

Life Reserves Work Group

Margin Examples using a 20 Year Term Plan
Based on Male 45, Best Class

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Purpose

- This worksheet was developed to assist regulators and interested parties understanding of the Principles-Based Reserve Approach and in particular the impact margins have on the level and emergence of reserves. For comparison purposes, basic reserves under current CRVM requirements are also shown.
- These examples were produced using a worksheet developed by the LRWG. This worksheet can be used to develop further examples using a 20 year term product to enhance understanding of the PBR methodology.



- Reserves for each example are computed for the following 6 sets of margins and assumptions:
 - Margin Set 1: Using margins as shown in each example with the underlying mortality consistent with best estimate assumptions being 100% credible.
 - Margin Set 2: For comparison purposes with Set 1, with the underlying mortality consistent with best estimate assumptions being 100% credible.
 - Margin Set 3: Using margins as shown in each example with the underlying mortality blended with industry mortality assumptions reflecting credibility less than 100%
 - Margin Set 4: For comparison purposes with Set 3, with the underlying mortality blended with industry mortality assumptions reflecting credibility less than 100%.
 - 2001 Basic Formula Reserves: Currently required CRVM reserves, using a 4% discount rate and X-factors sufficient to result in no deficiency reserves.
 - 2001 Basic Formula Reserves as above, however, reducing the 2001 CSO table by the 2001 CSO margins.



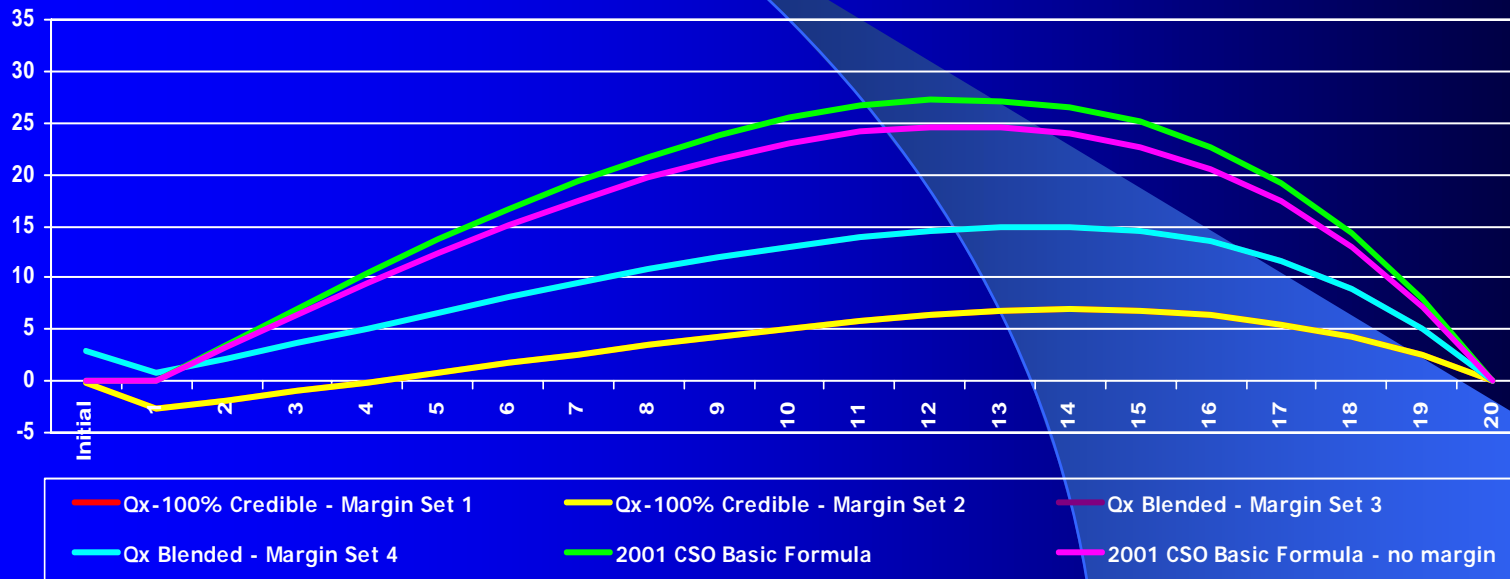
- Application of the PBR methodology is expected to result in periodic review and updating of assumptions, thus it is unlikely that assumptions would remain unchanged over a long period of valuation dates. The following are examples and should not be relied upon.



Example 1: No Margins other than interest margins

Input Assumptions ^b						
Term Premium	\$1,415					
Input	Qx -100% Credible Margin Set 1	Qx -100% Credible Margin Set 2	Qx Blended Margin Set 3	Qx Blended Margin Set 4	Basic Formula Reserve 2001 CSO	Basic Formal Reserve 2001 CSO less Margin
Mortality Margin (extra deaths/e _x)	0	0	0	0	0	Na
Mortality Margin (% extra)	0.0%	0.0%	0.0%	0.0%	Na	Na
Lapse Rate Margin	0%	0%	0%	0%	Na	Na
Discount Rate Margin	Det	Det	Det	Det	Na	Na
Expense Margin	0.0%	0.0%	0.0%	0.0%	Na	Na

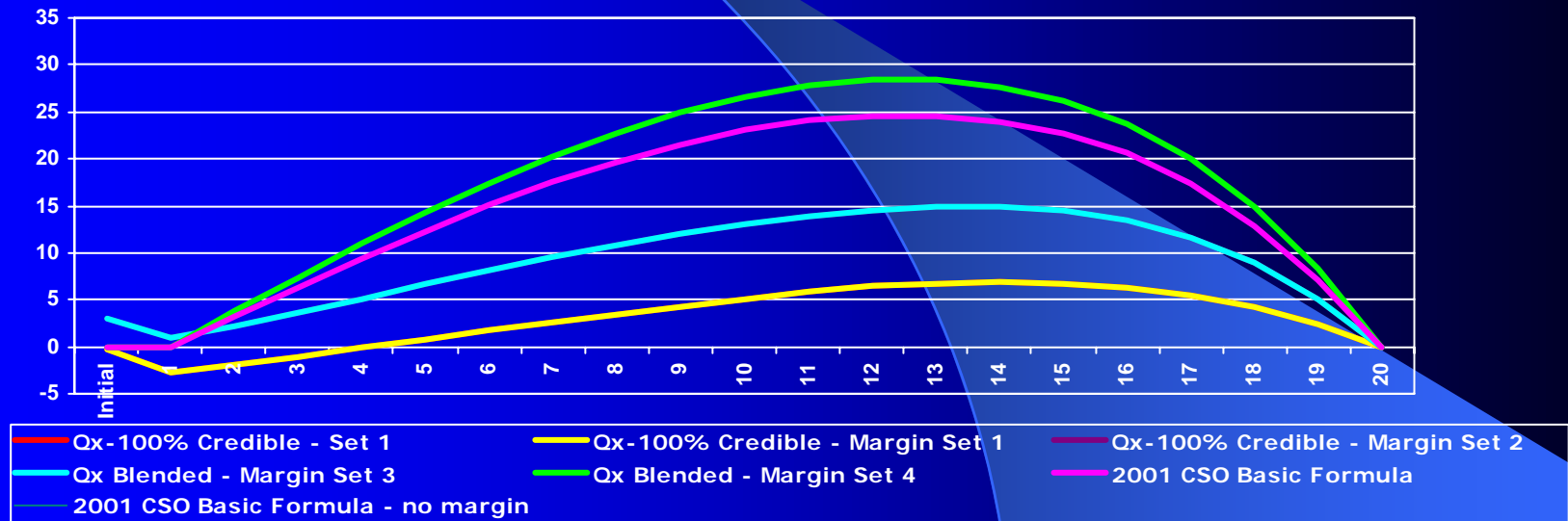
20 Year Term 45 Male, Best Class
Reserves per 1000



Example 2: Margins added to mortality under Formula Reserve have a greater impact in later policy years than earlier policy years

Input Assumptions						
Term Premium	\$1,415					
Input	Qx -100% Credible Margin Set 1	Qx -100% Credible Margin Set 2	Qx Blended Margin Set 3	Qx Blended Margin Set 4	Basic Formula Reserve 2001 CSO	Basic Formal Reserve 2001 CSO less Margin
Mortality Margin (extra deaths/e _x)	0	0	0	0	20	Na
Mortality Margin (% extra)	0.0%	0.0%	0.0%	0.0%	Na	Na
Lapse Rate Margin	0%	0%	0%	0%	Na	Na
Discount Rate Margin	Det	Det	Det	Det	Na	Na
Expense Margin	0.0%	0.0%	0.0%	0.0%	Na	Na

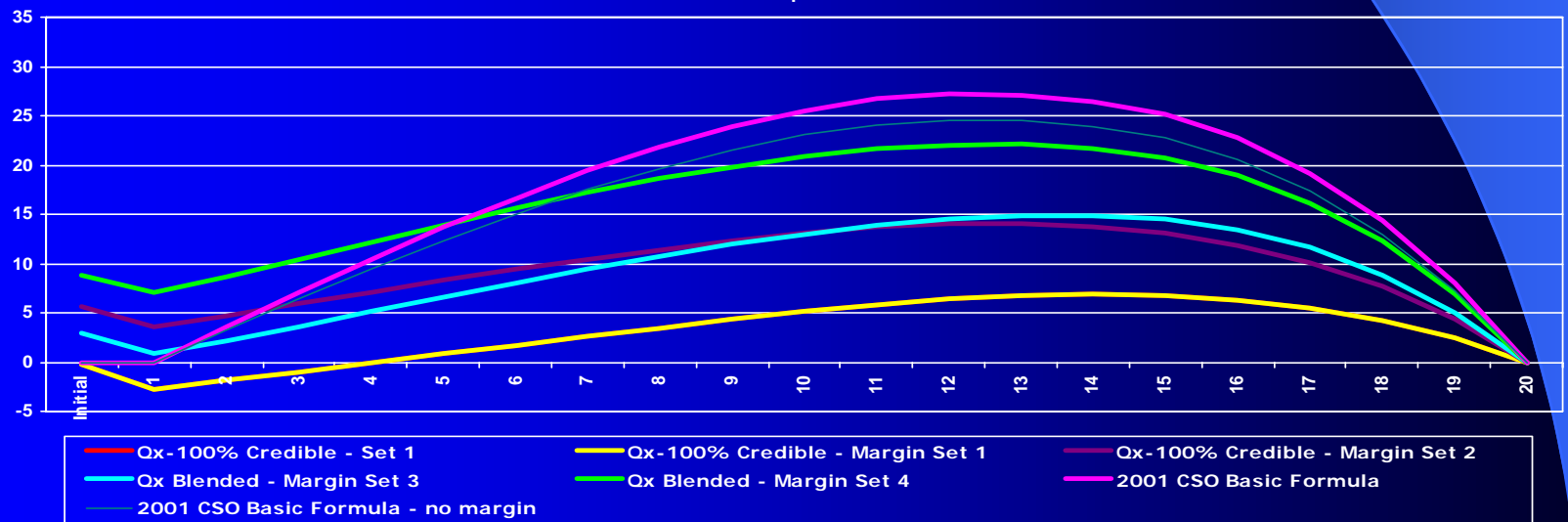
20 Year Term 45 Male, Best Class
Reserves per 1000



Example 3: Mortality Margins with PBR approach have a greater impact in earlier policy years

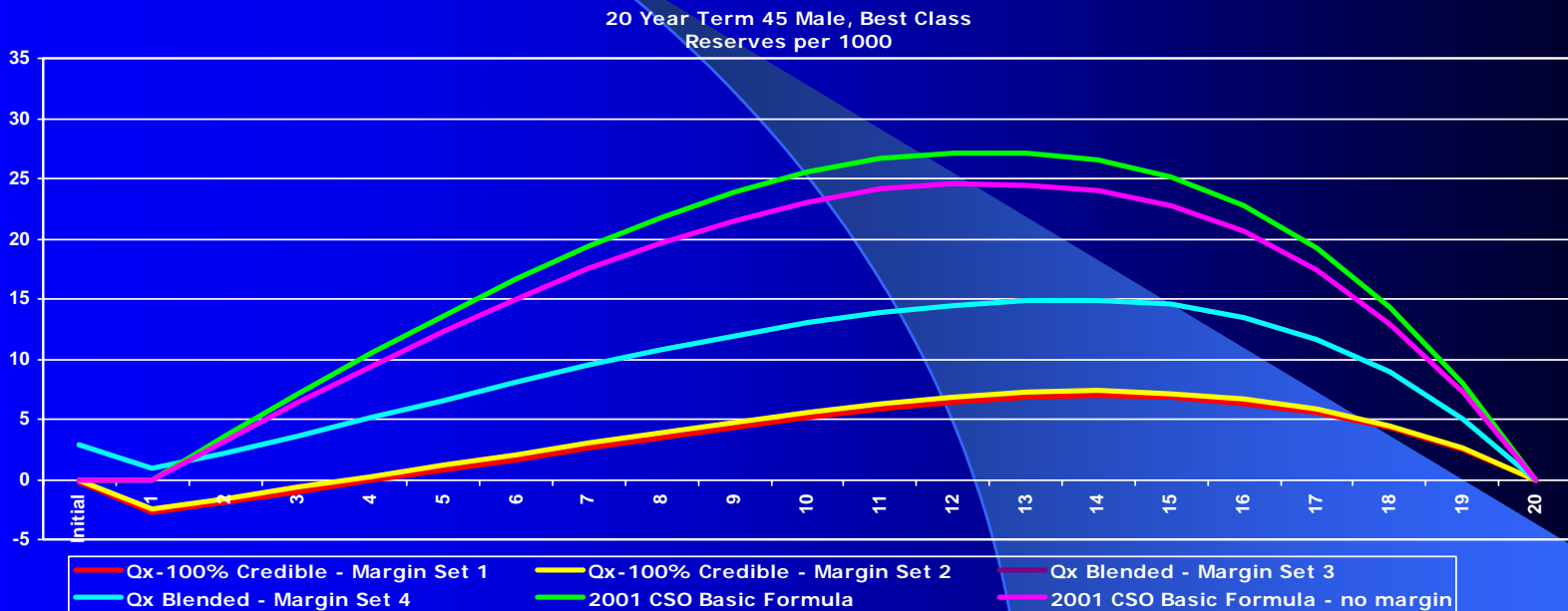
Input Assumptions						
Term Premium	\$1,415					
Input	Qx -100% Credible Margin Set 1	Qx -100% Credible Margin Set 2	Qx Blended Margin Set 3	Qx Blended Margin Set 4	Basic Formula Reserve 2001 CSO	Basic Formal Reserve 2001 CSO less Margin
Mortality Margin (extra deaths/e _x)	0	2001	0	2001	0	Na
Mortality Margin (% extra)	0.0%	0.0%	0.0%	0.0%	Na	Na
Lapse Rate Margin	0%	0%	0%	0%	Na	Na
Discount Rate Margin	Det	Det	Det	Det	Na	Na
Expense Margin	0.0%	0.0%	0.0%	0.0%	Na	Na

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Reserves per 1000



Example 4: Shows Mortality Margin as % extra to result in a Reserve of Zero at Issue

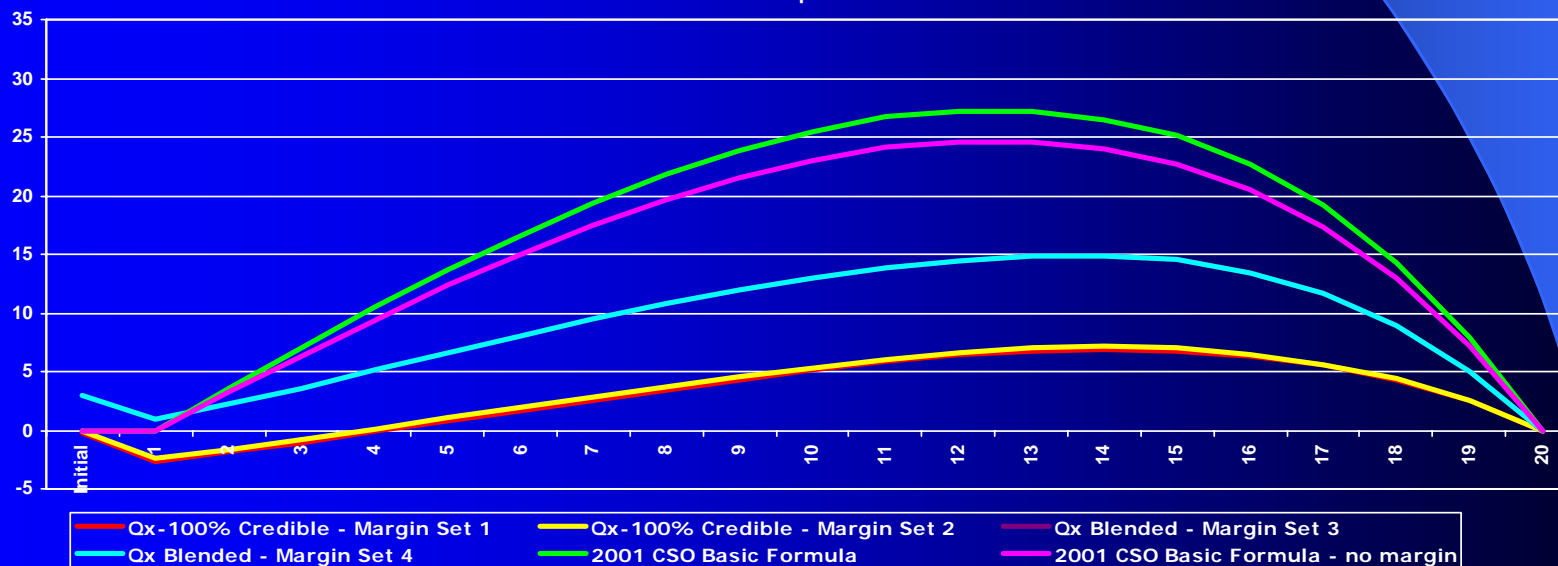
Input Assumptionsb						
Term Premium	\$1,415					
Input	Qx -100% Credible Margin Set 1	Qx -100% Credible Margin Set 2	Qx Blended Margin Set 3	Qx Blended Margin Set 4	Basic Formula Reserve 2001 CSO	Basic Formal Reserve 2001 CSO less Margin
Mortality Margin (extra deaths/e_x)l	0	0	0	0	0	Na
Mortality Margin (% extra)	0.0%	3.2%	0.0%	0.0%	Na	Na
Lapse Rate Margin	0%	0%	0%	0%	Na	Na
Discount Rate Margin	Det	Det	Det	Det	Na	Na
Expense Margin	0.0%	0.0%	0.0%	0.0%	Na	Na



Example 5: Shows Mortality Margin as constant extra death $/e_x$ to result in a Reserve of Zero at Issue

Input Assumptions						
Term Premium	\$1,415					
Input	Qx -100% Credible Margin Set 1	Qx -100% Credible Margin Set 2	Qx Blended Margin Set 3	Qx Blended Margin Set 4	Basic Formula Reserve 2001 CSO	Basic Formal Reserve 2001 CSO less Margin
Mortality Margin (extra deaths/ e_x)	0	0.76	0	0	0	Na
Mortality Margin (% extra)	0.0%	0%	0.0%	0.0%	Na	Na
Lapse Rate Margin	0%	0%	0%	0%	Na	Na
Discount Rate Margin	Det	Det	Det	Det	Na	Na
Expense Margin	0.0%	0.0%	0.0%	0.0%	Na	Na

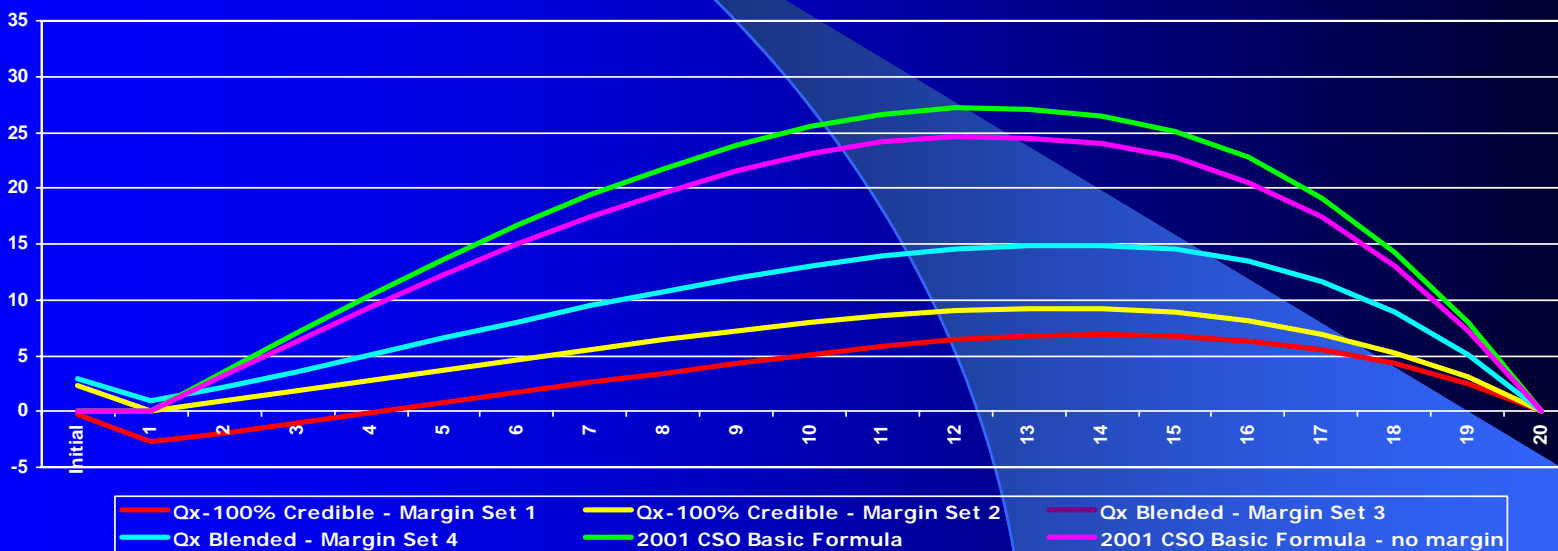
20 Year Term 45 Male, Best Class
Reserves per 1000



Example 6: Shows Mortality Margin as constant extra death $/e_x$ to result in a Reserve of Zero at the End of Year 1 (within range of Canadian Margins)

Input Assumptions						
Term Premium	\$1,415					
Input	Qx -100% Credible Margin Set 1	Qx -100% Credible Margin Set 2	Qx Blended Margin Set 3	Qx Blended Margin Set 4	Basic Formula Reserve 2001 CSO	Basic Formal Reserve 2001 CSO less Margin
Mortality Margin (extra deaths/ e_x)	0	8.6	0	0	0	Na
Mortality Margin (% extra)	0.0%	0%	0.0%	0.0%	Na	Na
Lapse Rate Margin	0%	0%	0%	0%	Na	Na
Discount Rate Margin	Det	Det	Det	Det	Na	Na
Expense Margin	0.0%	0.0%	0.0%	0.0%	Na	Na

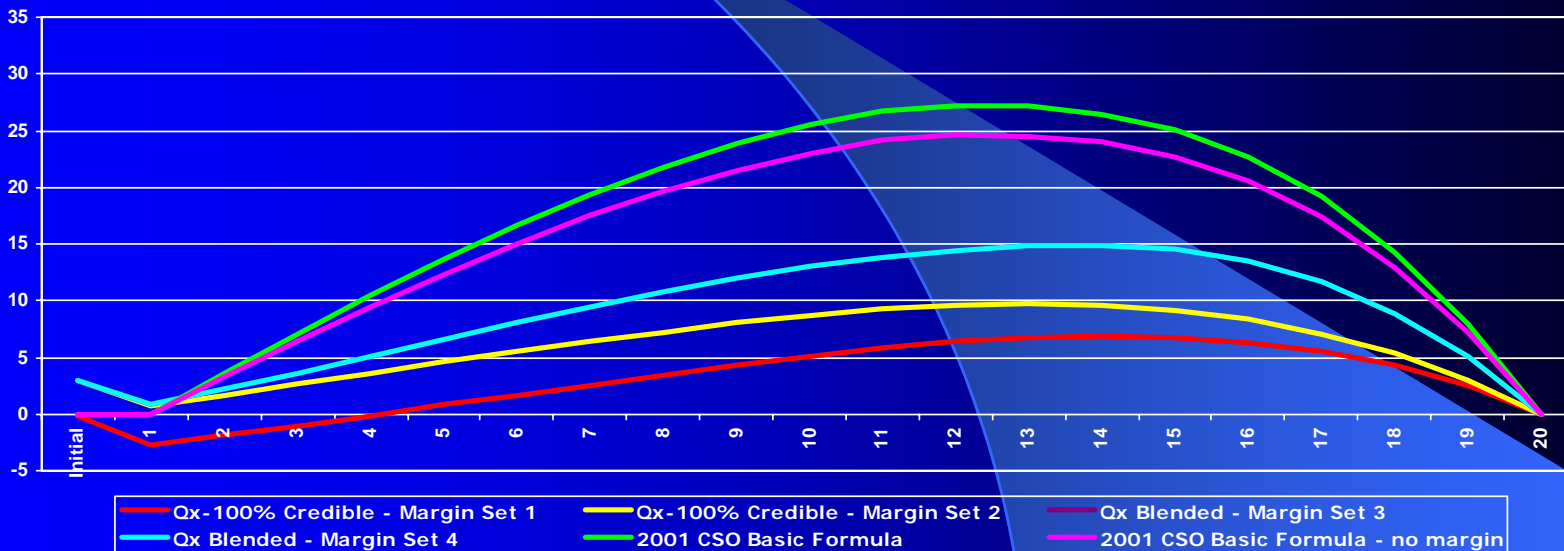
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Example 7: Impact of Adding Lapse Margins to Example 6

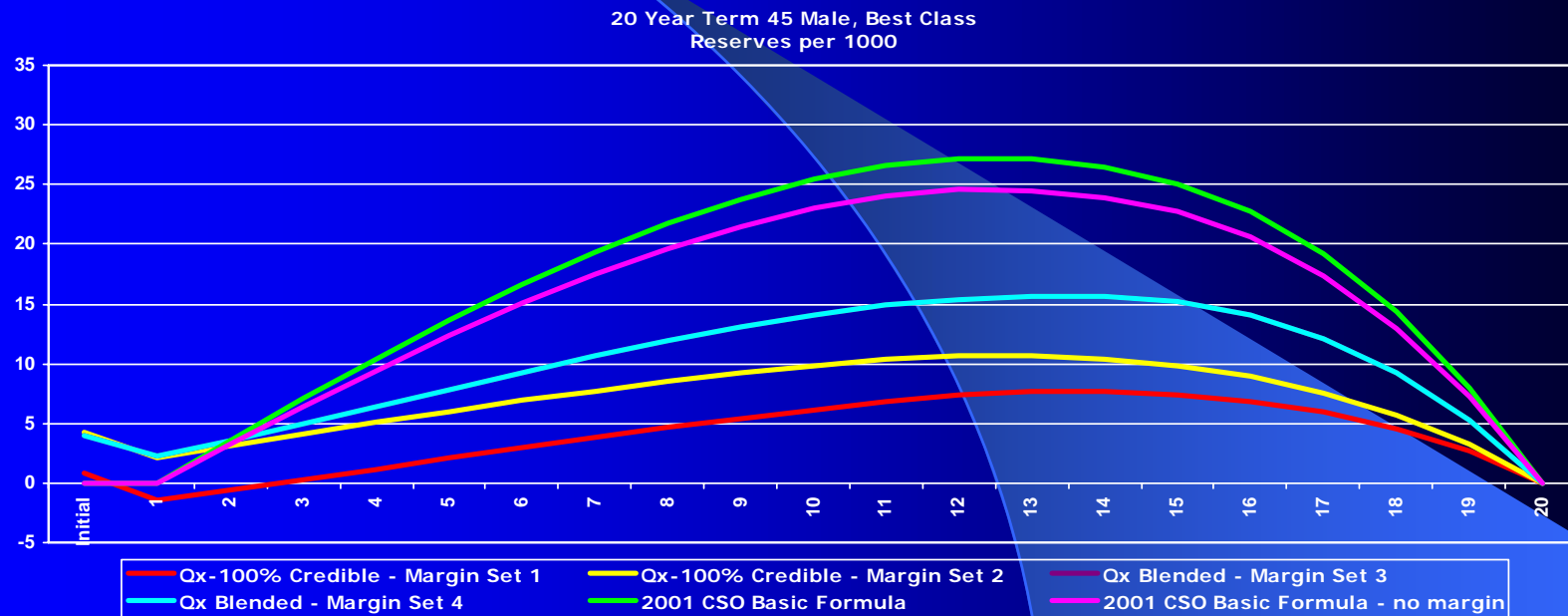
Input Assumptions						
Term Premium	\$1,415					
Input	Qx -100% Credible Margin Set 1	Qx -100% Credible Margin Set 2	Qx Blended Margin Set 3	Qx Blended Margin Set 4	Basic Formula Reserve 2001 CSO	Basic Formal Reserve 2001 CSO less Margin
Mortality Margin (extra deaths/ e_x)	0	8.6	0	0	0	Na
Mortality Margin (% extra)	0.0%	0%	0.0%	0.0%	Na	Na
Lapse Rate Margin	0%	30%	0%	0%	Na	Na
Discount Rate Margin	Det	Det	Det	Det	Na	Na
Expense Margin	0.0%	0.0%	0.0%	0.0%	Na	Na

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Reserves per 1000



Example 8: Impact of a Lower Guaranteed Premium to Example 7. This increases reserves, impact is greatest in early years

Input Assumptions						
Term Premium	\$1,250					
Input	Qx -100% Credible Margin Set 1	Qx -100% Credible Margin Set 2	Qx Blended Margin Set 3	Qx Blended Margin Set 4	Basic Formula Reserve 2001 CSO	Basic Formal Reserve 2001 CSO less Margin
Mortality Margin (extra deaths/e _x)	0	8.6	0	0	0	Na
Mortality Margin (% extra)	0.0%	0%	0.0%	0.0%	Na	Na
Lapse Rate Margin	0%	30%	0%	0%	Na	Na
Discount Rate Margin	Det	Det	Det	Det	Na	Na
Expense Margin	0.0%	0.0%	0.0%	0.0%	Na	Na



Notes/Limitations and Disclosures

- The discount rate used is a single set of discount rates, either best estimate less a margin or the initial deterministic interest rates from the work group's prior term example. This was done for ease of presentation and understanding, however, it is not technically consistent with the PBR methodology, as discount rates at future valuation dates are expected to vary at each future date under the PBR methodology reflecting a portfolio of assets on the valuation date. However, for education purposes, we believe the approach used is appropriate to allow focusing on margins rather than the level of discount rates.



Notes/Limitations and Disclosures

- The column of results labeled, "Basic Formula Terminal Reserve without 2001 CSO margin" only approximates the removal of the 2001 CSO margin as the approach used is to subtract a margin from the 2001 valuation table. The margin subtracted was determined by calculating the extra deaths by attained age used in the 2001 CSO margins, however, using life expectancy based on the 2001 valuation mortality assumption. So the impact is approximate rather than precise, but helps demonstrate the impact of margins on formula reserves and the development of these reserves by policy year.



Notes/Limitations and Disclosures

- Cash flows do not extend beyond the 20 year level period.
- Cash flow timing is assumed to be annual, however, an interest adjustment is to reflect death benefit payable prior to the end of a policy year.



Source: Term Example worksheet, LRWG
Term Example Version 2006-02-20.xls

