200X CSO Loading

Life and Health Actuarial Task Force

March 22, 2001

Nashville

200X CSO Overview

- Table development to date
- Review 1980 CSO loadings
- 200X CSO loading considerations
- Illustrate a couple of possible loadings
- Next steps in the table development
- Work in progress - we need your input!

We Need Your Input!

1. Determination of the load

   "Mortality Margin" v. "Reserve Margin"

2. Level of the load

3. Form of the load

Definitions

- Composite Mortality - Mortality for smokers and nonsmokers combined
- “Economic Reserve” - Reserve based on the CRVM statutory reserve method except for:
  - Mortality may be different than statutory minimum
  - Interest may be different than statutory minimum
  - May include lapses

200X CSO Development to Date

- 1990-95 Basic Mortality Tables

  SOA Individual Experience Studies Committee

  April, 2000

- 200X Valuation Basic Tables (VBT)

  SOA Individual Life Insurance Valuation Mortality Task Force

  Draft tables released March 14, 2001

- 200X CSO Tables

  AAA Task Force

  – Loading Subcommittee

  – Goal is to have loading ready for exposure by June, 2001

Starting Point - Draft 200X VBT

- Observations on draft 200X VBT
  - Male table is reasonably complete
  - Female table has graduation issues
- Composite smoker/nonsmoker is the underlying basis for 1990-95 Basic Tables
- Loading Subcommittee's work has focused on composite male VBT

1980 CSO Loading Constraints

1980 CSO Loading
Primary Constraint

"The prime constraint on margins was that reserves on the loaded table not be materially less than reserves developed using underlying select and ultimate mortality." *

* From TSA XXXIII

1980 CSO Loading
Other Constraints

- "Loaded mortality rates should encompass the standard mortality experience in the 1970-75 period of most companies writing ordinary insurance with normal underwriting standards." *
- "Terminal reserves on the loaded table should not be significantly distorted when compared with terminal reserves on the graduated basic table." *

* From TSA XXXIII

1980 CSO Loading
Other Constraints

- "The methodology should be consistent in providing margins for both male and female tables." *
- "Loaded mortality rates should not result in unreasonable statutory premium deficiencies on term insurance plans." *

* From TSA XXXIII

200X CSO Loading Considerations

200X CSO Loading Considerations

- Statutory reserves on the loaded table should not be materially less than statutory reserves developed using the underlying select and ultimate mortality
  - These comparisons use statutory interest rates and no lapses
  - These comparisons are done for both terminal and mean reserves

200X CSO Loading Considerations

- Loaded mortality should provide reasonable margin for possible future adverse mortality experience
- Terminal reserves on the loaded table should not be significantly distorted when compared with terminal reserves on the graduated basic table

200X CSO Loading Considerations

- The loading should be consistent in providing margins
  - For males and females
  - For smokers and nonsmokers
  - During select and ultimate periods
- Loaded mortality rates should not result in unreasonable statutory premium deficiencies on term insurance plans
- Reserves and net premiums on the loaded table should not be excessive

1980 CSO Loading

1980 CSO Loading Formula

$$\text{Load} = (0.035 - 0.00025x + 0.000009x^2) / e_x$$

+0.035

"produced a desirable dollar loading at age 0" *

-0.00025x

"was necessary to keep loadings at appropriate levels at ages under 50, and to help minimize premium deficiencies" *

$+0.000009x^2$

"was chosen to maximize the slope of the loaded table without providing overly redundant margins ... at higher ages" *

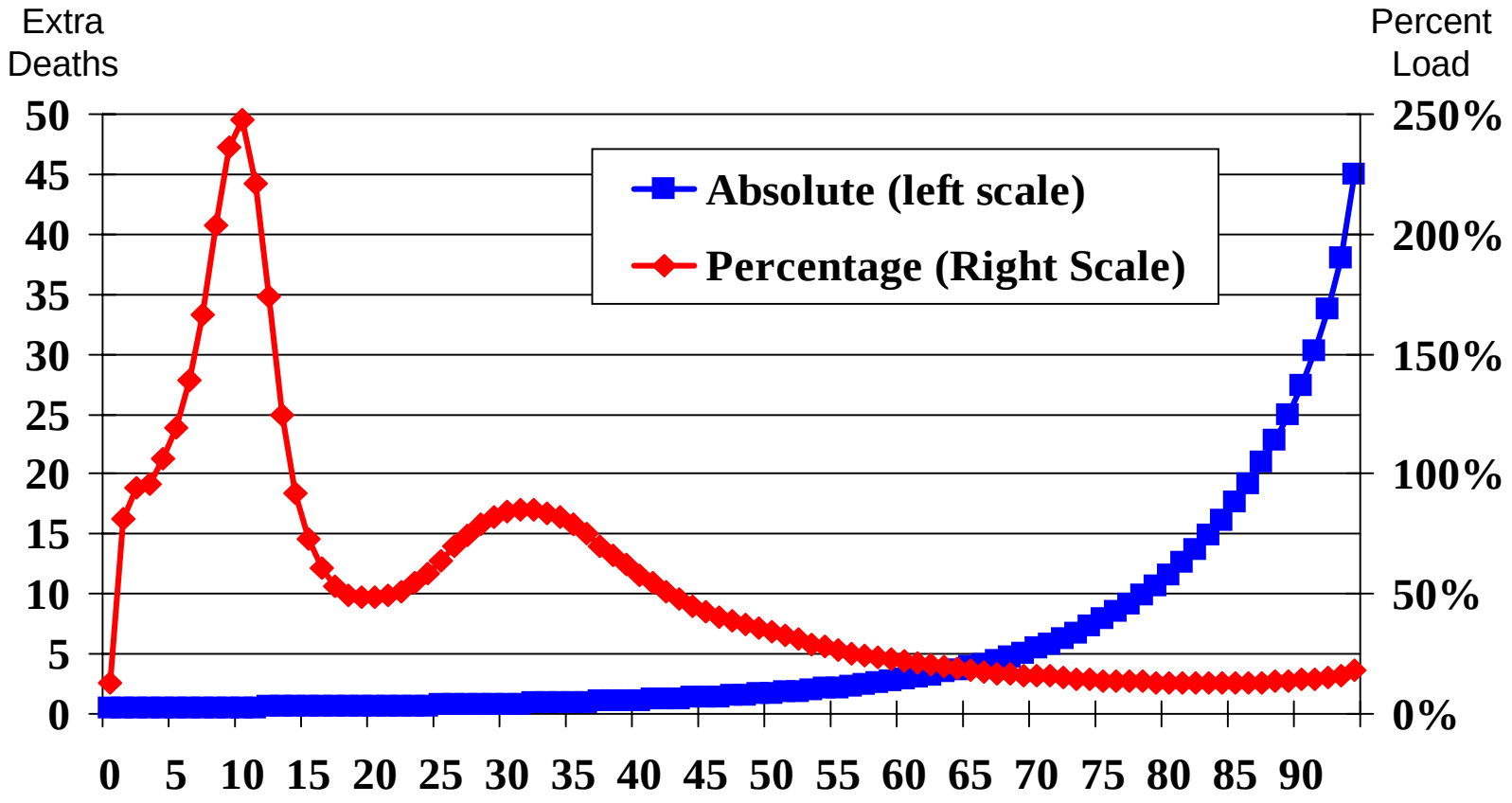
* From TSA XXXIII

1980 CSO Loading Formula

- Based on reciprocal of 1970-75 Basic Table expectation of life
- Smaller absolute loads at younger ages
- Smaller percentage loads at higher ages

80 CSO Loads

Aggregate, Composite Male



Characteristics of a Loading That Is a Function of $1/e_x$

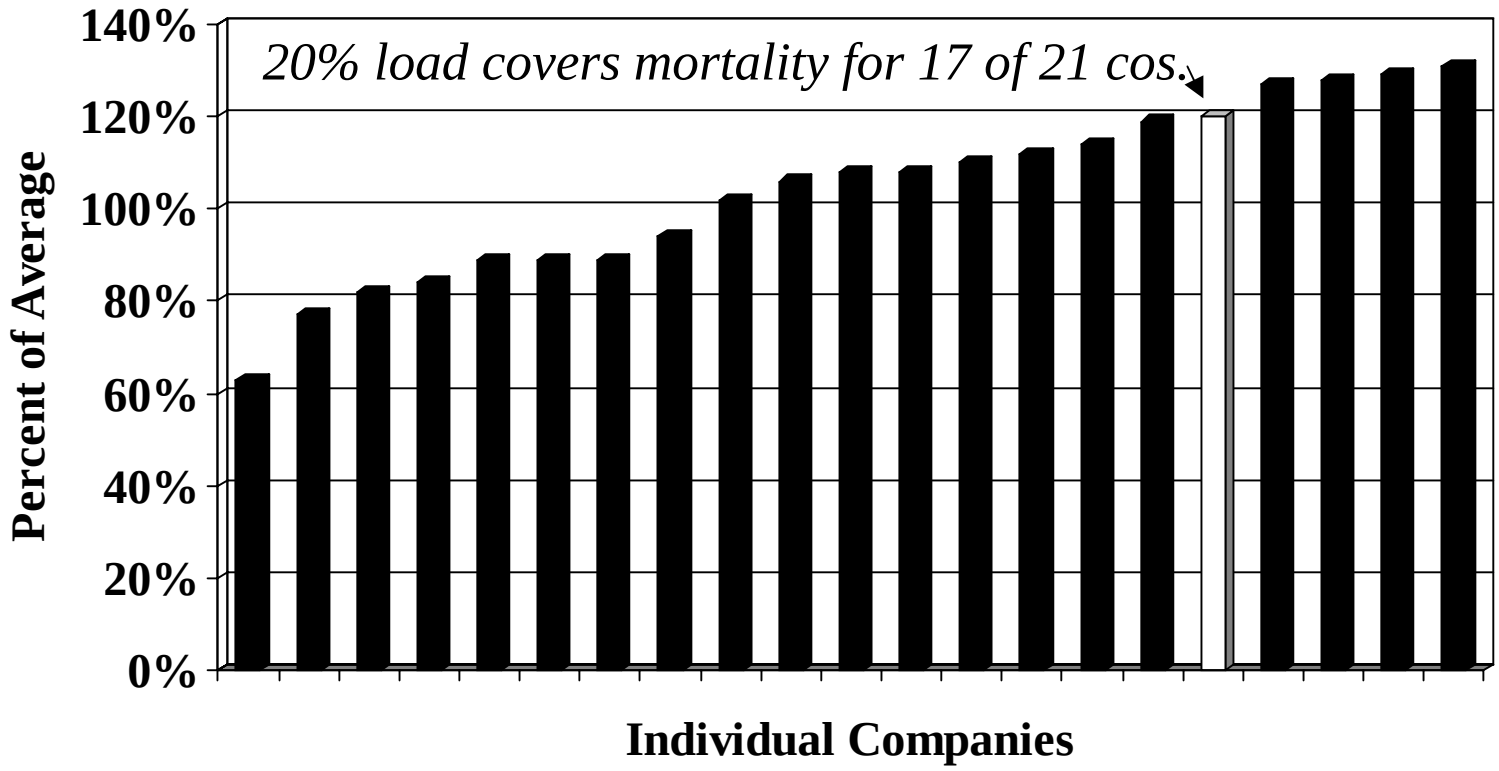
- Absolute loads monotonically increase with age
- Percentage loads generally decrease with age
- During select period, loads are smaller for select and ultimate mortality than for ultimate mortality

Mortality Margin Loading Approach

First Loading Illustration - 20%

- “Mortality Margin” approach
- Margins stand on their own
- Loading needed is that which is sufficient to ensure valuation mortality covers experience of most companies
- 20% load covers 17 of the 21 companies (81%) that contributed to 1990-95 Basic Table

SOA Comparative Mortality Study 1990-95



Sample 20% Loading Formula

$$\text{Load} = (0.0038 - 0.00011x + 0.000011x^2) / e_x$$

+0.0038

produced a 10% loading at age 0

-0.00011x

was necessary to keep loadings at appropriate levels at younger ages

$+0.000011x^2$

was chosen to maintain desirable reserves at ages over 50

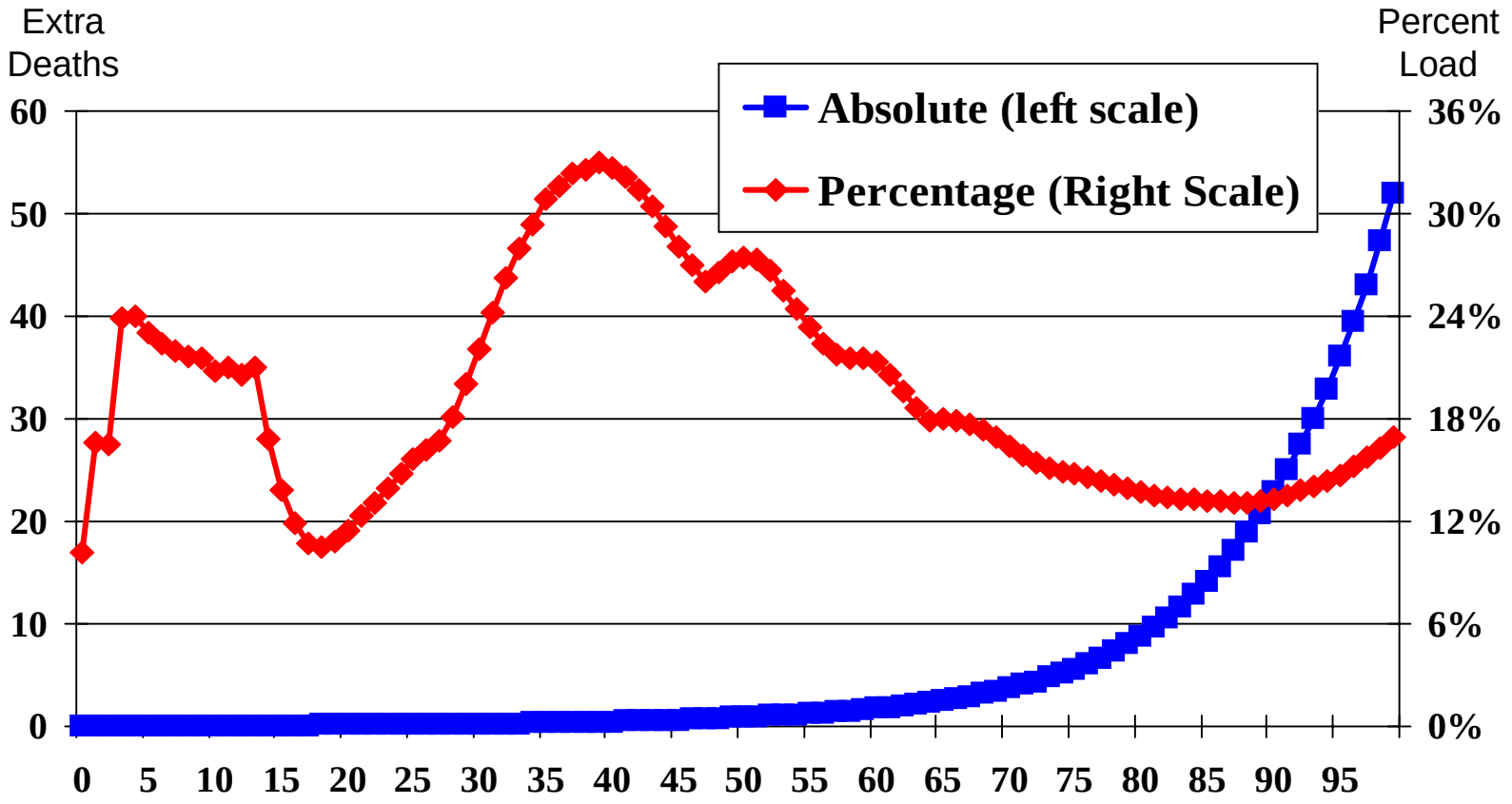
Sample 20% Loading Formula

$$\text{Load} = (0.0038 - 0.00011x + 0.000011x^2) / e_x$$

- Absolute load is monotonically increasing
- Percentage load is generally decreasing

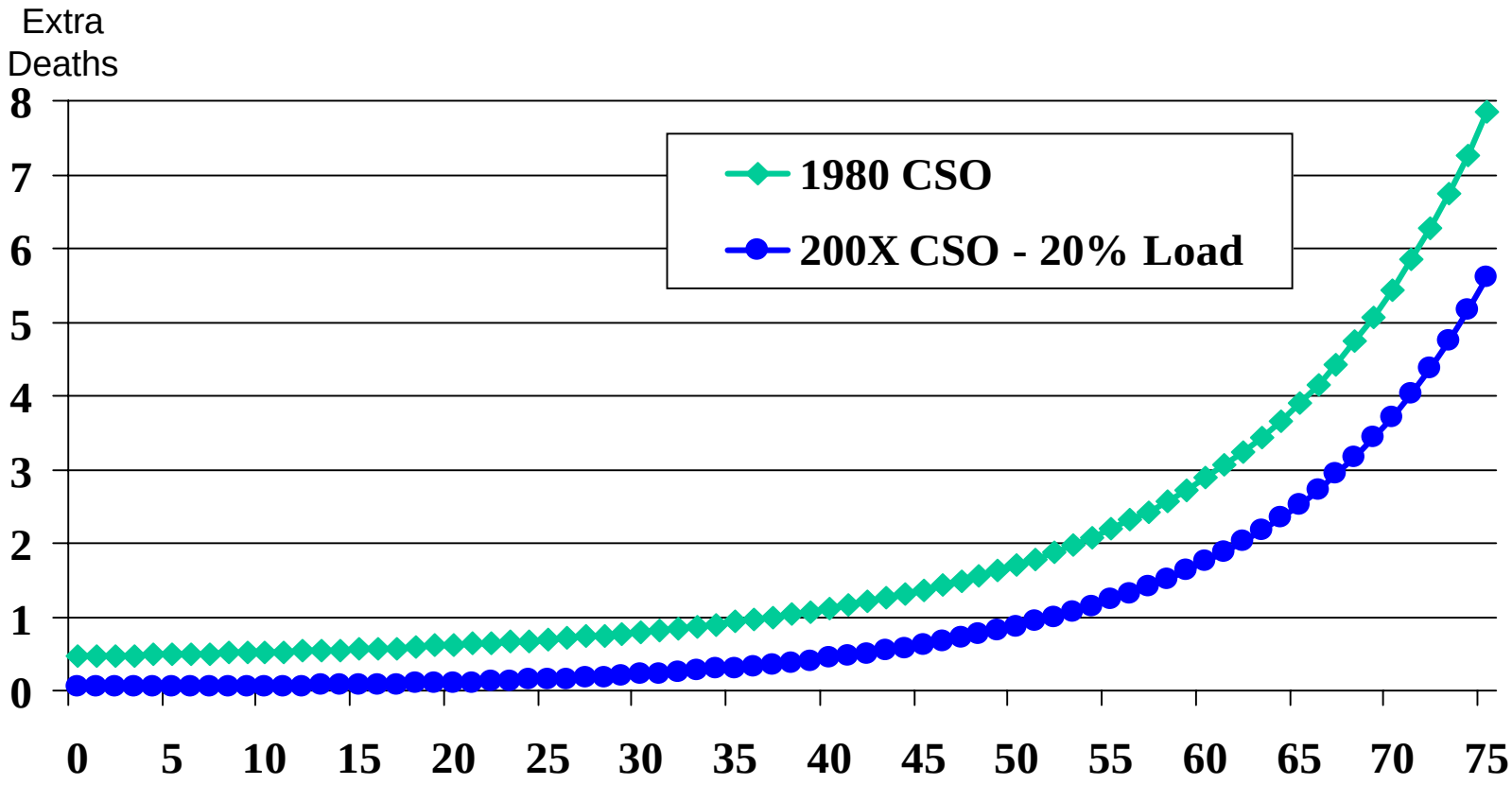
Sample 20% Loading

Ultimate, Composite Male



80 CSO v. 200X Sample 20% Loading

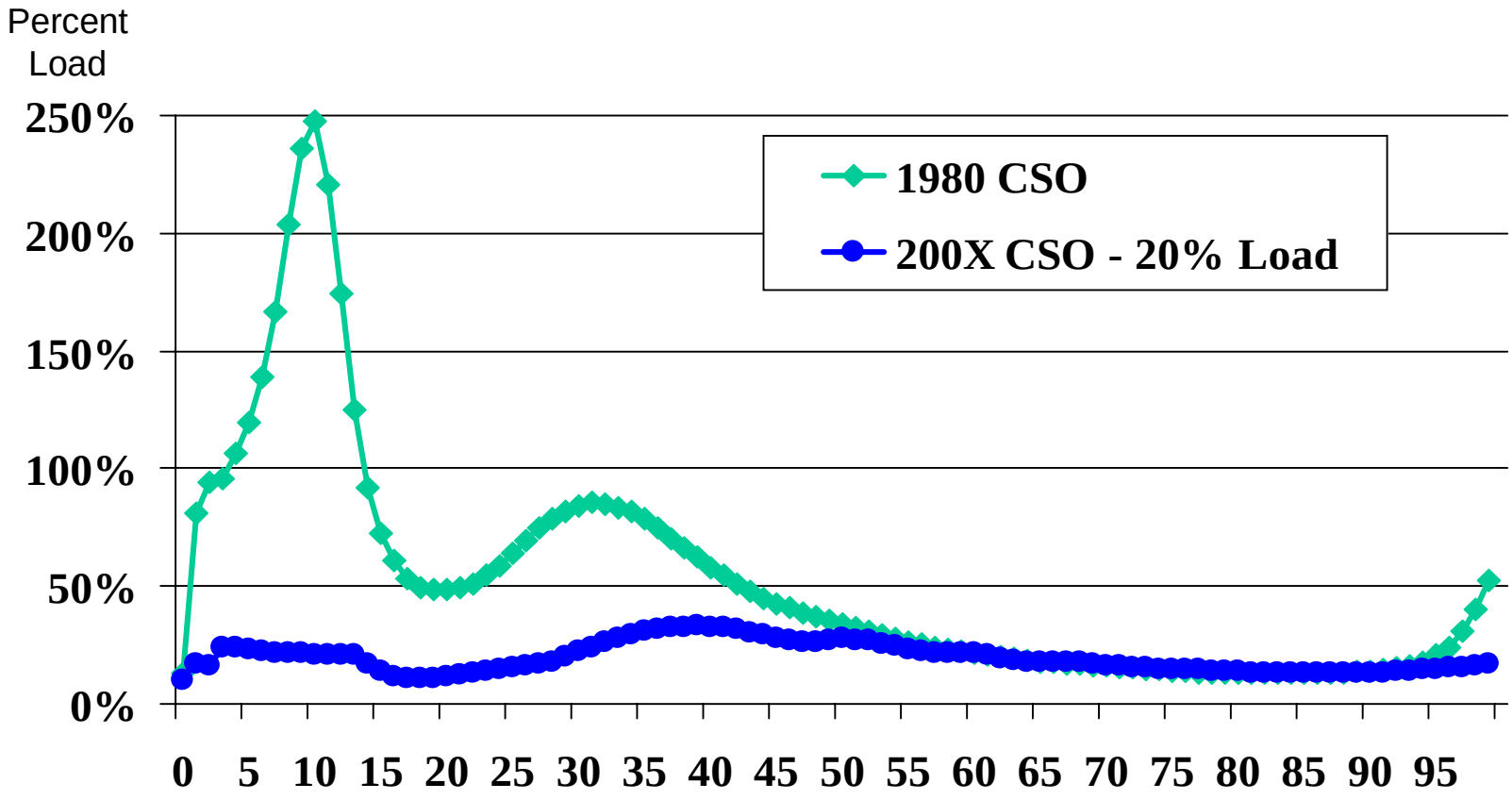
Ultimate*, Composite Male



* 1980 CSO is aggregate.

80 CSO v. 200X Sample 20% Loading

Ultimate*, Composite Male



* 1980 CSO is aggregate.

Reserve Margin Loading Approach

Second Loading Illustration - 10%

- “Reserve Margin” approach
- Adequacy of reserves
- Loading needed is that which produces reserves that are adequate for most companies that will use the table
- 10% load provides reasonable coverage of “economic reserves” calculated using mortality, interest, and lapses

Basis of 10% Load

- Appropriate mortality load is that which produces statutory reserves that are greater than or equal to the economic reserves
- “Economic Reserve” is a reserve based on the CRVM statutory reserve method except that
  - Mortality may be different than statutory minimum
  - Interest may be different than statutory minimum
  - May include lapses

Economic Reserve Focused on Term

- Pressure to minimize load comes from term
- Inclusion of lapses in economic reserve is not appropriate for whole life since the cash value is paid to the policyholder upon lapse
- Mortality assumption is more significant for term

Evaluation of Economic Reserve Interest Assumption

- Variation of interest rates over time
- Variation in individual company experience about the industry average

Variation in Interest Rates Over Time

- Used interest rate model that is used for part of the NAIC required RBC calculation for C3 risk
- Simulates movement in Treasury rates over a 30 year period for 200 scenarios
- 6,000 interest rates
- Used 10-year rate

Results for 6,000 10-Year Treasury Rates*

	Average Rate	Standard Deviation	Average Less One Standard Deviation
Overall	6.61%	2.60%	4.01%
Geometric Mean	6.59%	1.78%	4.81%

* Based on 12/31/00 yield curve and NAIC C3 model.

Variation in Individual Company Experience About the Industry Average

- Needed to get a feel for how far below the expected future to go to feel confident that most companies are covered by the rate
- Calculated 5-year net investment returns from NAIC data base

Results for 5-Year NAIC Net Investment Returns*

	Average Rate	Standard Deviation	Average Less One Standard Deviation
Simple Average	7.24%	3.81%	3.43%
Weighted Average	7.71%	1.83%	5.88%

* Based on 1995-99 period.

Evaluation of Economic Reserve Interest Assumption

- Variation in interest rates over time and about the industry average were considered
- Corporate spread of 50 to 70 basis points should be added to Treasury rates in the analysis of variation in interest rates over time
- These two analyses lead to 4.5% to 5.0% as an appropriate interest rate to cover most companies

Evaluation of Economic Reserve Lapse Assumptions

- Most significant difference between Mortality Margin method and Reserve Margin method is the inclusion of lapses in the considerations of loads
  - Interest assumption in the Reserve Margin method is only marginally higher than the Mortality Margin method
  - We used the same mortality assumption for both methods

Evaluation of Economic Reserve Lapse Assumptions

- Illustrated on a scenario basis because we don’t yet have reliable estimates on variation in lapse rates by company
- Various levels of lapses were used to frame the appropriate level of economic reserves for this illustration

Lapse Scenarios Used in Economic Reserve Calculation

- Level 0%
- Level 4%
- Level 5%
- 5% in Year 1 grading to 2.5% in Year 6 and level thereafter
- 10% in Year 1 grading to 5% in Year 6 and level thereafter

Examples of Economic Reserves

20 Year Term, Male, Ultimate, Composite

Economic Reserve Assumptions			Mortality Load Needed
Mortality	Interest	Lapses	
120% VBT	4.5%	0%	20%
120% VBT	5.5%	0%	18%
120% VBT	4.5%	4%	13%
120% VBT	5.5%	4%	11%
120% VBT	4.5%	5%	11%
120% VBT	5.5%	5%	8%

Values based on 10 years of sales growing at 5% annually.

Sample 10% Loading Formula

$$\text{Load} = (0.0019 - 0.000055x + 0.0000055x^2) / e_x$$

+0.0019

produced a 5% loading at age 0

-0.000055x

was necessary to keep loadings at appropriate levels at younger ages

$+0.0000055x^2$

was chosen to maintain desirable reserves at ages over 50

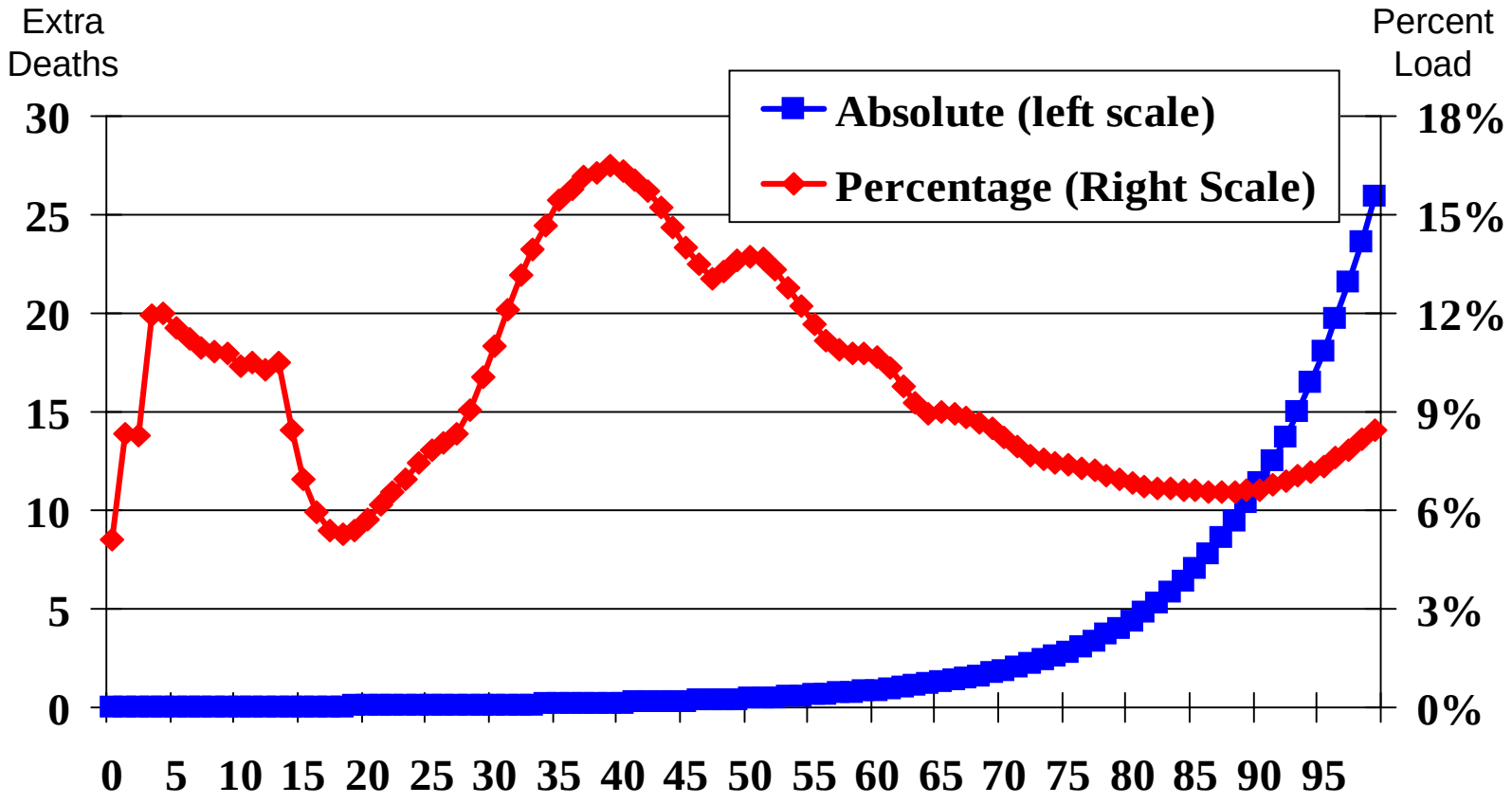
Sample 10% Loading Formula

$$\text{Load} = (0.0019 - 0.000055x + 0.0000055x^2) / e_x$$

- Absolute load is monotonically increasing
- Percentage load is generally decreasing

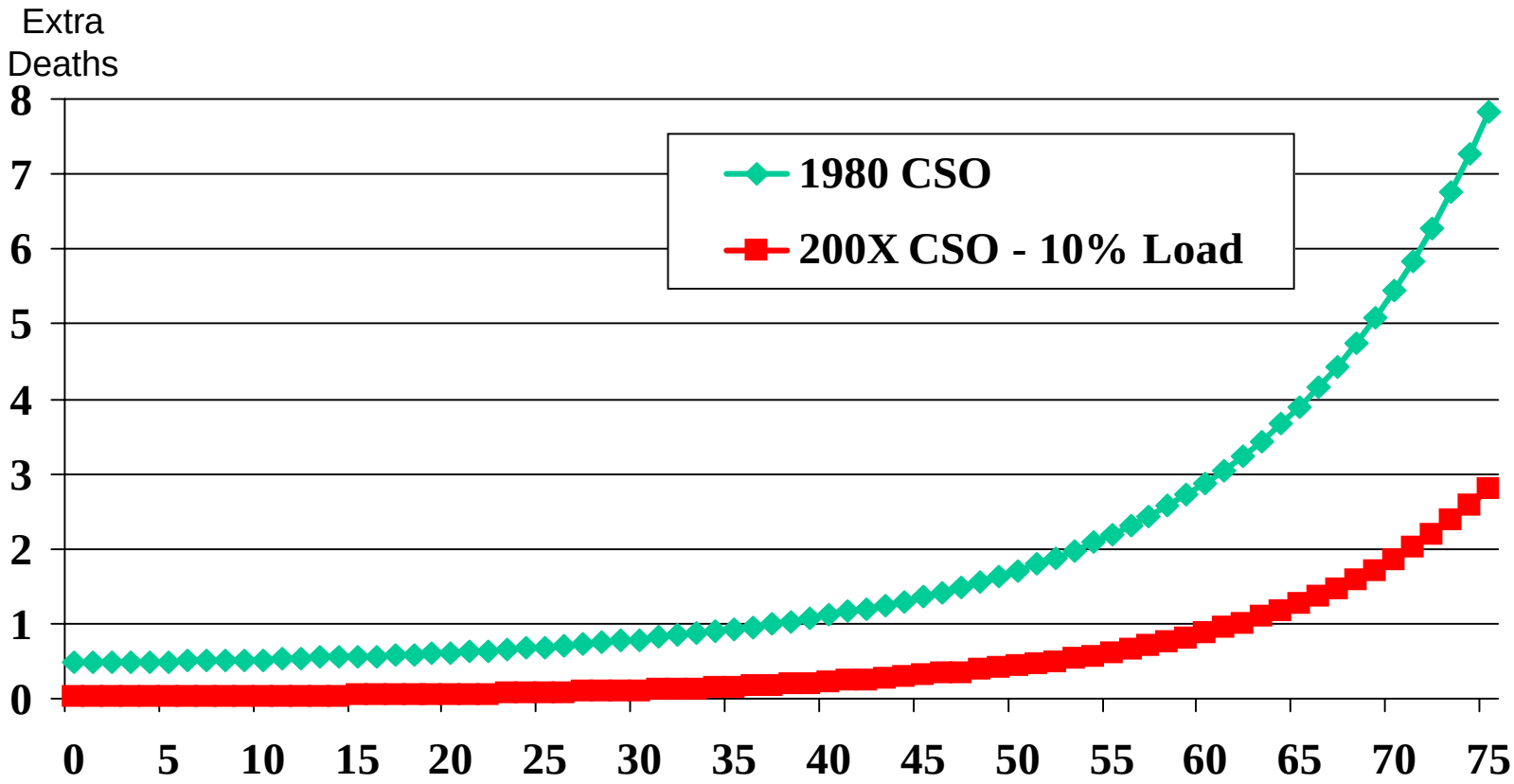
Sample 10% Loading

Ultimate, Composite Male



80 CSO v. 200X Sample 10% Loading

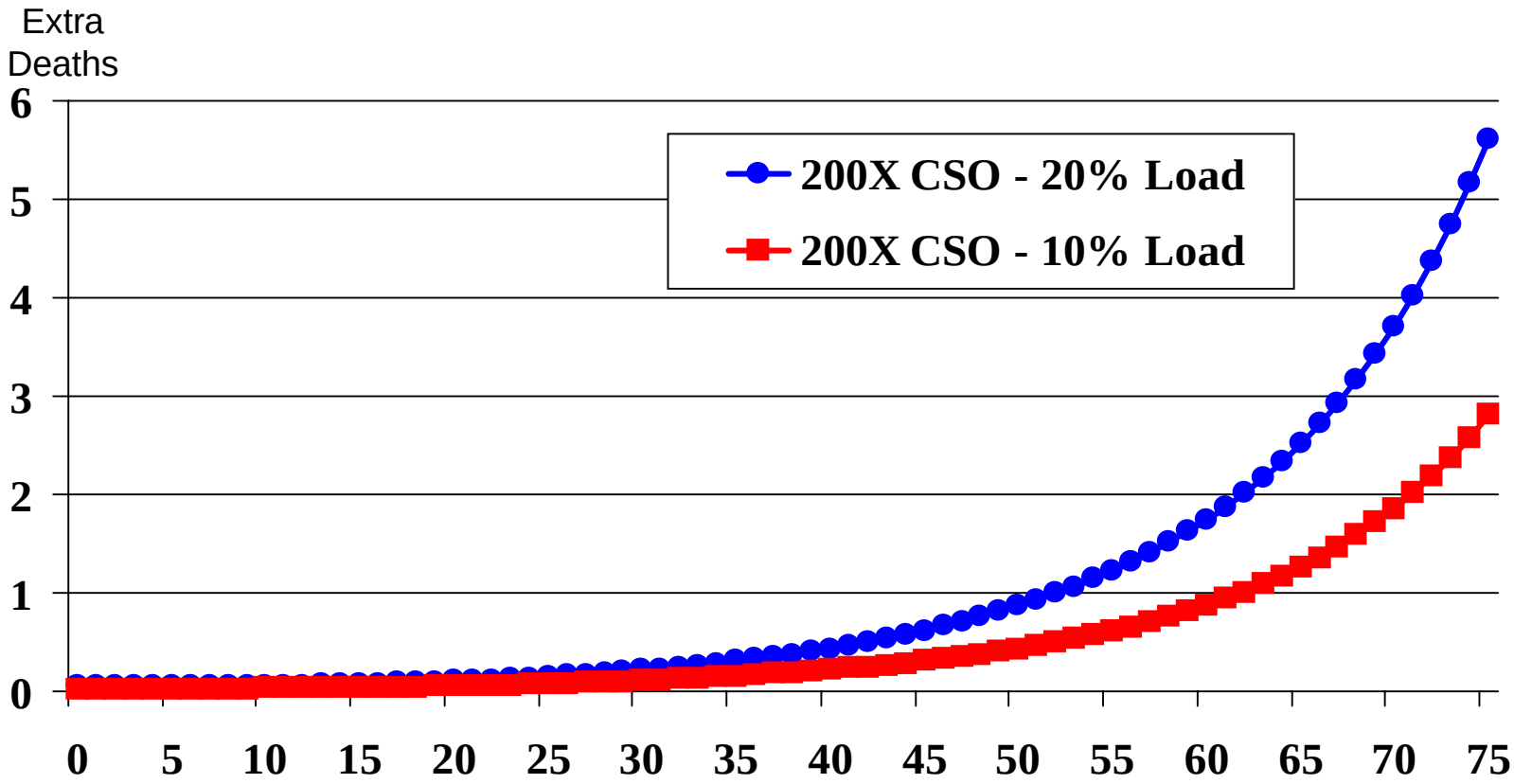
Ultimate*, Composite Male



* 1980 CSO is aggregate.

200X Sample 10% v. 20% Loading

Ultimate, Composite Male



80 CSO v. 200X Sample 10% Loading

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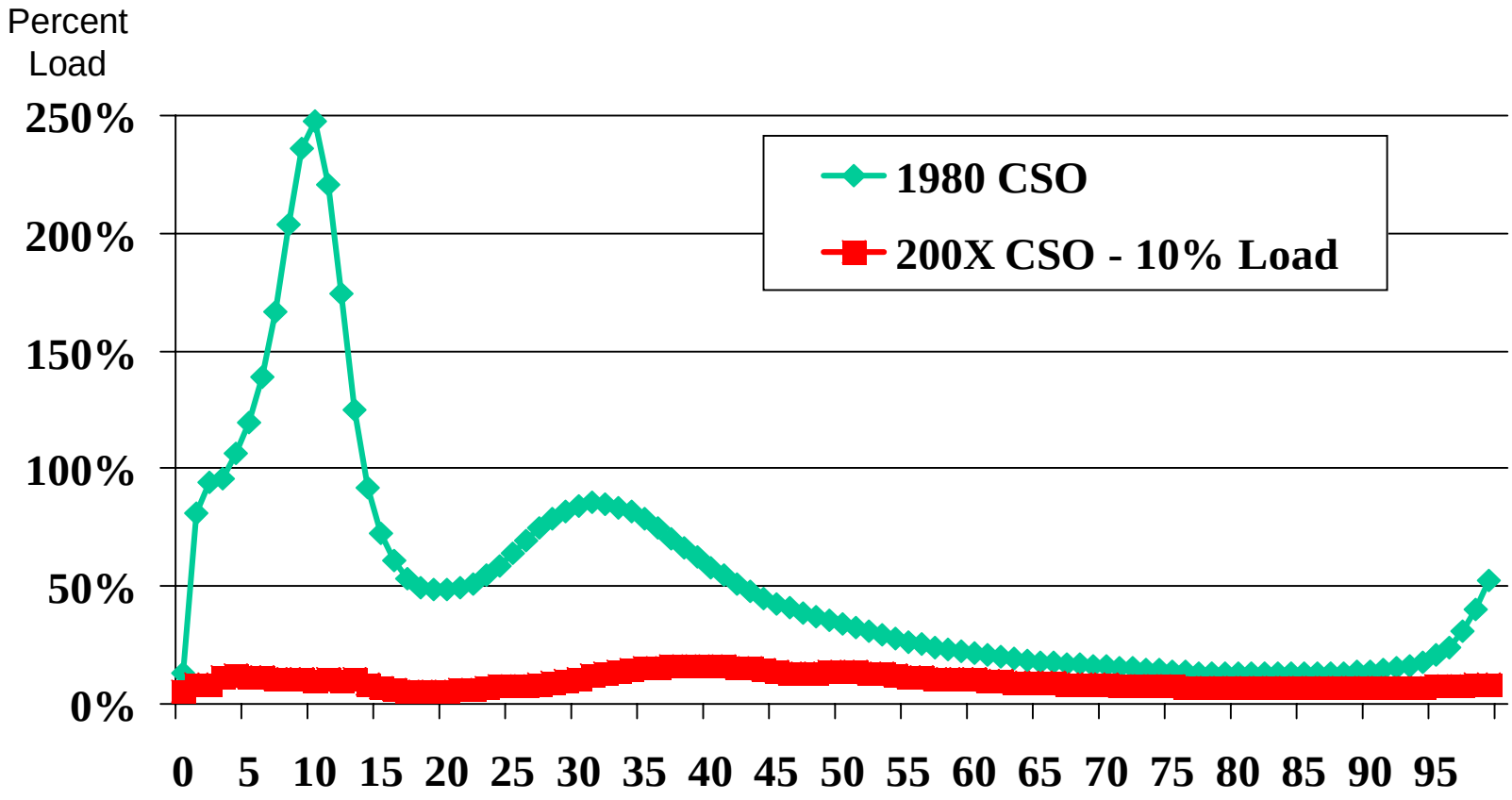

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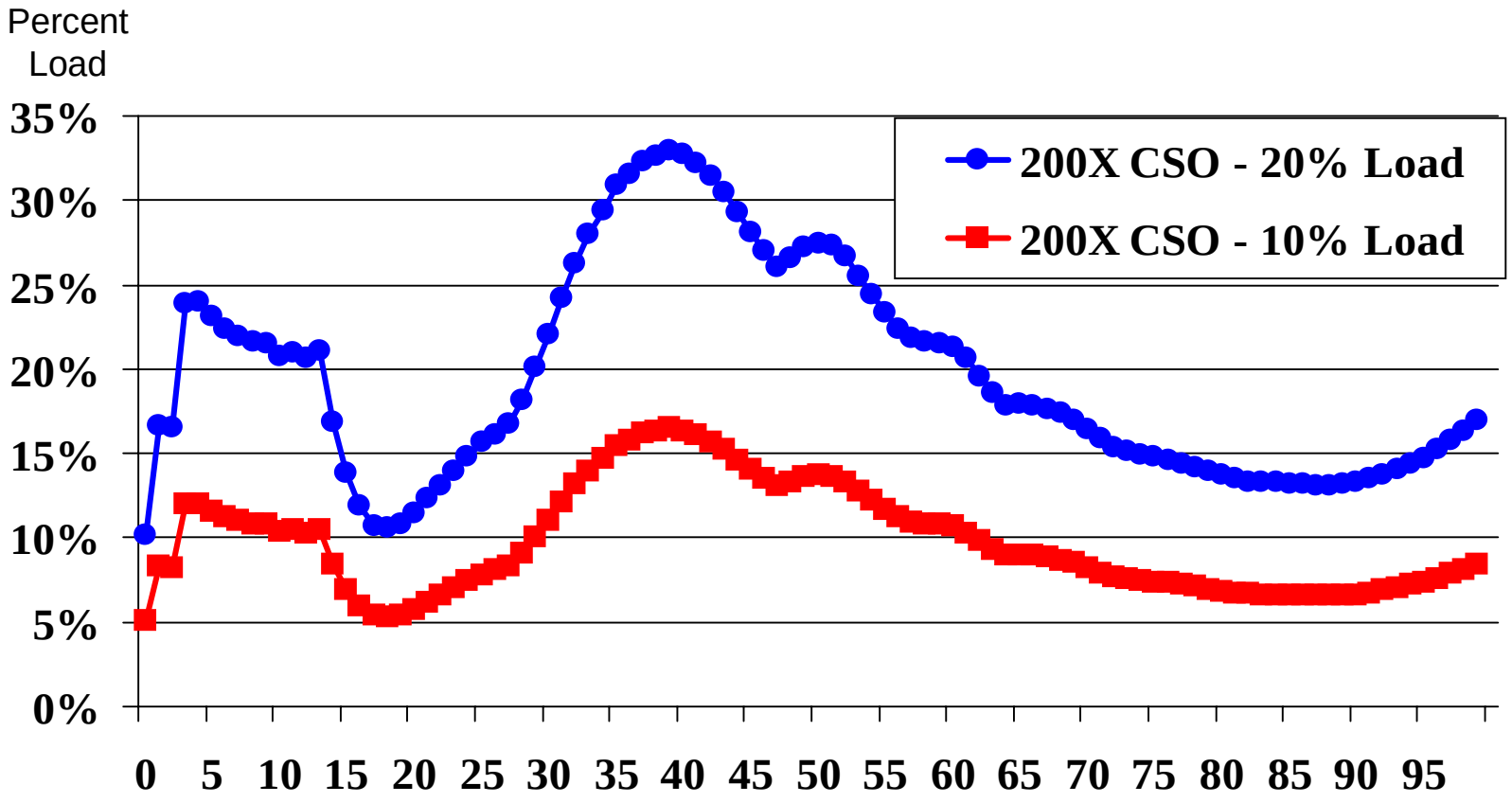
200X Sample 10% v. 20% Loading

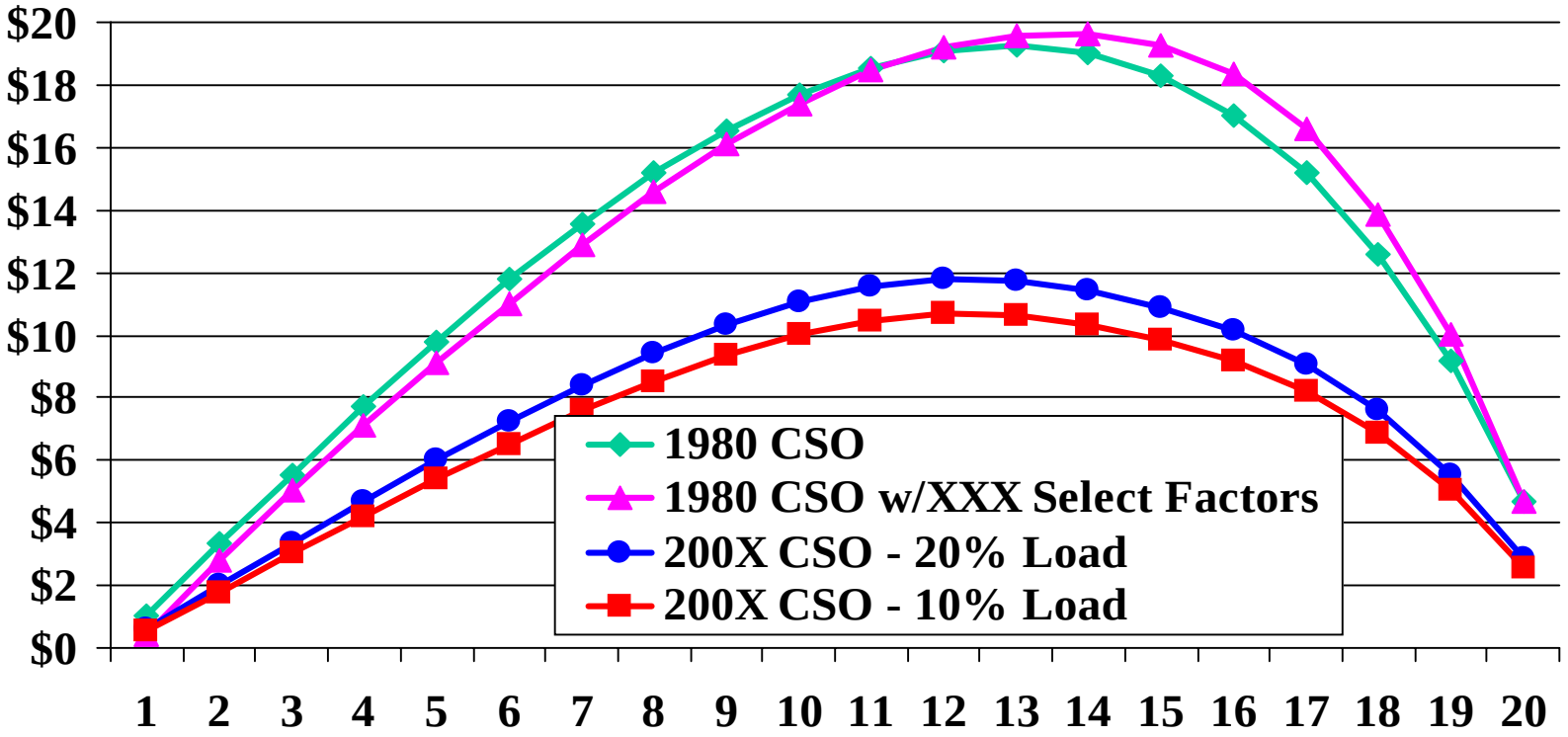
Ultimate, Composite Male



Reserve Graphs

20 Year Term Mean Reserves per $1,000

Ultimate*, Composite Male, Age 35



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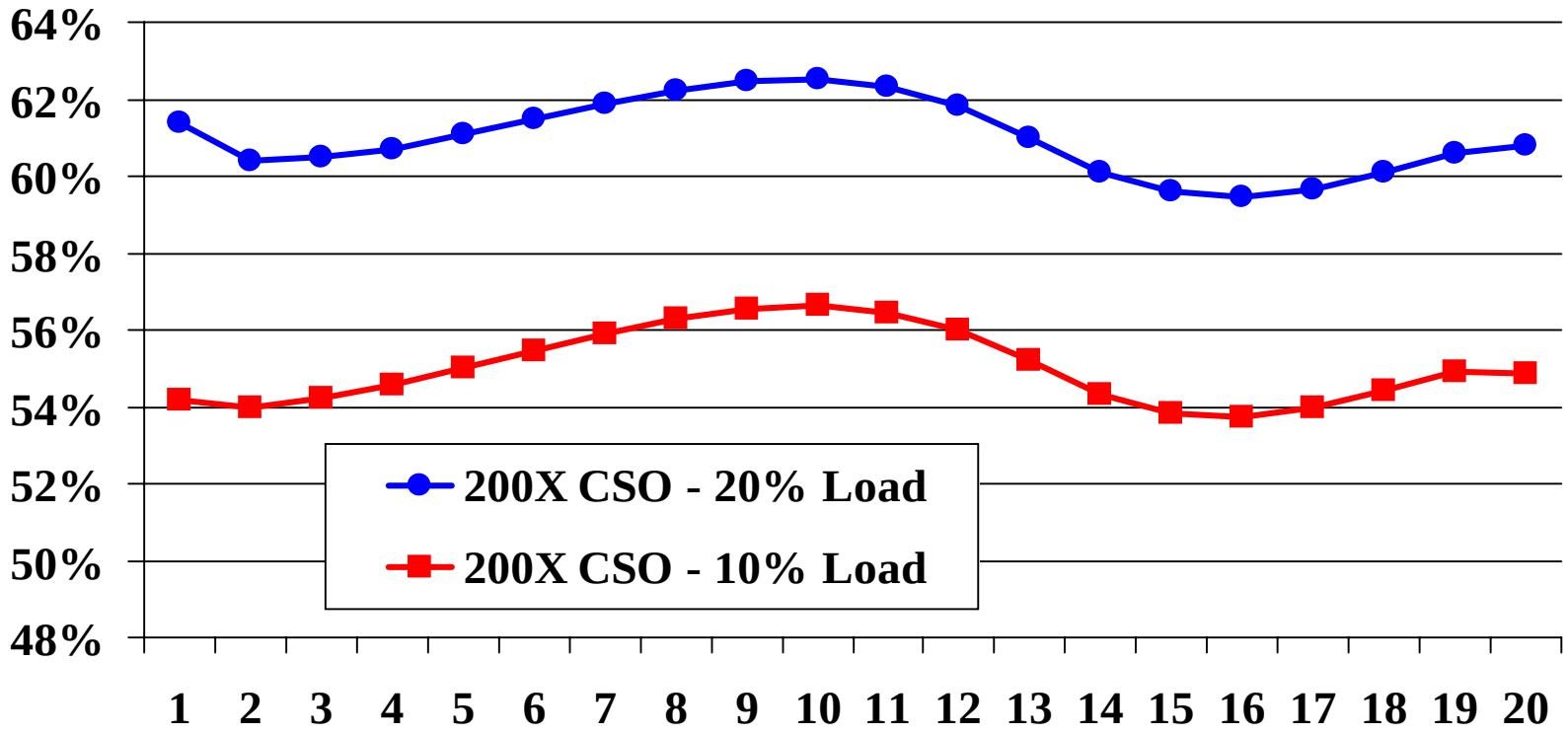
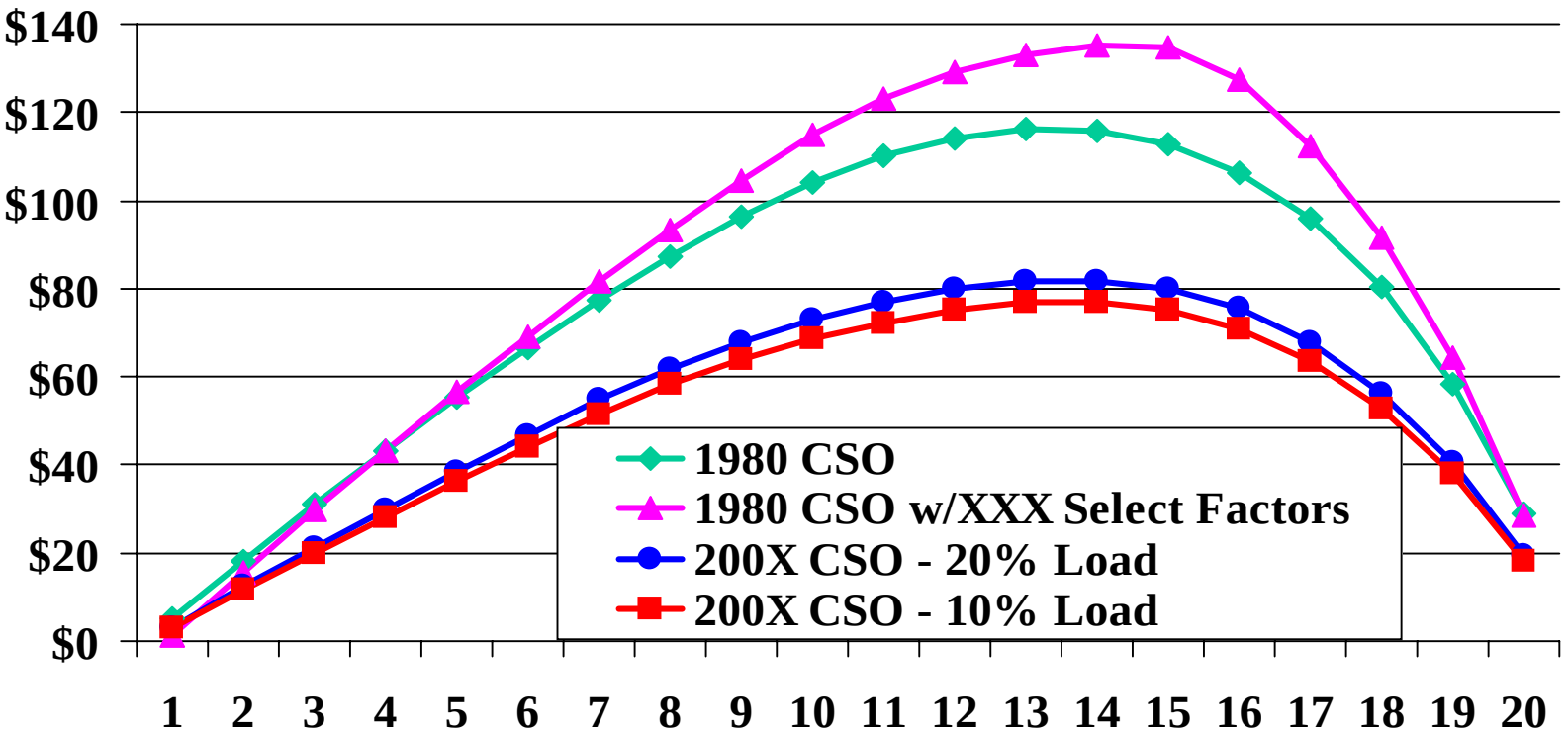
20 Year Term Mean Reserves as a Percent of 1980 CSO 20 Year Term Mean Reserves

Ultimate*, Composite Male, Age 35



* 1980 CSO is aggregate.

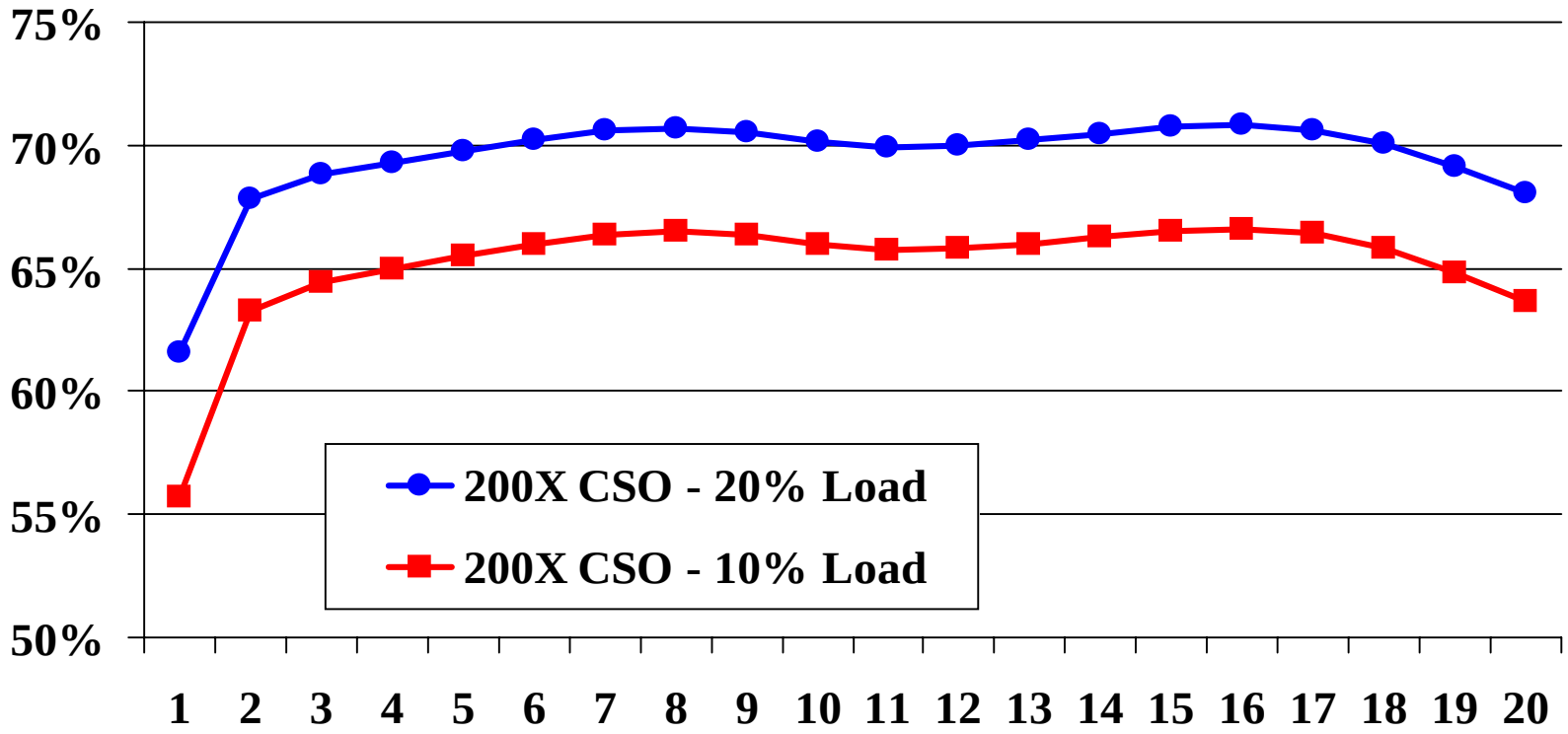
20 Year Term Mean Reserves per $1,000
Ultimate*, Composite Male, Age 55



* 1980 CSO is aggregate.

20 Year Term Mean Reserves as a Percent of 1980 CSO 20 Year Term Mean Reserves

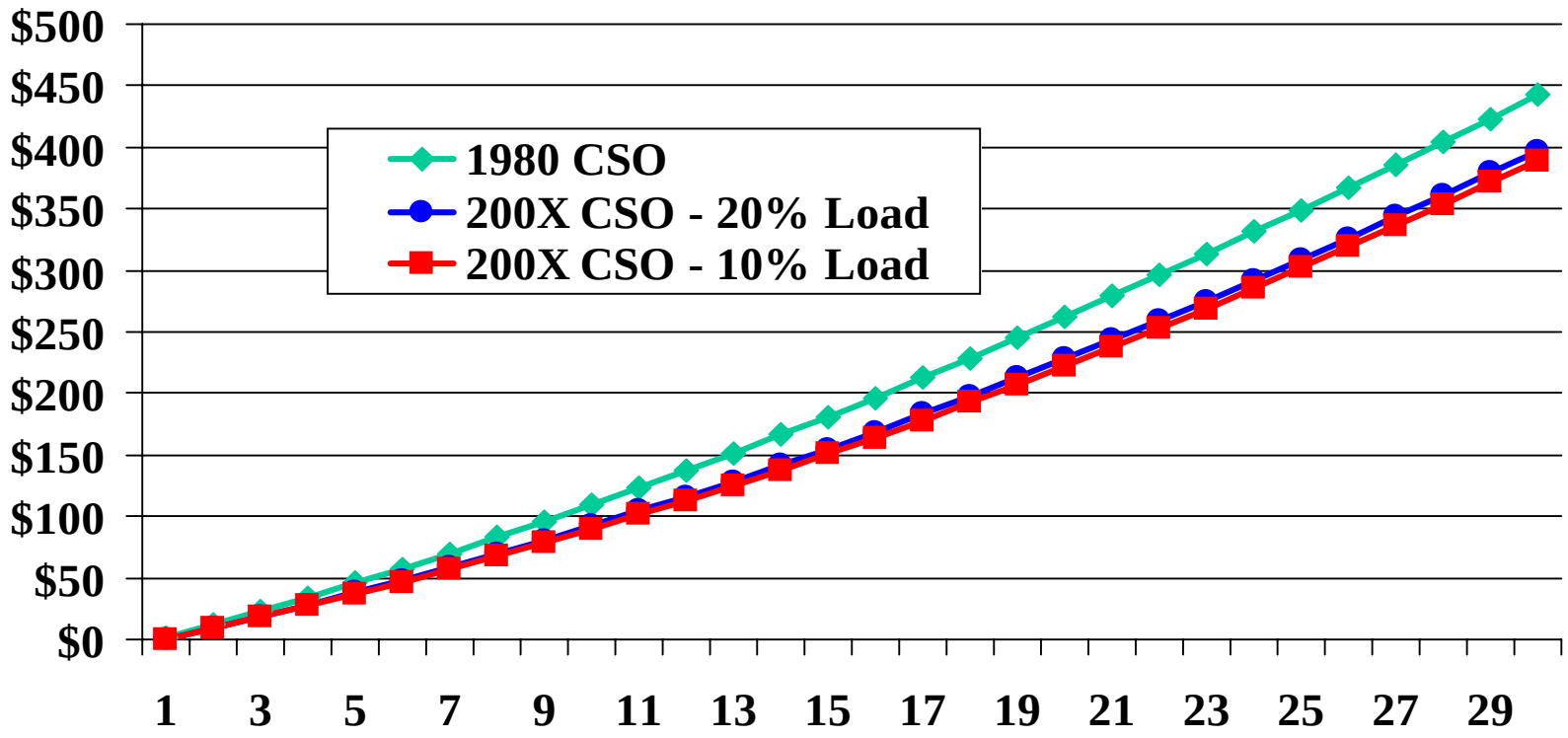
Ultimate*, Composite Male, Age 55



* 1980 CSO is aggregate.

Whole Life Mean Reserves per $1,000

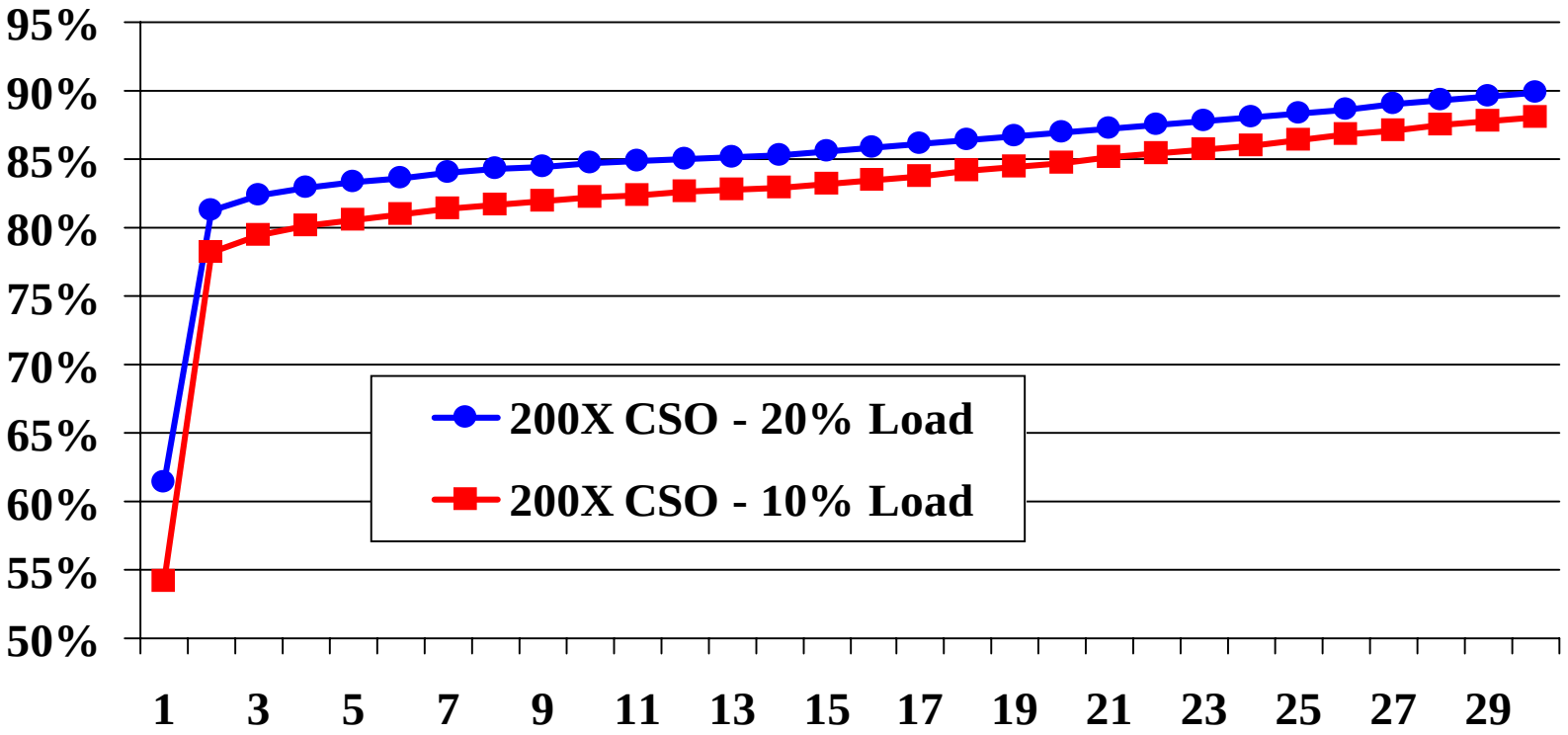
Ultimate*, Composite Male, Age 35



* 1980 CSO is aggregate.

Whole Life Mean Reserves as a Percent of 1980 CSO Whole Life Mean Reserves

Ultimate*, Composite Male, Age 35



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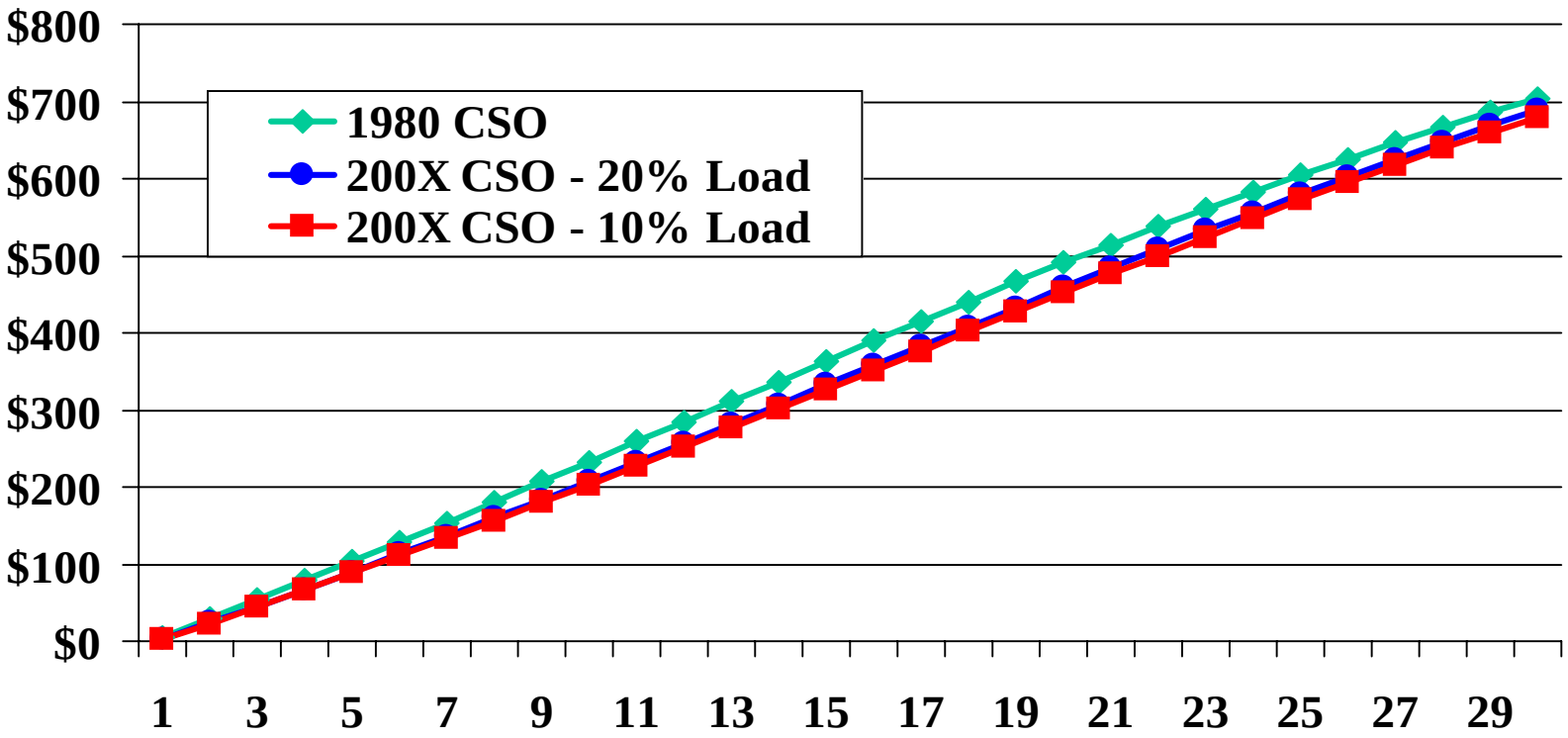
Whole Life Mean Reserves per $1,000
Ultimate*, Composite Male, Age 55



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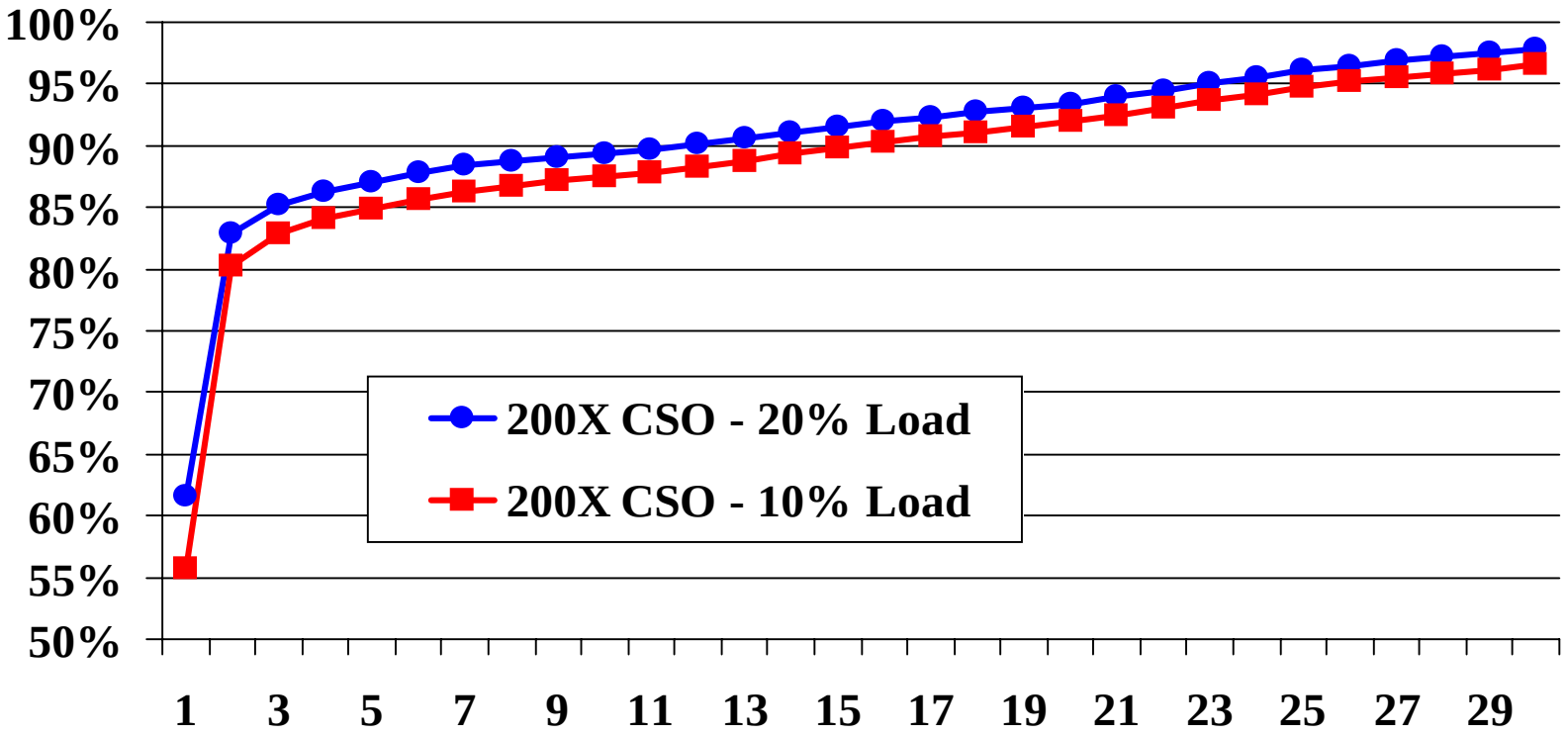
Whole Life Mean Reserves as a Percent of 1980 CSO Whole Life Mean Reserves

Ultimate*, Composite Male, Age 55



* 1980 CSO is aggregate.

Pros and Cons

Mortality Margin Approach - Pros

- Does not apportion margins in other factors to the mortality load (i.e., each factor stands on its own)
- Ensures valuation mortality covers most of the industry
- Concept is simple
- Greater consistency with 1980 CSO

Mortality Margin Approach - Pros

- Provides adequate tabular reserves for all products including those that have minimal lapse and interest margins (e.g., YRT)
- Provides reasonable assurance that mortality is adequate for companies that do not do cash flow testing

Mortality Margin Approach - Cons

- Does not reflect recent changes in valuation requirements (e.g., cash flow testing)
- Some argue that reserve adequacy should be the concern, not margin adequacy
- Statutory valuation ignores margins in interest and lapsation
- Does not recognize preferred risk underwriting

Reserve Margin Approach - Pros

- Key issue is amount of reserve margin, not mortality margin
- Some feel it is more consistent with economic reality

Reserve Margin Approach - Pros

- World is different today than it was in 1980
  - Cash flow testing for large companies
  - Term more prevalent
  - Preferred risk underwriting more prevalent
  - RBC requirements help ensure solvency
  - Regulation XXX

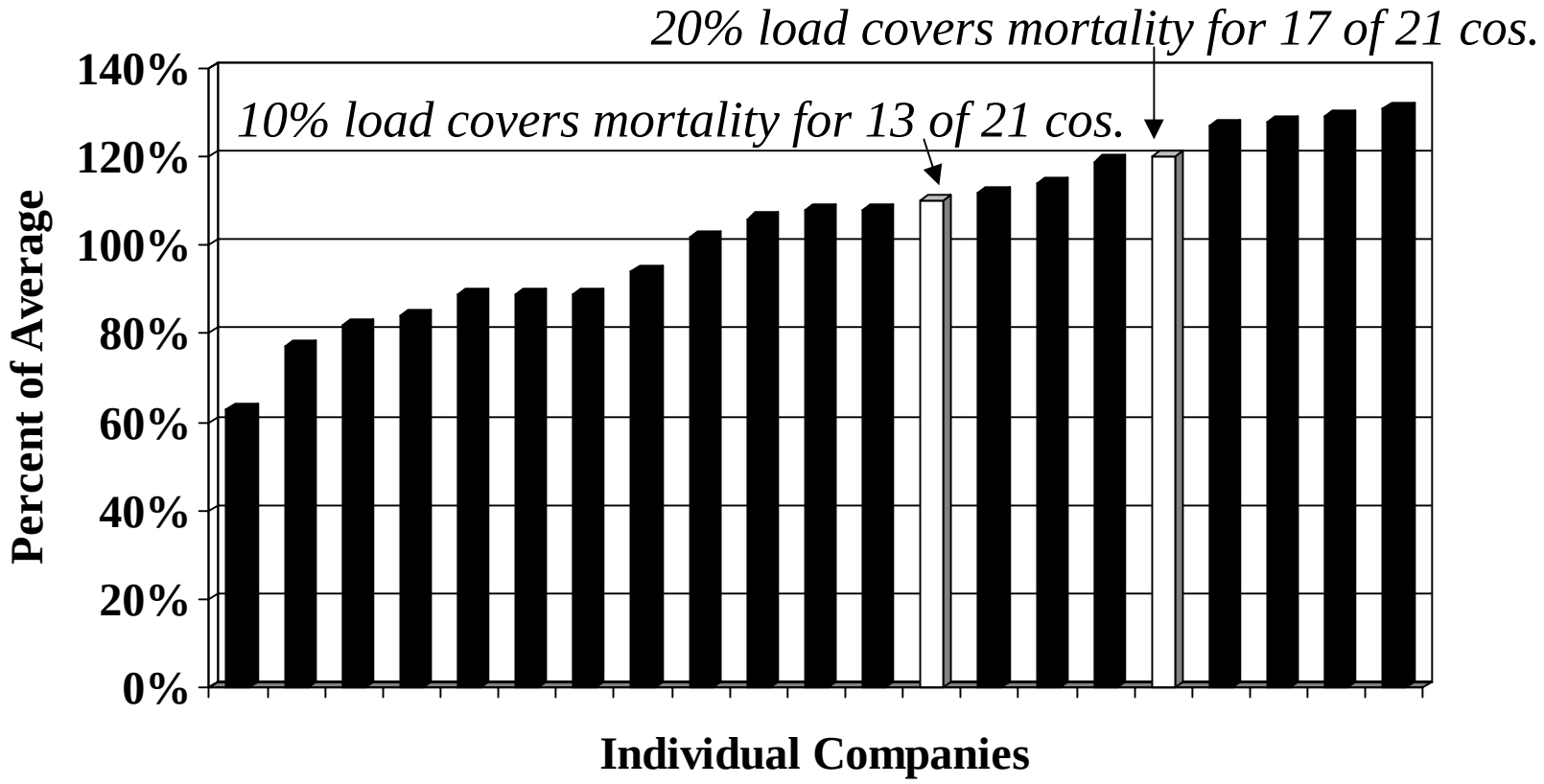
Reserve Margin Approach - Cons

- Its justification introduces lapses into valuation considerations
  - Reserve margins will be lower for policies where lapse is not a factor (e.g., YRT) than for policies where lapse is a factor
  - For permanent plans that have cash values equal to reserves, lapses do not produce any margin
  - Tabular reserves are more likely to be inadequate if policyholders exercise their option not to lapse

Reserve Margin Approach - Cons

- It introduces additional factors and concepts
- It lowers industry mortality margins

SOA Comparative Mortality Study 1990-95



Reserve Validation

Validation of Reserve Levels

- We used the “economic reserve”
- Gross Premium Valuation was not used
  - Some feel GPV inappropriately apportions margins
  - GPV is dependent upon its assumptions and there are no obvious choices for these assumptions
  - GPV ignores amortization of acquisition costs
  - Most of all, GPV is entirely dependent upon profit margins

Next Steps

Next Steps

- Put final touches on 200X VBT
- Incorporate your input
- Settle on final load level
- Re-evaluate loading formula

Next Steps

- Check appropriateness of loading formula when it is applied to all VBT's
  - Male / Female
  - Smoker / Nonsmoker / Composite
  - Select / Ultimate
- Include Universal Life reserves
- Run loaded tables through model to look at results for the industry

Model Description

- Products: Whole life, UL & 20 year term
- Ages: 25, 35, 45, 55 & 65
- Genders: Male & female
- Mortality: Composite
- Face Amount Distribution: LIMRA's 1999 US Buyer Study

LIMRA 1999 US Buyer Study

Policy Type by Age - Percent by Total Volume

	25	35	45	55	65	All Ages Total
Male						
WL	3%	3%	3%	1%	1%	11%
Term	8%	16%	14%	6%	2%	46%
UL	3%	3%	3%	2%	1%	11%
Total	14%	22%	19%	10%	3%	67%
Female						
WL	3%	2%	2%	1%	1%	8%
Term	5%	7%	5%	2%	0%	19%
UL	2%	2%	1%	1%	0%	6%
Total	9%	11%	8%	4%	1%	33%
Male and Female Combined						
WL	6%	5%	4%	3%	1%	19%
Term	13%	23%	19%	8%	2%	64%
UL	5%	5%	4%	3%	1%	17%
Total	23%	32%	27%	13%	4%	100%

Model Description

- Survivorship:
  - LIMRA lapse rates
  - 200X VBT select & ultimate
- Deferred Premiums:
  - Mean reserves reduced by net deferred premiums
  - LIMRA premium mode assumptions
- Paid-up Additions: Assume 50% of whole life policies have dividends purchasing additions

We Need Your Input!

1. Determination of the load

   "Mortality Margin" v. "Reserve Margin"

2. Level of the load

3. Form of the load

   Is a function of $1/e_x$ appropriate?