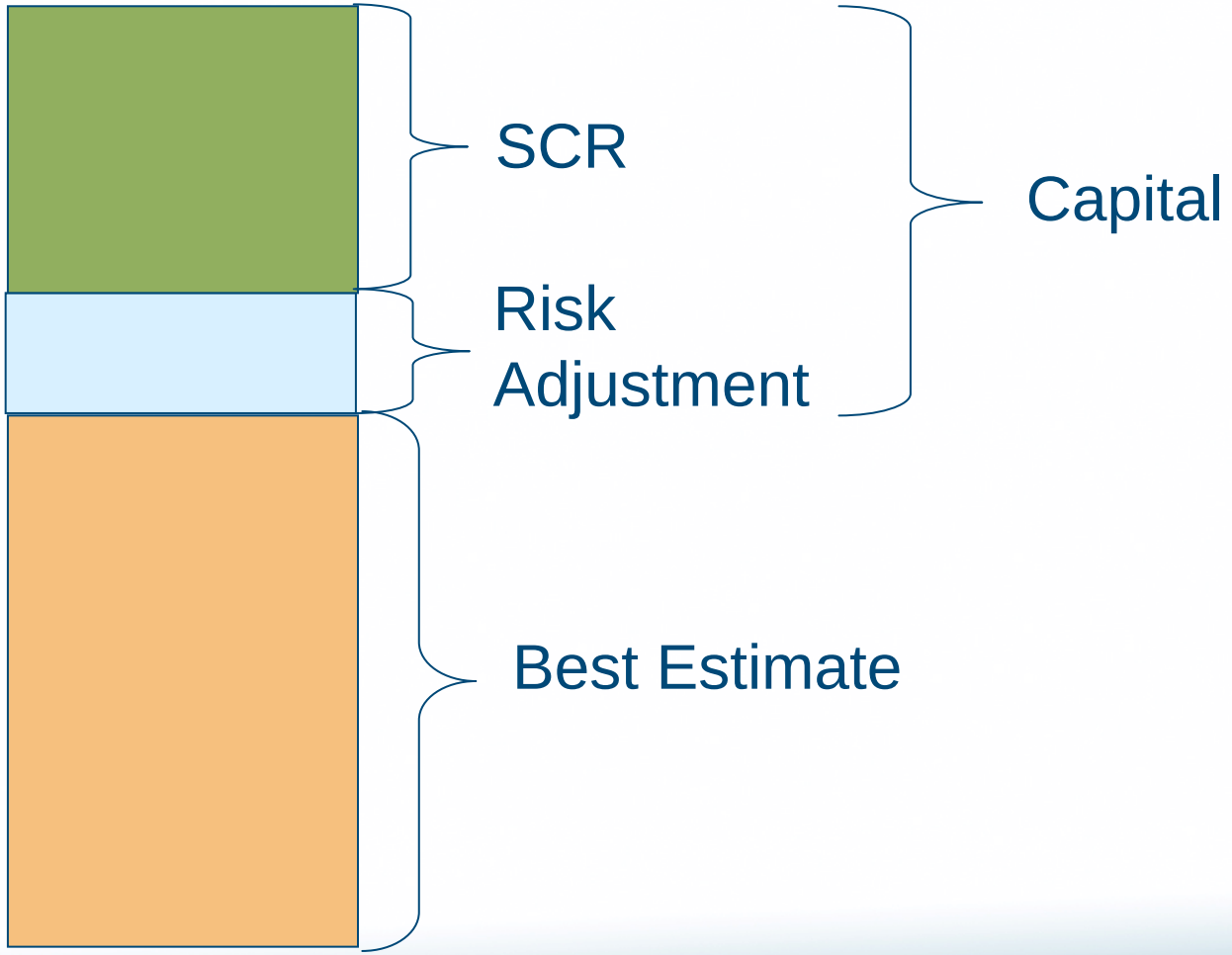
Solvency II Method*



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Solvency II Method

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

Solvency II Method

Solvency II

$$\sum \frac{SCR \times (CoC - r_f)}{(1 + r_f)}$$

Cost of Capital

$$\sum \frac{Capital \times (CoC - r_f)}{(1 + CoC)}$$

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Simple Example – Solvency II

$$t = 1, \quad Capital_0 = \$100 \qquad r_f = 4\%, \quad CoC = 10\%$$

$$RA = \frac{SCR \times (CoC - r_f)}{1 + r_f}$$

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Simple Example – Solvency II

$$t = 1, \quad Capital_0 = \$100 \qquad r_f = 4\%, \quad CoC = 10\%$$

$$RA = \frac{SCR \times (CoC - r_f)}{1 + r_f}$$

$$RA = \frac{(\$100 - RA) \times (0.10 - 0.04)}{1 + 0.04}$$

Simple Example

$$t = 1, \quad Capital_0 = \$100 \qquad r_f = 4\%, \quad CoC = 10\%$$

$$RA = \frac{SCR \times (CoC - r_f)}{1 + r_f}$$

$$RA = \frac{(\$100 - RA) \times (0.10 - 0.04)}{1 + 0.04}$$

$$RA\left(1 + \frac{0.06}{1.04}\right) = \frac{\$100 \times 0.06}{1.04}$$

Simple Example

$$t = 1, \quad Capital_0 = \$100 \qquad r_f = 4\%, \quad CoC = 10\%$$

$$RA = \frac{SCR \times (CoC - r_f)}{1 + r_f}$$

$$RA = \frac{(\$100 - RA) \times (0.10 - 0.04)}{1 + 0.04}$$

$$RA\left(1 + \frac{0.06}{1.04}\right) = \frac{\$100 \times 0.06}{1.04}$$

$$RA = 5.45$$

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Solvency II Method

Solvency II

$$\sum \frac{SCR \times (CoC - r_f)}{(1 + r_f)}$$

=

Cost of Capital

$$\sum \frac{Capital \times (CoC - r_f)}{(1 + CoC)}$$

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Solvency II Method

Solvency II

$$\sum \frac{SCR \times (CoC - r_f)}{(1 + r_f)}$$

=

Cost of Capital

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1. Liability Valuation under IFRS

2. Valuation from First Principles

3. Valuation using the Cost of Capital Method =

4. Valuation using the Solvency II Method =

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Required

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Risk Adjustments under IFRS

1. Liability Valuation under IFRS

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Use

Required

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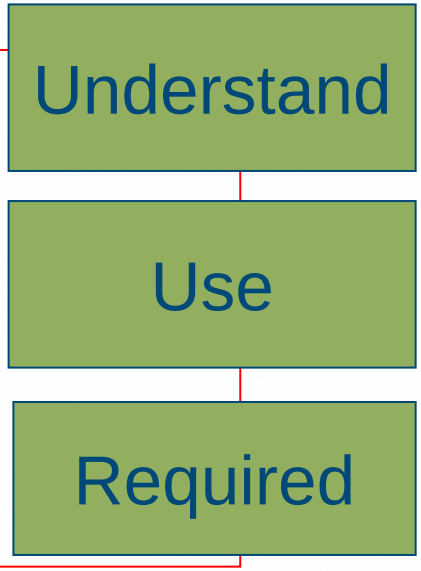

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