Preferred Mortality

September 21 LHATF

Valuation Table Team Update

Society of Actuaries & American Academy of Actuaries Joint Project Oversight Group

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Agenda

- Testing of Basic Table
- Comparison of Test Loaded Table to Experience of Contribution Companies
- Development of Actuarially Sound Margin Methodology to Achieve Targeted Coverage of Contributing Companies
- Testing of Valuation Table

Testing

- Parallel Testing
- Testing Basic Reserves (excluding Deficiency Reserves)
- Compare CRVM reserves under 2008 Test Valuation Table with PBR reserves under 2008 VBT and 2008 Valuation Table

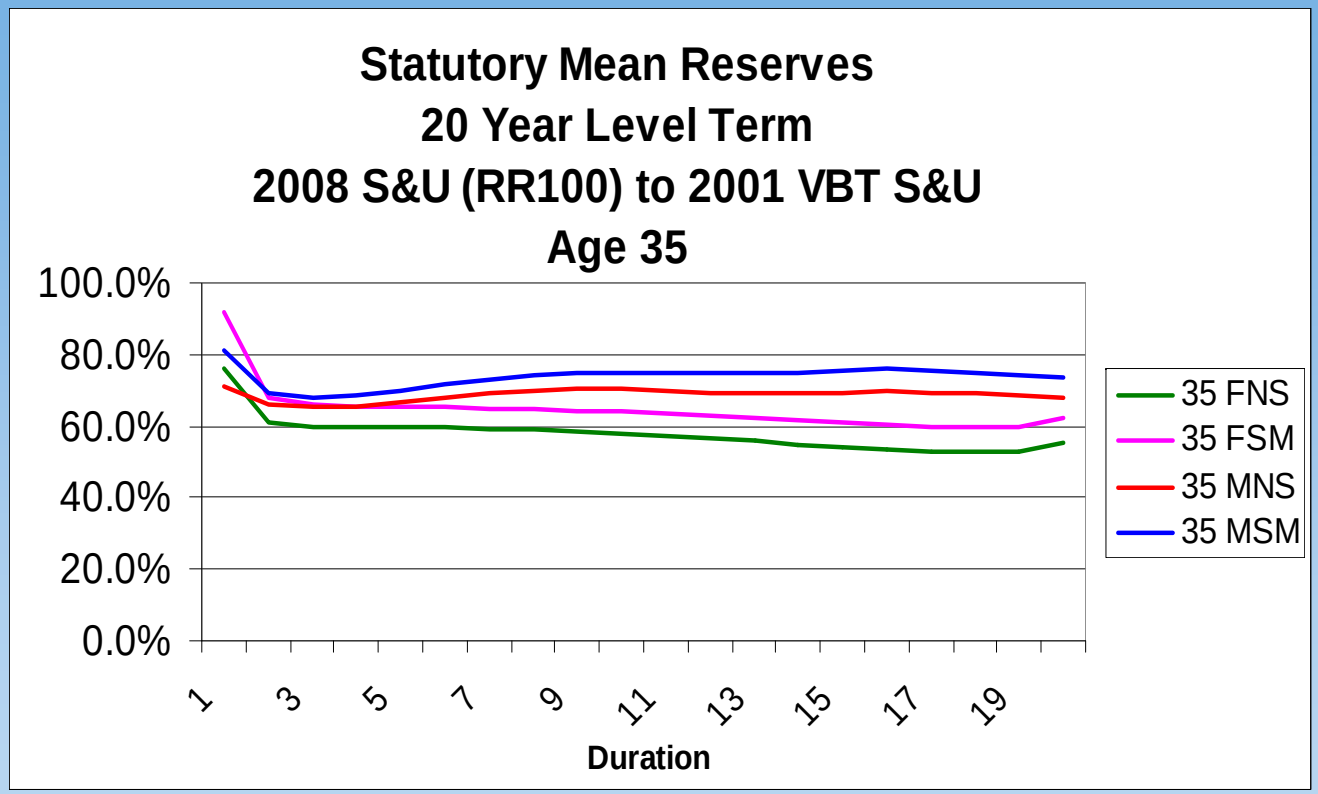
Testing Completed to Date

- Comparison of CRVM reserves for 20 yr. term using 2008 VBT to those produced by 2001 VBT using a Valuation interest rate of 4%
- Comparison of UL CRVM reserves using 2008 Test Valuation Table to UL PBR type reserves using both the VBT and the Test Valuation Table

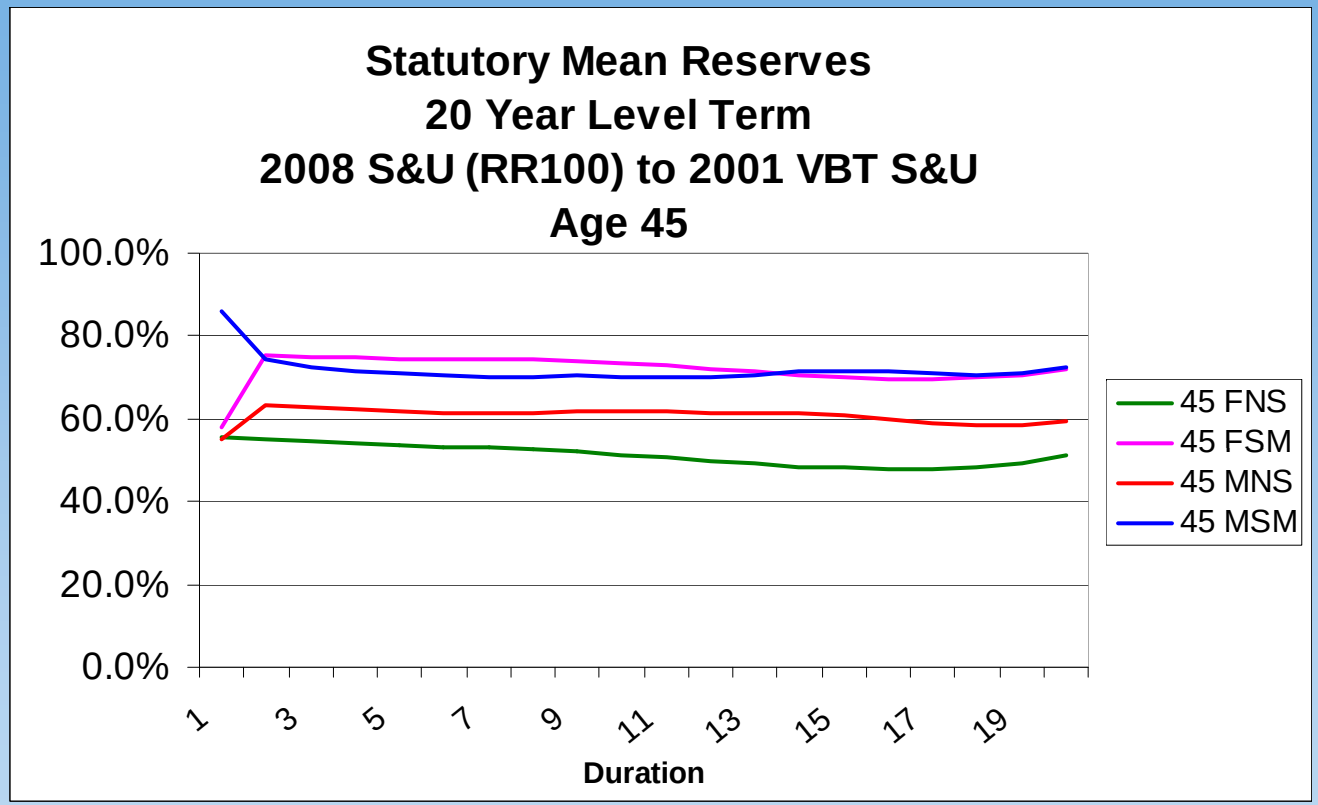
Comparison of Term Reserves

- The following slides show the testing results for CRVM reserves on a 20 year term product.
- Ratios are shown of reserves using the 2008 Basic table to reserves using the 2001 Basic table.

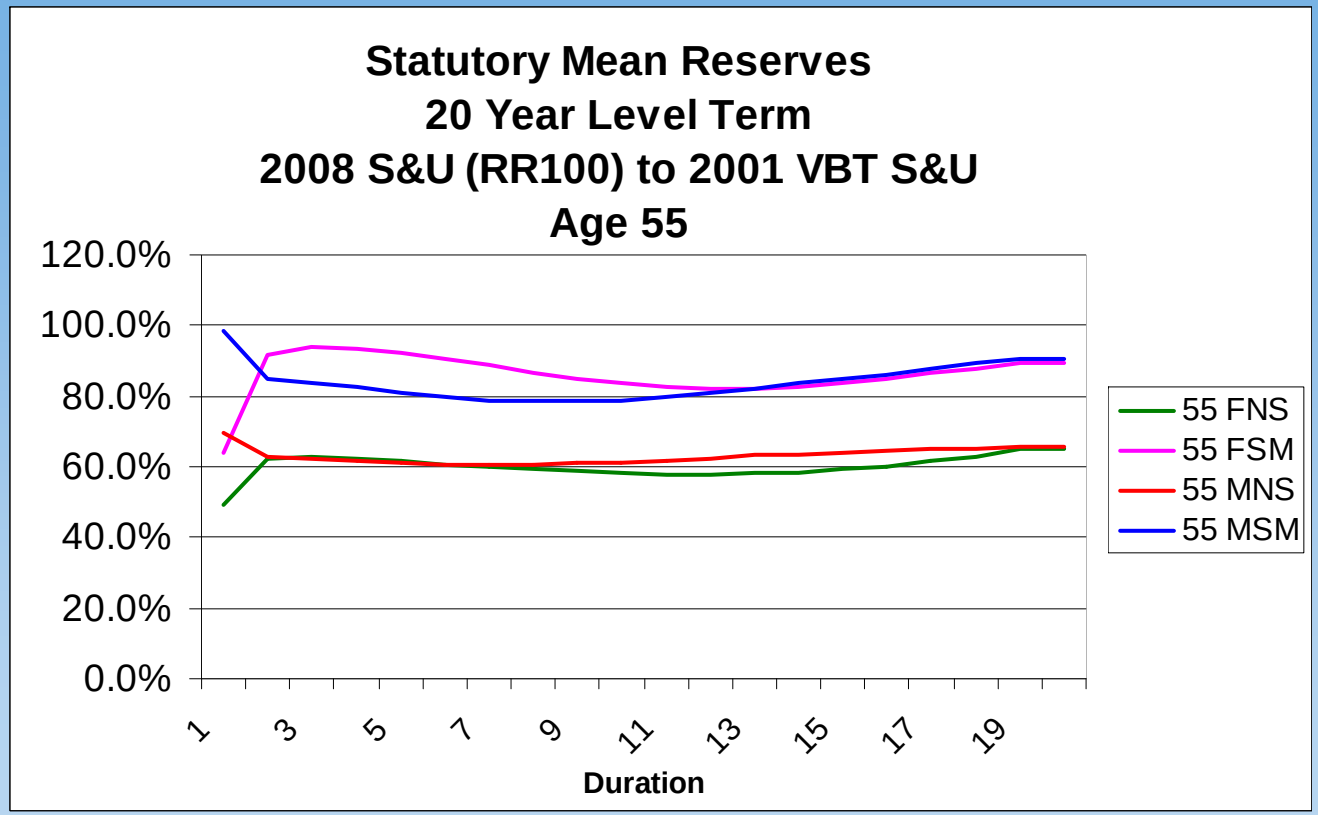
Testing Without Margins



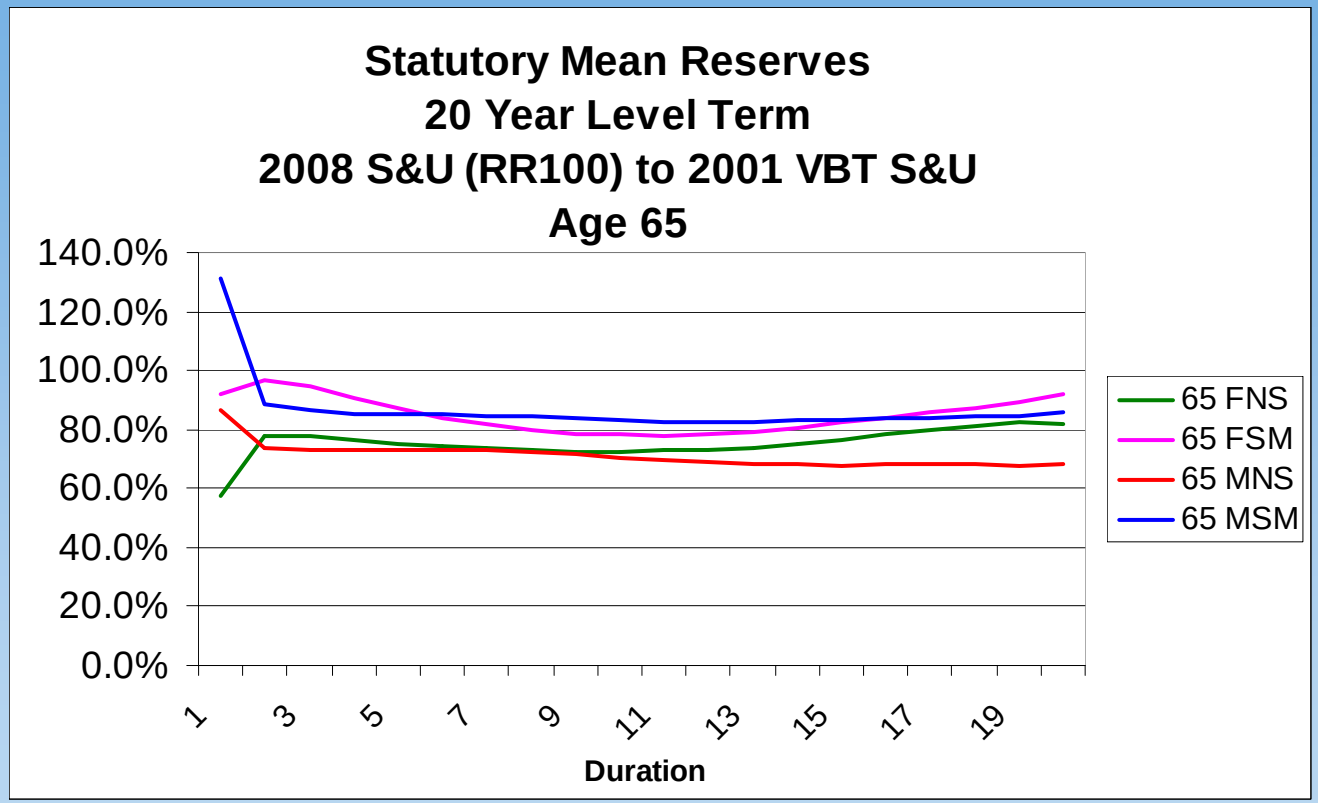
Testing Without Margins (cont'd):



Testing Without Margins (cont'd):



Testing Without Margins (cont'd):



Margins

- Specifications in VM-20
- Margin Considerations for 2001 Commissioners' Standard Ordinary Table (2001 CSO)
- Comparison of 2001 CSO Margin to Canada's Guidelines
- Purposes of the Margin
- Results of Comparison of Test Valuation Table to Contributing Companies' Experience
- Proposed Loading Formula

Section E.2.7 of VM-20

- Companies not meeting the minimum credibility level set the prudent (i.e., with margin) mortality assumption to the mortality rates in the commissioner's tables
- Companies with experience meeting the minimum credibility level set margin to provide for adverse deviation and estimation error plus uncertainty caused by situations including, but not limited to, the following:
  - Reliability of experience studies
  - Changes in underwriting
  - Non-homogeneous data
  - Unfavorable environmental or health developments
  - Market forces that may cause antiselection

Margin Considerations for 2001 CSO

- Reserves on loaded table should not be materially less than reserves using basic, select and ultimate mortality
- Terminal reserves on loaded table should not be significantly distorted compared with terminal reserves on basic table
- Consistency between males vs. females, smokers vs. nonsmokers, select vs. ultimate
- Should not result in unreasonable statutory premium deficiencies on term insurance plans
- Reserves and net premiums on the loaded table should not be excessive
- Margin should provide reasonable provision for possible future adverse mortality experience

Margin Considerations for 2001 CSO (cont'd)

- June 2001 presentation to LHATF
  - An average 20% margin was shown to cover mortality from at least 80% of contributing companies
  - Sample calculations on 20-year term indicated that an overall 10% mortality margin on formula reserves was roughly equivalent to 20% margin on economic reserves due to conservatism in other components of formula reserves
- LHATF recommended an overall 15% margin
- Loaded 2001 CSO table compared to mortality of contributing companies
  - Covered 15 of 21 companies (71%) in durations 1-15
  - Covered 14 of 14 companies (100%) in durations 1-25 (only these 14 companies had experience in durations 16-25)
  - Covered 11 of 14 companies (79%) in ultimate durations

Comparison of 2001 CSO Margin to Canada's Guidelines

Margins are in terms of extra deaths per thousand

- 2001 CSO formula is $(0.0056 – 0.00016x + 0.000008x^2)/e_x$
- Canada's guideline range is 3.75 to 15.00, divided by e_x
- Comparison of numerators

Attained Age	2001 CSO	Canada
25	10.2	3.75-15.00
45	21.1	3.75-15.00
65	38.4	3.75-15.00
85	62.0	3.75-15.00
105	92.1	3.75-15.00

Purposes of the Margin

- In its final report, the 2001 CSO Task Force discussed four purposes of mortality loads (margins):
  - Confidence of experience study – mortality should cover the "true" mortality underlying the experience study (the 1990-95 experience study was based on a large volume of data, so no margin was needed for this)
  - Variation among companies – the margin should be large enough to cover a large proportion of companies
  - Random fluctuation – margin should address random fluctuations caused by having a small number of exposures
  - Unknown variation – this covers one-time events (epidemics) and future trends (e.g., changes in general health conditions) – by definition, this cannot be quantified

Valuation Table Team's Analysis of Margins – Confidence of Experience Study

- The SOA's 2002-04 experience study has a large volume of data – no margin is needed to produce sufficient confidence for the aggregate 2008 VBT
- The selection of relative risk tables based on UCS scoring is based on less data than the SOA 2002-04 study
  - However, the relative risk table assignment is, to a large extent, a split of the aggregate basic table
  - Relative risk tables grade to the aggregate table at higher attained ages, so any difference would wear off in later durations
- The Valuation Table Team does not propose an explicit margin for confidence

Valuation Table Team's Analysis of Margins – Variation by Company

- At the request of the VTT a Test Valuation Table using the 2001 CSO loading formula applied to the 2008 VBT was compared to the experience of the companies that contributed to the study.
- Tentative adjustments were made to the VBT to accomplish this including the termination of the table at age 120 assuming a mortality rate of 100% and the creation of a "uni-smoke" table assuming 80% non-smokers and 20% smokers. In addition, the mortality improvements that were included in the 2008 VBT were backed out for this analysis.
- The results of the test run are shown in the following table

Valuation Table Team's Analysis of Margins – Variation by Company

Analysis of Companies Covered by Test Version of 2008 Valuation Table

Durations	1-10	11-25	26+	All
Total number of Contributors to VBT	35	32	23	35
Number of Contributors with at least 50 deaths	30	27	14	33
Number of Contributors Covered by Test Table	28	25	14	29
Percentage Covered	93%	93%	100%	88%
85% of Companies with at least 50 deaths	25.5	23	12	28
A/E for that 85% of Covered Companies	80.5%	89.3%	101.1%	85.1%

Two values averaged if .5 in Rank Value Used.
Expected based on 2008 Test Valuation Table Created Using 2001 CSO Loading Formula.

Valuation Table Team's Analysis of Margins – Variation by Company

- The experience of companies with small numbers of death claims was thought to fluctuate too much to be included in this analysis by number of companies.
- For the groups that exclude companies with either less than 100 or less than 50 death claims for the exposure period the targeted coverage of 85% of the companies in the reduced groups could be accomplished by about:
  - 80% of the test table for durations from issue of 1-10
  - 90% of the test table for durations from issue of 11-25
  - 100% of the test table for durations from issue of 26+
- It was noted that the Test Valuation Table placed a heavier load at the early durations following issue.
- The VTT felt that the mortality experience of a company would be more predictable immediately after underwriting and would be less predictable in later durations following issue.
- One component of the Test Valuation Table loading formula was therefore modified to consider duration since issue.

Valuation Table Team's Analysis of Margins – Variation by Company

- If companies without credible experience use the proposed valuation table "as is," then the margin requirements would be a little heavier than the 2001 CSO table, i.e., they will cover 85% of the contributing companies versus the 80% coverage of the 2001 valuation table.
- Due to the select and ultimate nature of the 2008 VBT and the variation in the number of contributing companies by duration, the percentage of companies covered by the Test Valuation Table varied by duration from issue.
- The 2001 CSO and 1980 CSO loading formulae did not explicitly consider duration since issue since they were developed for ultimate valuation mortality.
- Formulae using the concept of a quantity divided by the curtate expectation of life were developed considering duration since issue and varying by duration groupings of 1-10, 11-25, and 26+.

Valuation Table Team's Analysis of Margins – Variation by Company

- Alternative loading formulae might look something like the following:
  - Durations 1-10 = $(.0021 - .00003*(x+t) + .0000006*t*(x+t)^2) / e_x$
  - Durations 11-25 = $(.0035 - .00004*(x+t) + .00000035*t*(x+t)^2) / e_x$
  - Durations 26+ = $(.0018 - .00016*(x+t) + .000009*(x+t)^2) / e_x$
- 2001 CSO formula is $(0.0056 – 0.00016(x+t) + 0.000008(x+t)^2)/e_x$
- The average percentage loads for the Male NS Primary Table would then be:
  - Durations 1-10 = 15.4%
  - Durations 11-25 = 17.3%
  - Durations 26+ = 20.0%
- The average 2001 CSO load was 15%.
- The loads were kept somewhat higher in moving from Durations 1-10 to Durations 11-25 in order to ensure continuity in mortality rate increases from year to year. The same issue was addressed in moving from Durations 11-25 to Durations 26+. In addition, the fact that a higher load appears desirable at these higher durations in order to cover those companies with less than credible contributed experience. Note that the final tables will also be graduated in order to ensure reasonable mortality rate patterns from year to year.

Valuation Table Team's Preliminary Views on Margins – Random Fluctuations

- The random fluctuation discussed in the 2001 CSO report considered a single year's experience
  - For PBR, we should consider the effects of random fluctuation on the present value of future mortality
  - "Present value" takes account of many years experience, so random fluctuation is reduced compared with a single year's experience
- It is not practical to have a valuation mortality table with loading that varies by the size of the block of business
- RBC factors for mortality are larger for smaller volumes
- Companies with credible mortality experience would need to perform an analysis of random fluctuations

Valuation Table Team's Preliminary Views on Margins – Unknown Variation

- The Valuation Team suggests that "one-time" events be covered by surplus, not reserves
- This leaves unknown trends and other unknowns to be covered
  - Note that the absence of future mortality improvement in the VBT can be considered a margin vs. anticipated experience
  - The "company variation" component of margin at the higher ages may reflect an element of trend variance (where trends are caused by items such as anti-selection)
  - PBR methodology will allow the for the table/margins to be updated based on experience

UL Reserve Testing of 2008 Valuation Table

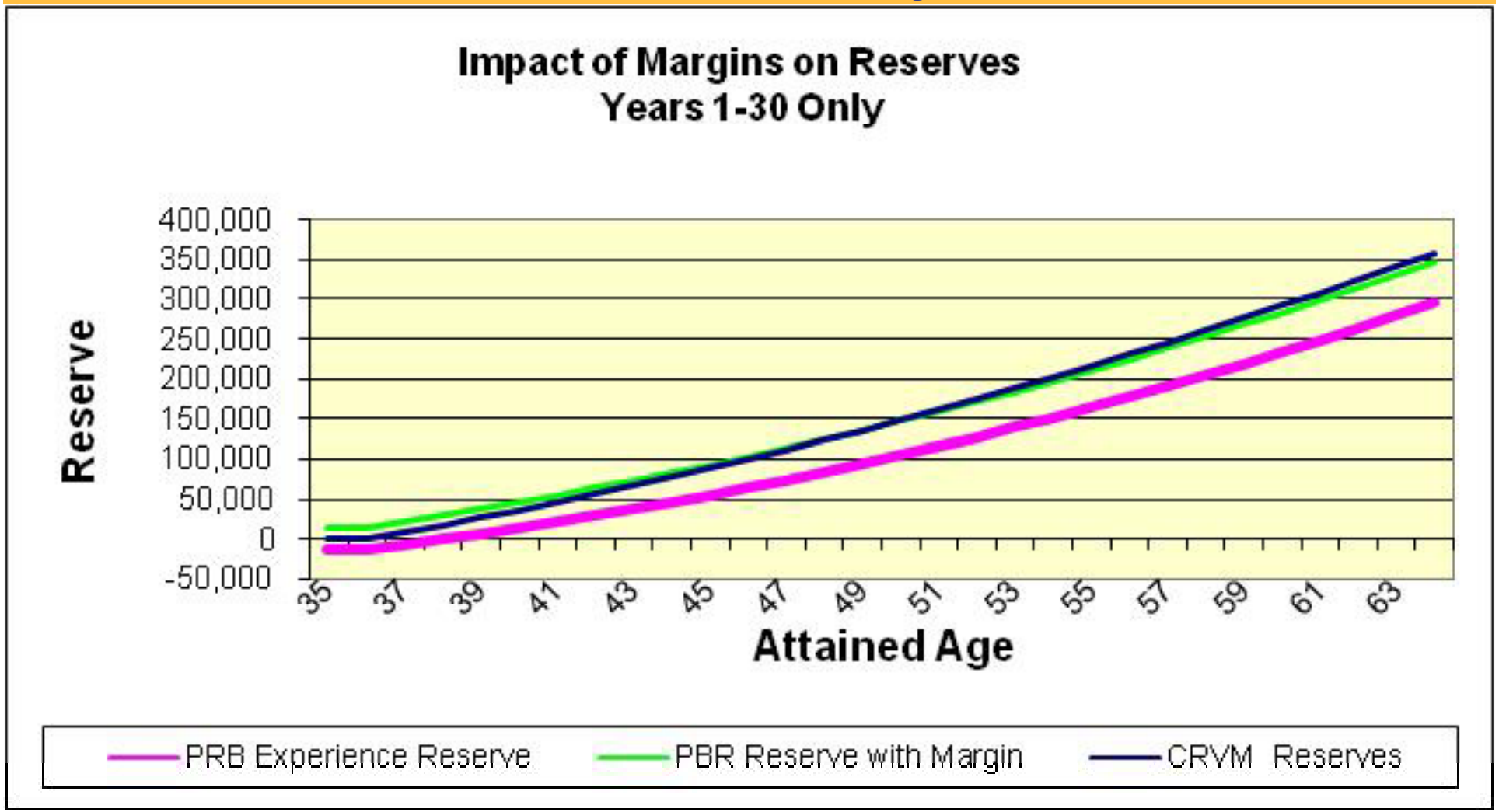
- Pay $10,439 All Years
- Lifetime $1,000,000 Death Benefit
- 8% before tax profit margin on premium

Assumption Summary

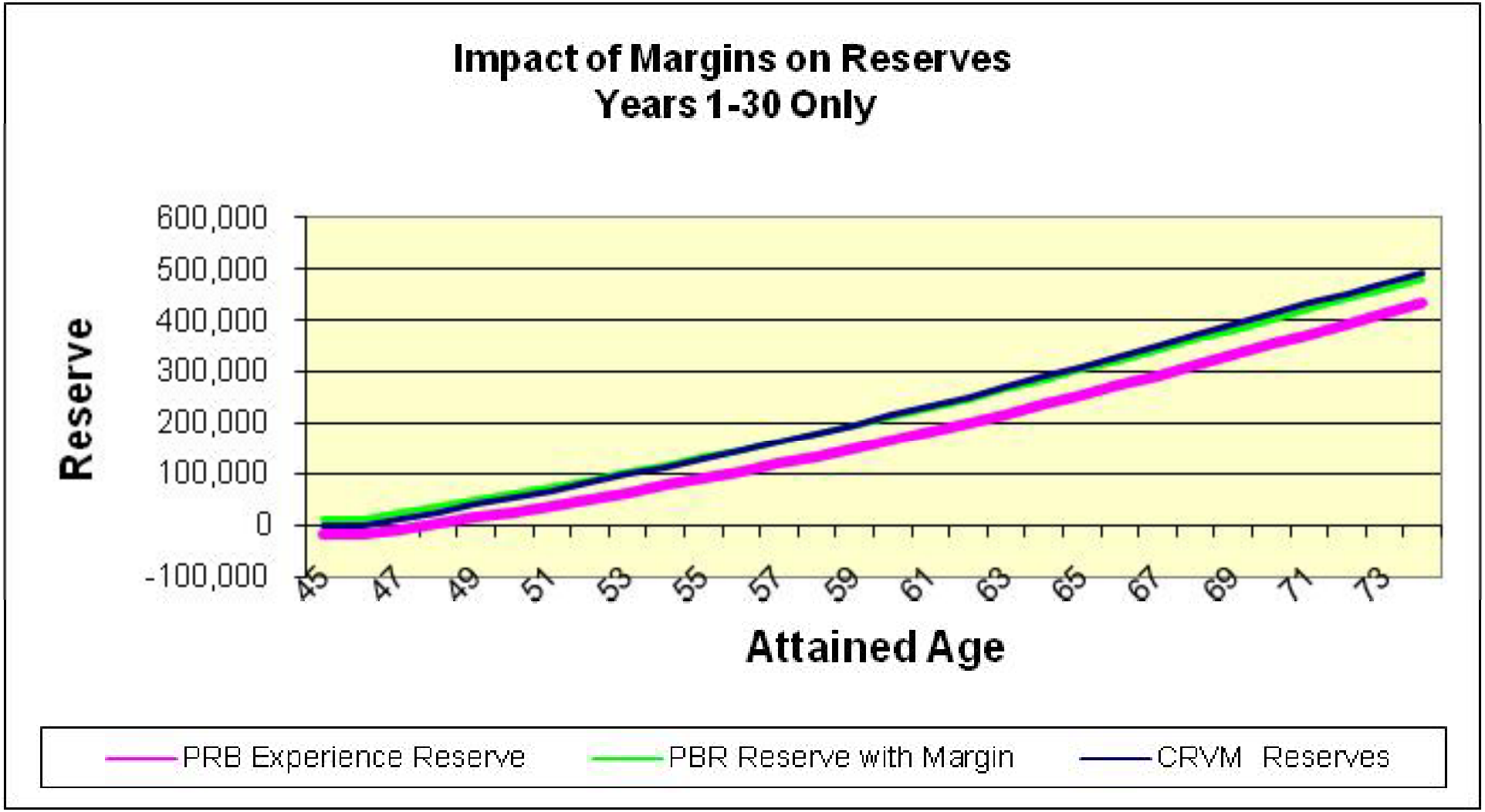
- Pricing Assumptions and PBR Experience Assumptions
  - Assumes AG38 Lapse Rates (Interim Solution)
  - 5% Investment Yield all years
  - Expenses
    - 99% FY Premium, 5% Renewal Premium
    - $300 FY expense, $75 renewal years
  - 8% pre-tax profit margin in gross premiums
  - 2008 VBT – RR100 - Mortality Table
  - Margins
    - Mortality margins defined earlier.
    - Interest margin 50bps
    - Expense margin – none

- **CRVM Reserves**
  - 4% Interest
  - 2008 VBT – RR100 - Mortality Table
  - Mortality Margins Added to Cover at Least 85% of Contributing Companies

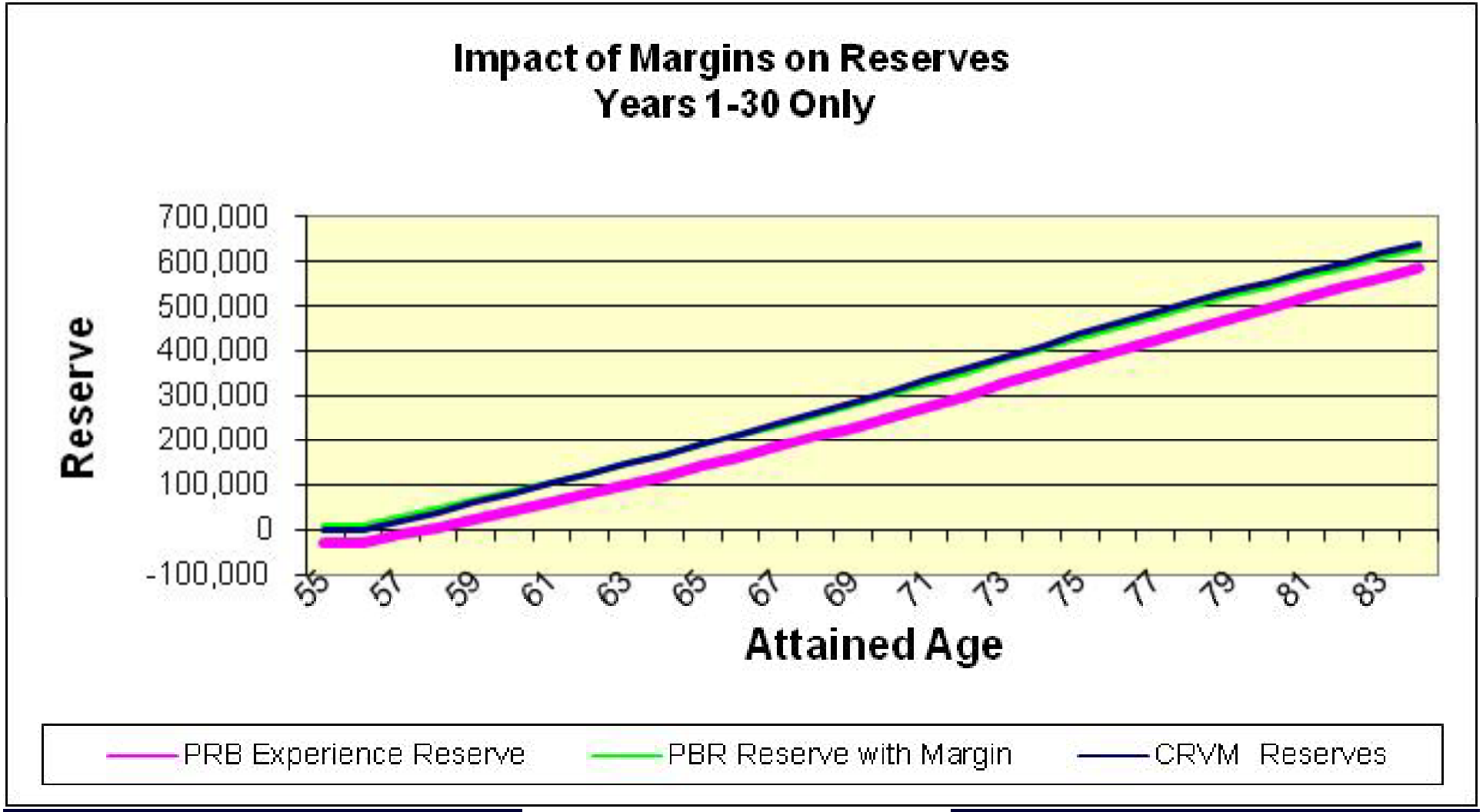
Impact of Various Margins on CRVM Type Reserves Male NS Issue Age 35



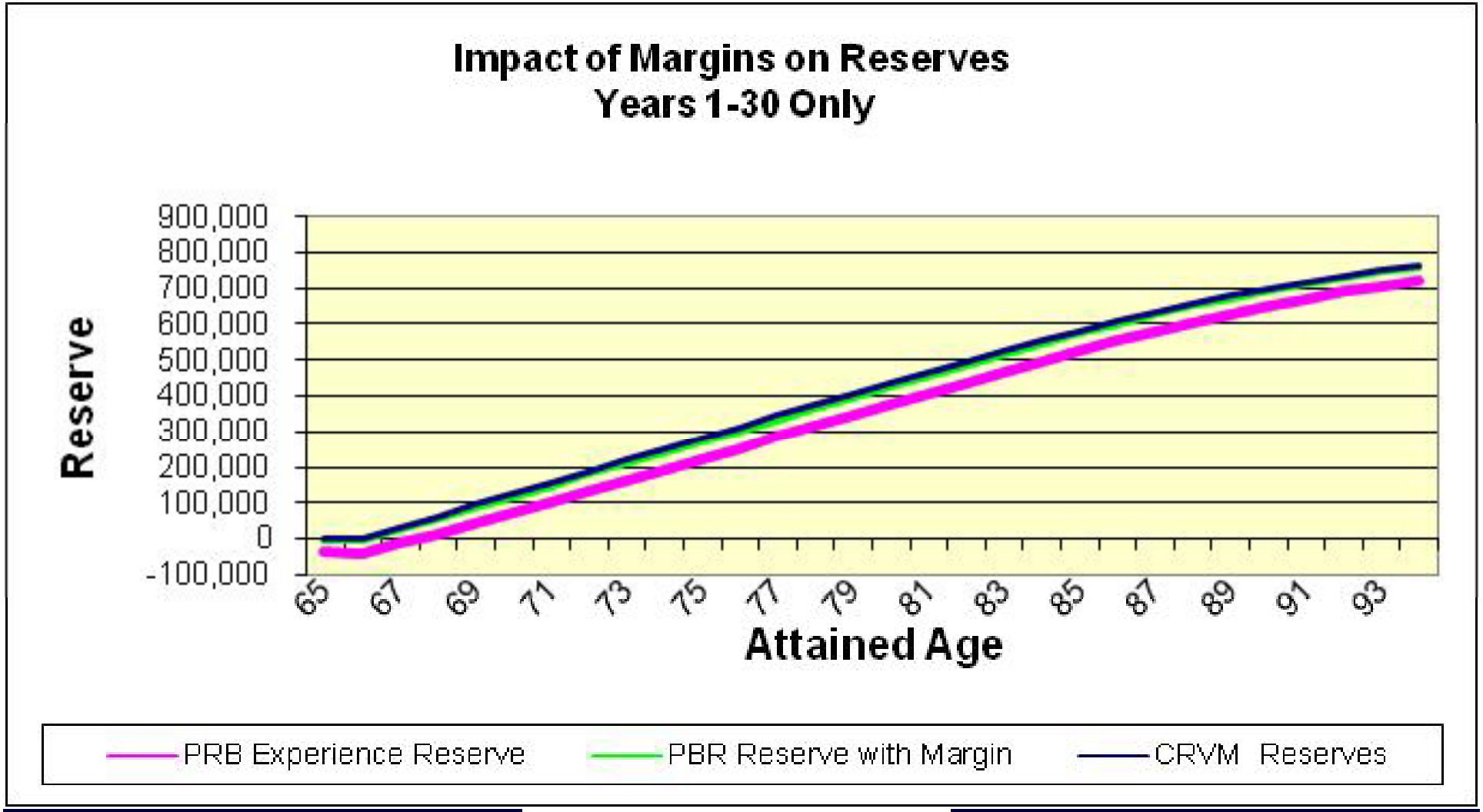
Impact of Various Margins on CRVM Type Reserves
Male NS Issue Age 45



Impact of Various Margins on PBR Type Reserves
Male NS Issue Age 55



Impact of Various Margins on PBR Type Reserves
Male NS Issue Age 65



Discussion Topics

- Coverage of all companies at all durations by the loaded table. Not just those with more than 50/100 death claims for the exposure period.
- Implicit margins resulting from future mortality improvement.
- ACLI comments on Treasury's input.

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