

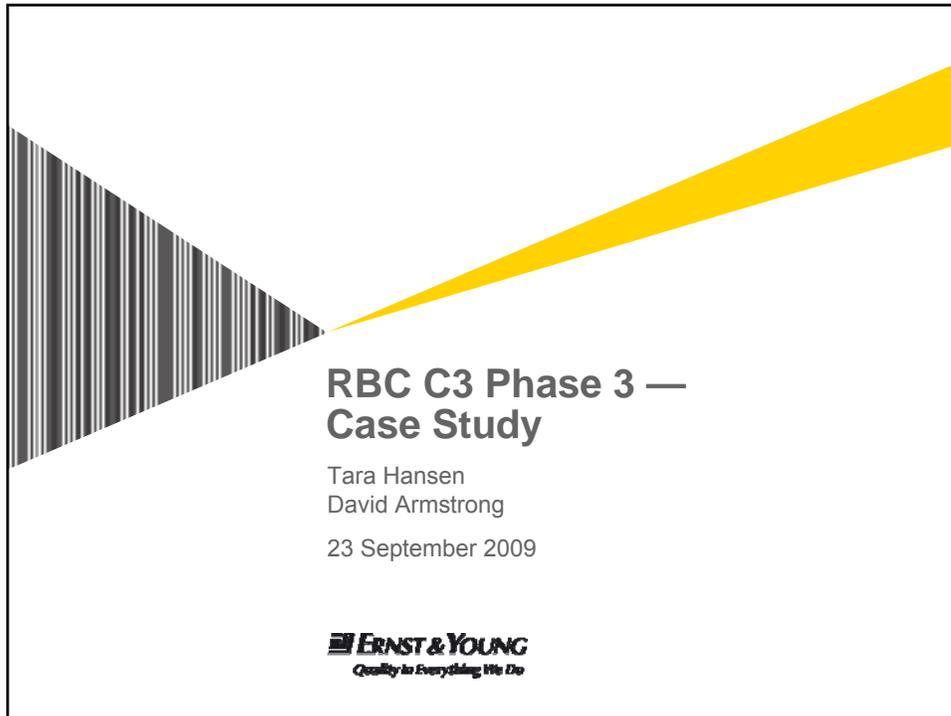


SOCIETY OF ACTUARIES

**Advanced Seminar on Principle-Based Capital
September 23, 2009**

Session 2: Case Study

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**RBC C3 Phase 3 —
Case Study**

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Agenda

- ▶ RBC C3 Phase 3 overview
- ▶ Case study approach
- ▶ Universal life case study
- ▶ Term case study

Overview

RBC C3 Phase 3 introduces a principles-based approach to the determination of interest rate risk and market risk capital requirements for life insurance products.

► Products in scope:

1. Universal life
2. Variable life and variable universal life
3. Term life
4. Whole life
5. Indexed life and universal indexed life
6. Group life
7. Combination policies (includes life plus other benefits) that are filed as life insurance policies

Current target implementation date is year-end 2010.

Summary of steps

RBC C3 Phase 3 is calculated with five steps:

1. Project cash flows using stochastic scenarios.
2. Calculate the accumulated deficiency at the end of each projection year.
3. Determine the greatest present value for each scenario.
4. Determine scenario amounts.
5. Determine the stochastic amount (CTE 90).

Prudent estimate assumptions:

- Prudent estimate assumptions if not stochastic or prescribed
- Prudent estimate assumption = anticipated experience + margin
- Higher margin for more uncertain risk
- Higher margin if limited experience

Case study approach

Sample products:

- ▶ Universal life
- ▶ Term

Modeling approach:

- ▶ All calculations done within model office
- ▶ Single cells
- ▶ Starting with a new business model, projected C3 requirement for 30 years (performed stochastic projection from 30 different starting points over life of policies)
- ▶ Single point in time analysis performed at policy year 5
- ▶ Monthly projections

Practical considerations

Case study considerations:

- ▶ Interest rate scenarios
- ▶ Margins for “prudent estimate assumptions”
- ▶ Single cell or inforce block
- ▶ Reinvestment strategy

Additional implementation considerations:

- ▶ Determining segments
- ▶ Stochastic exclusion test
- ▶ Stochastic, alternative, factor-based, and non-modeled amounts

Product specifications

- ▶ 1,000 identical policies
- ▶ Face amount per policy = \$250,000
- ▶ Male nonsmoker age 45
- ▶ \$20 per \$1,000 annual premium for moderate funding
- ▶ 3% guaranteed minimum credited rate
- ▶ Surrender charge (% of face amount) decreases to 0 over 15 years
- ▶ Cost of insurance = 70% of 1980 CSO ALB
- ▶ No secondary guarantee

Prudent estimate assumptions

Assumption	Anticipated experience	Margin
Mortality	▶ 70% of SOA 7580 S/U ALB	▶ Years 1-5: 5% ▶ Years 6-30: grades from 5% to 8%
Base lapse	▶ Years 1-2: 6% ▶ Years 3+: 5%	▶ Years 1-5: 7% ▶ Years 6-30: grades from 7% to 10%
Expense	▶ Maintenance expense (per unit) of \$50 /year ▶ Investment expense of 12 bps of assets	▶ Years 1-5: 4% ▶ Years 6-30: grades from 4% to 7%
Premium persistency	▶ Year 1 = 100%, year 2 = 95%, year 3 = 90%, year 4 = 86%, years 5+ = 80%	▶ Years 1-5: -5% ▶ Years 6-30: grades from -5% to -8%
Default charge	▶ 14 bps	▶ 50%

- ▶ Prudent estimate assumption = anticipated experience + margin
- ▶ Hypothetical product has significant underwriting experience, so margins are set relatively low
- ▶ CIA practice note on margins used as reasonableness check
- ▶ Margins increase over time due to greater uncertainty
- ▶ Assumptions with greater uncertainty (e.g., credit defaults) receive greater margins
- ▶ Margins could change direction in different projection years (i.e., lapse +/-)

Scenario and investment assumptions

Category	Assumption
Interest scenarios	▶ 1,000 stochastic scenarios from AAA generator
Crediting strategy	▶ Credited rate = max(3%, earned rate – 1.75% target spread) ▶ Only reset if changed more than 25 bps from previous year
Dynamic lapse	▶ If experience CR > valuation CR, additional lapse = 1% * (experience CR % - valuation CR %)^2
Reinvestment strategy	▶ Static reinvestment in following maturities: 3 yr – 10%, 5 yr – 10%, 10 yr – 20%, 20 yr – 20%, 30 yr – 40%
Credit spreads	▶ Credit spreads vary by maturity: cash - .25%, 3 yr - .70%, 5 yr - .85%, 10 yr - 1.1%, 20 yr -1.3%, 30 yr – 1.4%
Inflation	▶ 2% per annum

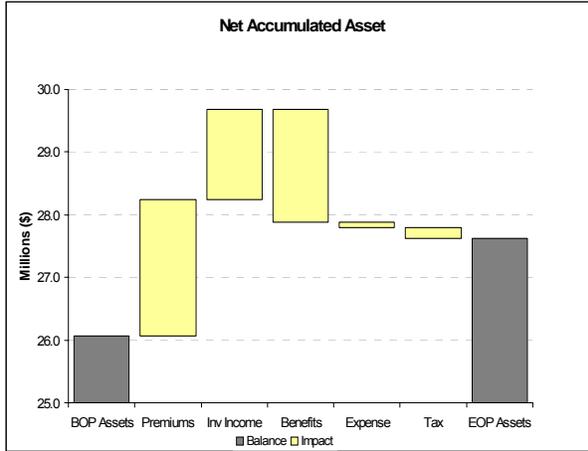
- ▶ Long-duration reinvestment strategy due to liability characteristics
- ▶ Assumptions related to scenarios do not receive additional margin because margin reflected by CTE calculation
- ▶ Possible refinement is for inflation to vary by scenario

Year 5: accumulated deficiency

- ▶ **Accumulated deficiency (t) = working reserve (t) – net accumulated asset amount (t)**
- ▶ **Working reserve (t) = cash surrender value (t)**
- ▶ **Net accumulated asset amount (t) =**
 net accumulated asset amount (t-1)
 + gross premium (t)
 + investment income (t)
 - death benefits (t)
 - expenses (t)
 - tax (t)

Year 5: accumulated deficiency

Net accumulated asset value rollforward



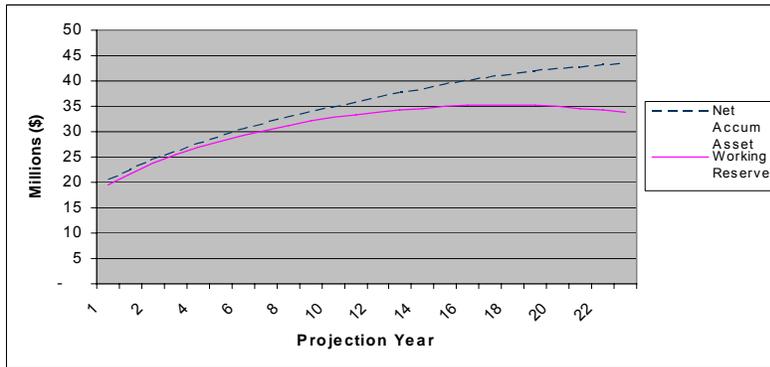
CSV (5) = \$26,885,602

Net accumulated asset (5) = \$27,628,994

Accumulated deficiency (5) = -\$743,392

Year 5: accumulated deficiency

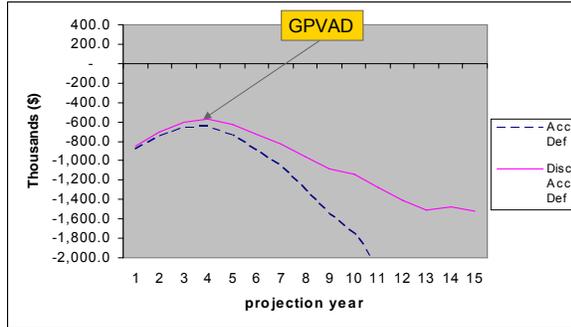
Development of accumulated deficiencies for a single scenario



- ▶ Net accumulated asset > working reserve for all years
- ▶ No positive accumulated deficiencies for scenario
- ▶ Driven by punitive surrender charge in early years and high profit margin in later years

Year 5: scenario 1 amount

Greatest present value of accumulated deficiencies



Scenario amount

Starting assets	\$14,608,655
Scenario 1 GPVAD	-\$567,800
Scenario 1 amount	\$14,040,855

- ▶ GPVAD = -\$567,800 and occurs in 4th projection year
- ▶ Timing driven by change in renewal commission more than interest rate scenario
- ▶ For this product, the working reserve increases faster than the Net Accumulated Asset until the commission drops from 5% of gross premium to 2%; this occurs in the 10th policy year (5th year of this projection)

Year 5: stochastic amount

Stochastic amount = CTE 90 of scenario amounts = \$14,078,595

Statutory reserve	\$14,608,655
Stochastic amount	\$14,078,595
C3 requirement	\$0

- ▶ Stochastic amount < statutory reserve
- ▶ No C3 requirement for product at year 5
- ▶ Not much deviation across scenarios; most experience passed on to policyholder
- ▶ Results driven by product design and impacted heavily by punitive surrender charge

Year 5: capital impact

Current C3 calculation:

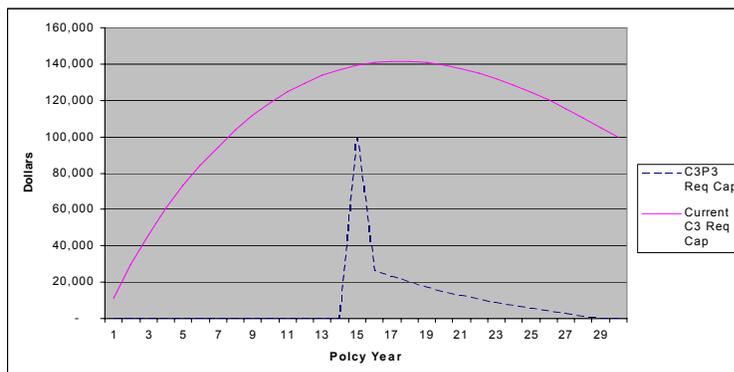
- ▶ $C3 = \text{factor} * \text{statutory reserve} * (1 - \text{tax rate})$
- ▶ C3 factor for life insurance = 0.77%
- ▶ Current framework C3 = $0.77\% * \$14,608,655 * (1 - 35\%) = \$73,116$

C3 Phase 3 capital impact on sample policy

- ▶ \$73,166 reduction in required capital at policy year 5

30-year projection

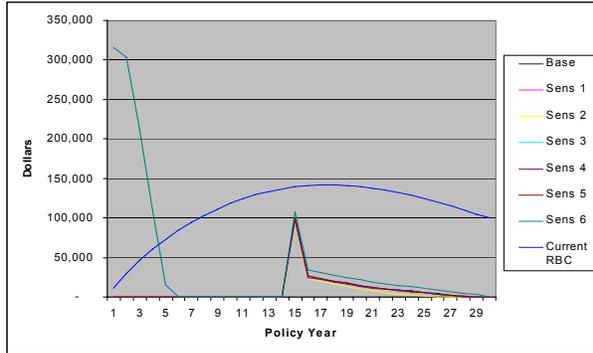
C3 required capital over time



- ▶ For this sample UL product, C3 capital is significantly lower under C3 Phase 3
- ▶ C3 under factor-based method follows pattern of reserve; C3P3 pattern can be very different
- ▶ Shape of C3P3 capital requirement is largely driven by surrender charge period ending at year 15

30-year projection

C3 required capital over time



- ▶ UL policy not overly sensitive to most changes
- ▶ Reducing the target spread over the crediting rate to 1% (base was 1.75%) causes a significant increase in C3 in early years

Sens. #1: No Margins
Sens. #2: 50 bps increase in credit spreads
Sens. #3: 50 bps decrease in credit spreads
Sens. #4: 50% increase in margins
Sens. #5: 50% decrease in margins
Sens. #6: 1% target spread over crediting rate

Observations

- ▶ C3 Phase 3 leads to a large capital reduction in all years compared to the current factor-based method.
- ▶ The pattern of capital does not track the reserve.
- ▶ C3 requirement is highly sensitive to product features like surrender charge.
- ▶ The timing of GPVAD depends more on profit emergence pattern than interest rate scenario.
- ▶ Scenarios are typically not severe enough for minimum crediting rate to be reached, so most experience is passed along to the policyholder.

Product specifications

- ▶ 20-year level term
- ▶ 1,000 identical policies
- ▶ Male nonsmoker age 40
- ▶ Death benefit of \$500,000
- ▶ \$1,335 annual premium per policy
- ▶ No cash value

Prudent estimate assumptions

Assumption	Anticipated Experience	Margin
Mortality	▶ 70% of SOA 7580 S/U ALB	▶ Years 1-5: 7% ▶ Years 6-20: grades from 7% to 10%
Base lapse	▶ Years 1-19: 5% ▶ Year 20: 100%	▶ Years 1-5: 9% ▶ Years 6-20: grades from 9% to 12%
Expense	▶ Maintenance expense (per unit) of \$40 /year ▶ Investment expense of 12 bps of assets	▶ Years 1-5: 4% ▶ Years 6-20: grades from 4% to 7%
Default charge	▶ 14 bps	▶ 50%

- ▶ Prudent estimate assumption = anticipated experience + margin
- ▶ Hypothetical product has little underwriting experience, so margins are set relatively high
- ▶ CIA practice note on margins used as reasonableness check
- ▶ Margins increase over time due to greater uncertainty
- ▶ Assumptions with greater uncertainty (e.g., credit defaults) receive greater margins

Scenario and investment assumptions

Category	Assumption
Interest scenarios	▶ 1,000 stochastic scenarios from AAA generator
Dynamic lapse	▶ none
Reinvestment strategy	▶ Static reinvestment in following maturities: 1 yr – 10%, 3 yr – 30%, 5 yr – 30%, 7 yr – 15%, 10 yr – 10%, 20 yr – 5%
Credit spreads	▶ Credit spreads vary by maturity: cash – .25%, 1 yr – .45%, 3 yr – .70%, 5 yr – .85%, 7 yr – .90%, 10 yr – 1.1%, 20 yr – 1.3%
Inflation	▶ 2% per annum

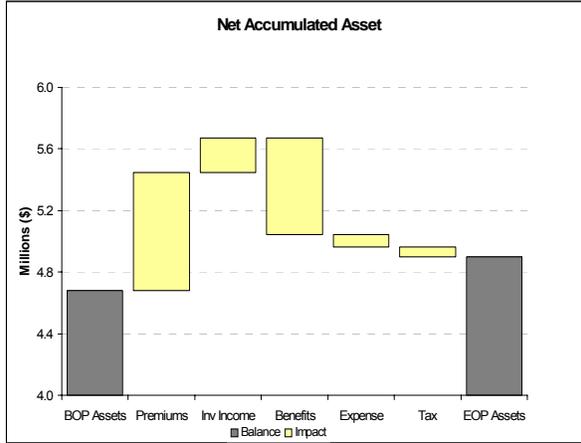
- ▶ Relatively short duration reinvestment strategy due to liability characteristics
- ▶ Assumptions related to scenarios do not receive additional margin because margin reflected by CTE calculation
- ▶ Possible refinement is for inflation to vary by scenario

Year 5: accumulated deficiency

- ▶ **Accumulated deficiency** (t) = working reserve (t) – net accumulated asset amount (t)
- ▶ **Working reserve** (t) = cash surrender value (t)
- ▶ **Net accumulated asset amount** (t) =
 - Net accumulated asset amount (t-1)
 - + gross premium (t)
 - + investment income (t)
 - death benefits (t)
 - expenses (t)
 - tax (t)

Year 5: accumulated deficiency

Net accumulated asset value rollforward



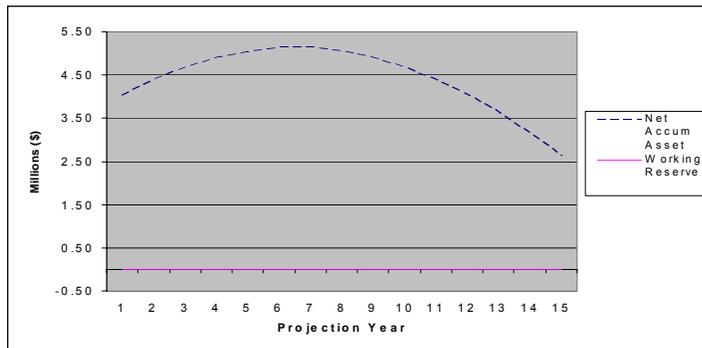
CSV (5) = \$0

Net Accumulated Asset (5) = \$4,899,983

Accumulated Deficiency (5) = -\$4,899,983

Year 5: accumulated deficiency

Development of accumulated deficiencies for a single scenario

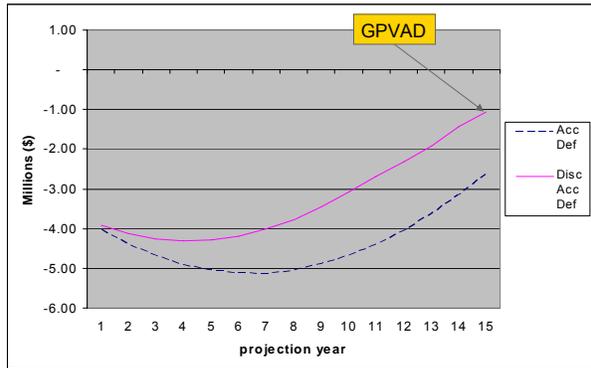


- ▶ Working reserve = CSV = 0, so accumulated deficiency = - net accumulated asset
- ▶ Net accumulated asset is never negative in this scenario, so accumulated deficiency is negative in all years
- ▶ Net accumulated asset begins to decrease around the 7th year due to the pattern of profit emergence for this sample policy

Term policy

Year 5: scenario 1 amount

Greatest present value of accumulated deficiencies



Scenario amount

Starting assets	\$3,580,177
Scenario 1 GPVAD	-1,071,558
Scenario 1 amount	2,508,619

- ▶ GPVAD = -\$1,071,558 and occurs in 15th projection year
- ▶ Timing driven by pattern of profit emergence for product
- ▶ Shape of curves and timing of GPVAD very different from UL policy

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Term policy

Year 5: stochastic amount

Stochastic amount = CTE 90 of scenario amounts = \$2,433,195

Statutory reserve	\$3,580,177
Stochastic amount	2,433,195
C3 requirement	0

- ▶ Stochastic amount < statutory reserve
- ▶ No C3 requirement for product in policy year 5
- ▶ Results driven by profitability of product
- ▶ Not very sensitive to interest rates
- ▶ Since CSV = 0, will only have positive C3 requirement if accumulated assets become negative

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Year 5: capital impact

Current C3 calculation:

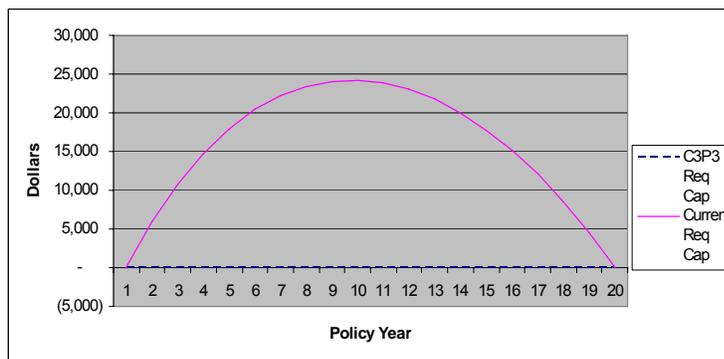
- ▶ $C3 = \text{factor} * \text{reserve} * (1 - \text{tax rate})$
- ▶ C3 factor for life insurance = 0.77%
- ▶ Current framework C3 = $0.77\% * \$3,580,177 * (1 - 35\%) = \$17,919$

C3 Phase 3 capital impact on sample policy:

- ▶ \$ 17,919 reduction in required capital at policy year 5

30-year projection

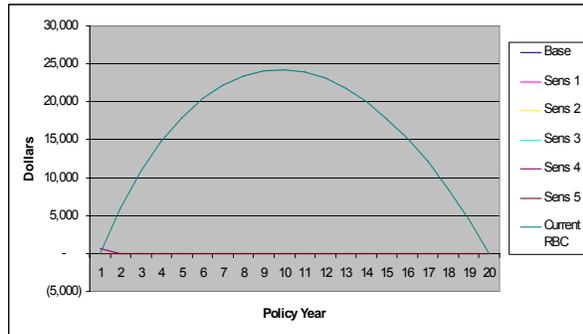
C3 required capital over time



- ▶ C3 = 0 for all policy years
- ▶ C3 under factor-based method follows pattern of reserve; C3P3 pattern can be materially different (in this case flat at zero)

30-year projection

C3 required capital over time



Sens. #1: No Margins
Sens. #2: 50 bps increase in credit spreads
Sens. #3: 50 bps decrease in credit spreads
Sens. #4: 50% increase in margins
Sens. #5: 50% decrease in margins

- ▶ Term policy not sensitive to changes
- ▶ Only sensitivity run that causes a positive C3 is Sensitivity 4: 50% increase in margins
- ▶ \$617 year one C3 requirement in Sensitivity 4; reason for the capital charge — decreased profitability creates positive deficiencies in later projection years
- ▶ Further increasing margins would cause greater C3 charge and would likely impact more than just year 1 required capital

Observations

- ▶ C3P3 capital is 0 for all years.
- ▶ Results are driven by high starting assets due to redundant XXX reserves and profitability of product.
- ▶ Term product is insensitive to interest rates.
- ▶ Result are most sensitive to change in margins.

Case study conclusions

- ▶ There is a potential reduction in C3 required capital for many life products, including elimination of C3 requirement for some.
- ▶ There is a lower cost of capital and increased profitability on life insurance products.
- ▶ Many life products would likely pass the stochastic exclusion test, but factor-based C3 would probably be higher.
- ▶ Must evaluate the trade-off of effort required to model stochastic calculations against a higher capital charge from factor-based amount.
- ▶ C3 Phase 3 results would be different with principles-based reserves instead of current statutory (XXX, CRVM).
- ▶ A conservative reserve causes higher starting assets in projection and a decreased likelihood of deficiencies and lower C3 requirement.