Comparison of the Impact of Mortality Loads, Net vs. Gross

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Comparison of the Impact of Mortality Loads on
Net Premium Reserves vs. Gross Premium Reserves

- Both Net Premium and Gross Premium Reserves are calculated as the present value of future benefits less the present value of future premiums (gross premium reserves also include the present value of future expenses as well as benefits).

- Gross premium reserves use the actual gross premiums (potentially modified if they are too low), and the premiums used for net premium reserves are calculated on the same basis as the present value of benefits.

- Margins added to the mortality assumption increases the present value of future benefits for both types of reserves in a similar fashion.

- However, the effect of margins added to the mortality assumption on the present value of future premiums is vastly different:
  - For gross premium reserves, actual gross premiums do not change. The present value of future premiums is actually slightly *decreased* due to the effect of higher mortality in discounting gross premiums.
  - For net premium reserves, the net premiums are *increased* due to use of the higher mortality assumption in the net premium calculation.

A CSO Type Load is not Suitable for VM-20 Deterministic and Stochastic Reserves

- The effect of mortality loads on gross premium reserves is dramatically larger than the effect on net premium reserves.
  - Reserve = PV(Future Benefits) – PV(Future Premiums)
  - Mortality load decreases gross premiums and increases net premiums

- The graph on the next page compares this effect for a sample 20 year level term plan issued to a Super Preferred Male age 45 that expires after 20 years.
  - The dark blue line is the net premium reserve (full preliminary term) based on 2008 VBT RR70 at 3.5%
  - The orange line is the net premium reserve using the 2008 VBT RR70 plus a CSO like load at 3.5% (CSO like load is the ratio of 2001 CSO/2001 VBT super-preferred)
  - The green line is the gross premium reserve using the 2008 VBT RR70 at 4%
  - The red line is the gross premium reserve using the 2008 VBT RR70 plus a CSO like load at 4%

- Conclusion – a load with a magnitude similar to a CSO type load is not suitable for gross premium reserves.

20 Year Level Premium Term Terminal Reserves Comparison of Effect of Mortality Margins on Net Premium and Gross Premium Reserves
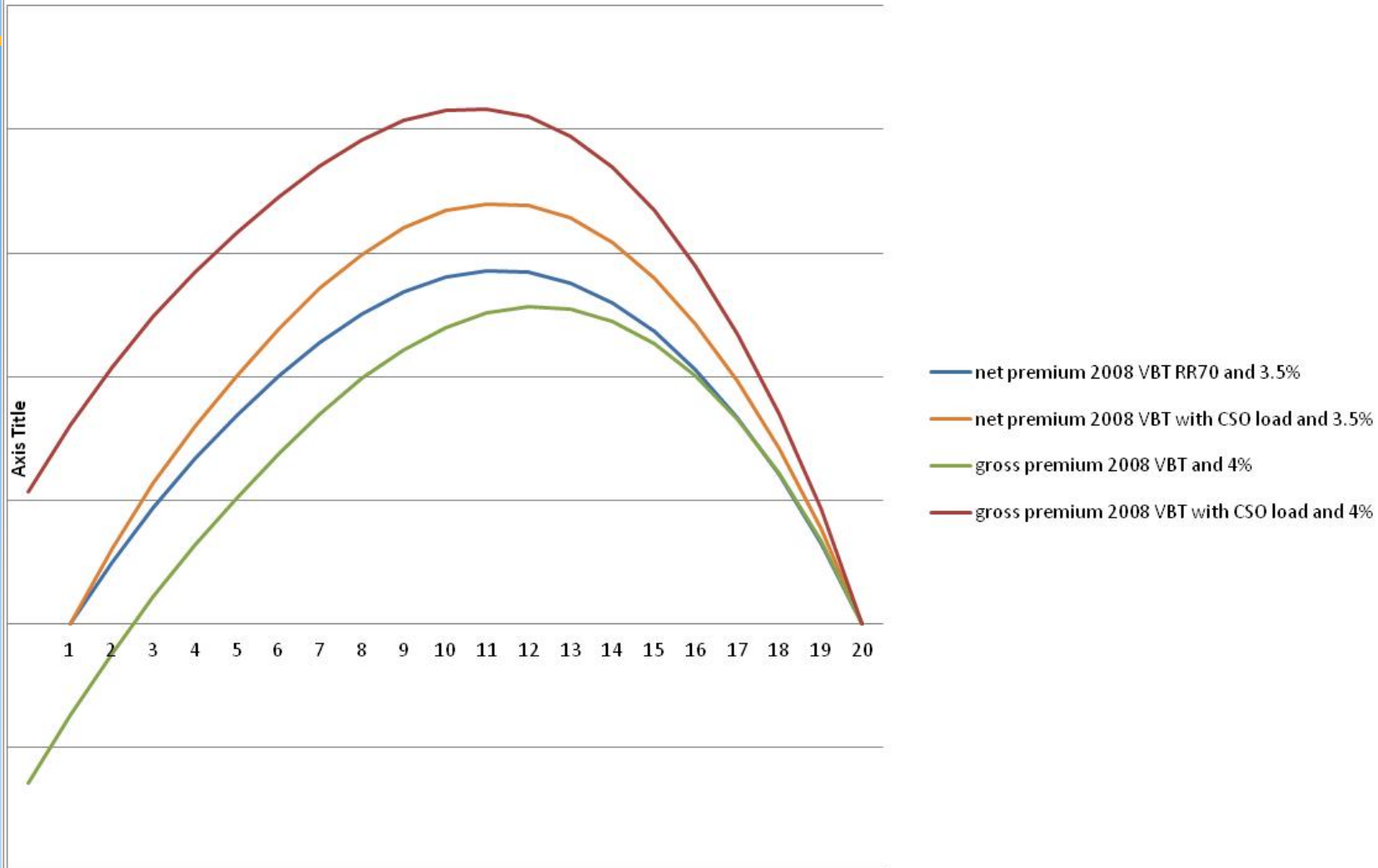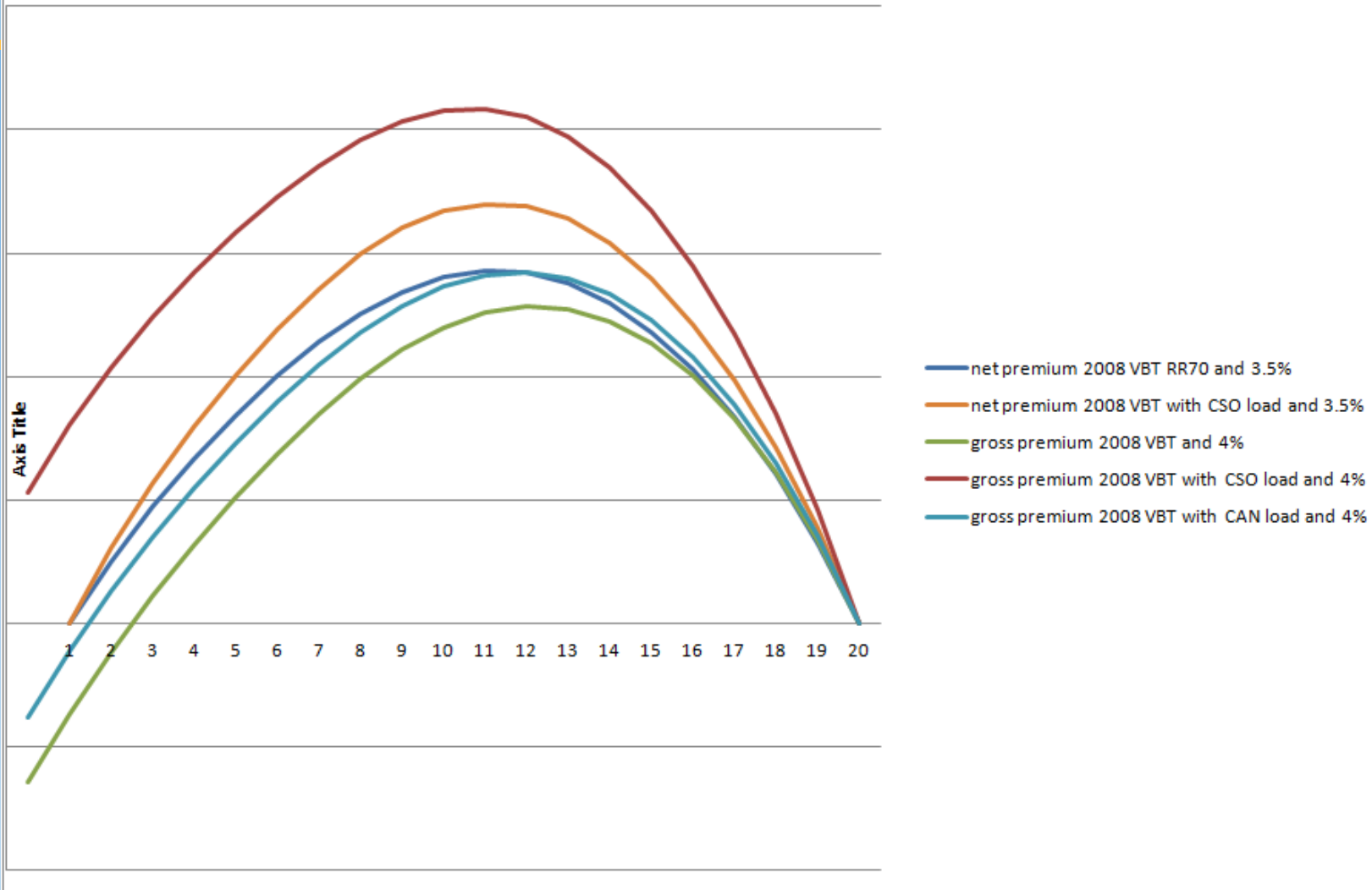
Possible Load for Gross Premium Reserve Calculations

- An example of a margin for a gross premium valuation method when there is a high level of confidence in the expected assumption can be found in the Canadian standard.

  - 3.75 deaths per 1000 divided by life expectancy
  - When looked at as a margin per 1000, this margin increases by duration
  - When looked at as a percentage of the mortality rate, this margin decreases by duration

- The graph on the following slide shows the effect of this margin in light blue compared to the green line.

  - The resulting margin in gross premium reserves produced by the Canadian margin is comparable to the margins in net premium reserves produced by a CSO like margin in mortality
  - The mortality rates used are shown on the last slide

20 Year Level Premium Term Terminal Reserves Comparison of
Effect of Mortality Margins on Net Premium and Gross Premium Reserves

Legend:
- net premium 2008 VBT RR70 and 3.5%
- net premium 2008 VBT with CSO load and 3.5%
- gross premium 2008 VBT and 4%
- gross premium 2008 VBT with CSO load and 4%
- gross premium 2008 VBT with CAN load and 4%

Duration	2008 VBT RR70	Mortality Used In Comparison Issue Age 45 (per 1000)	
		2008 VBT RR70 + CSO load*	2008 VBT RR70 + CAN load**
1	0.21	0.48	0.31
2	0.34	0.66	0.44
3	0.46	0.83	0.56
4	0.57	0.99	0.68
5	0.67	1.10	0.78
6	0.77	1.21	0.88
7	0.88	1.34	0.99
8	1.01	1.49	1.13
9	1.17	1.68	1.29
10	1.36	1.92	1.49
11	1.58	2.19	1.71
12	1.82	2.46	1.95
13	2.08	2.77	2.22
14	2.36	3.12	2.50
15	2.66	3.50	2.81
16	2.97	3.85	3.13
17	3.30	4.23	3.46
18	3.67	4.64	3.84
19	4.08	5.11	4.25
20	4.57	5.70	4.75

* = 2008 VBT times ratio of 2001 CSO super-preferred to 2001 VBT super-preferred
** = 2008 VBT plus 3.75 deaths per 1000 divided by life expectancy