Get Set:
Mortality Studies under PBR
(Credibility and VM-20)

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Variability is the Key

- Industry variability
  - Results vary from year to year
  - Valuation Basic Tables are updated periodically
- Company variability
  - Company results vary around industry studies that are used for valuation basic tables
  - Company results vary around UCS predictions
- VM-20 approach is to use industry standard and take into account company variability

Variability of Company Results around Industry-wide Mortality: 2008 VBT

Out of 39 companies in the SOA 2005-07 study

2008 VBT	
A/E Ratio by Amount	Number of Companies
Above 100%	12
95% up to 100%	9
90% up to 95%	7
Below 90%	11

Variability of Company Results around Industry-wide Mortality

UCS applied to Companies' NS Experience Varies from Mortality Increasing with UCS Score

UCS 2006 Study		
UCS Score	A/E Ratio	Deaths
26	47%	6
41	63.1%	21
42	71.8%	78
95	65.3%	63
96	79.3%	174
119	65.9%	230
120	72.5%	9
141	95.8%	2231

Company Variability

- Company results vary from predicted industry norms (2008 VBT or UCS)
  - Previous slides for mortality results
  - Especially true for policyholder behavior (lapse)
- Underlying VM-20 paradigm of Principles-Based Reserve mortality being industry based mortality that is credibility adjusted by company mortality experience
- Use Credibility Methodology

Get Set: Mortality Studies Under Principles-Based Reporting

- Why?

Transition: rules based to principles-based reserves

  - Overview, Organization and Study Methodologies

- *What?*

VM-20 approach to mortality, required use of credibility

  - VM-20 Paradigm of PBR Mortality
  - Two Well Established Credibility methods

- *How?*

Practical steps: gauge company's mortality under VM-20

Why?

Transition from rules based to principles-based reserves

Overview

Organization

- SOA (Aggregate reports)
- NYSID/NAIC (Company, aggregate reports)

Study Methodologies

- Policy Year within two Calendar Years
- Calendar Year with two partial Policy Years

Overview - Transition from rules based to principles-based reserves

- Rules based- CSO mortality table discounted by interest
  - Redundant Reserves on Level Term Products
  - High reserves on UL with Secondary Guarantees
- One approach to redundant reserves is securitization
- Another approach to redundant reserves is to change the reserving system

Overview - Transition from rules based to principles-based reserves

- Principles-Based Reserves
  - Mortality
  - Policyholder behavior,
  - Expense
  - Asset returns
- Principles-Based Reserve Mortality
  - Industry Based Mortality
  - Credibility Adjusted by Company Mortality Experience

Organization
Changes and Remains the Same

- SOA Voluntary Studies
  - Compiler – MIB
  - SOA aggregate reports
  - Academy recommends table to NAIC
- NYSID in 2011 implements NAIC PBR Role
  - Statistical Agent – MIB
  - Confidential individual company reports
  - Aggregate reports/table: SOA/ Academy retain prior roles

Study Methodologies

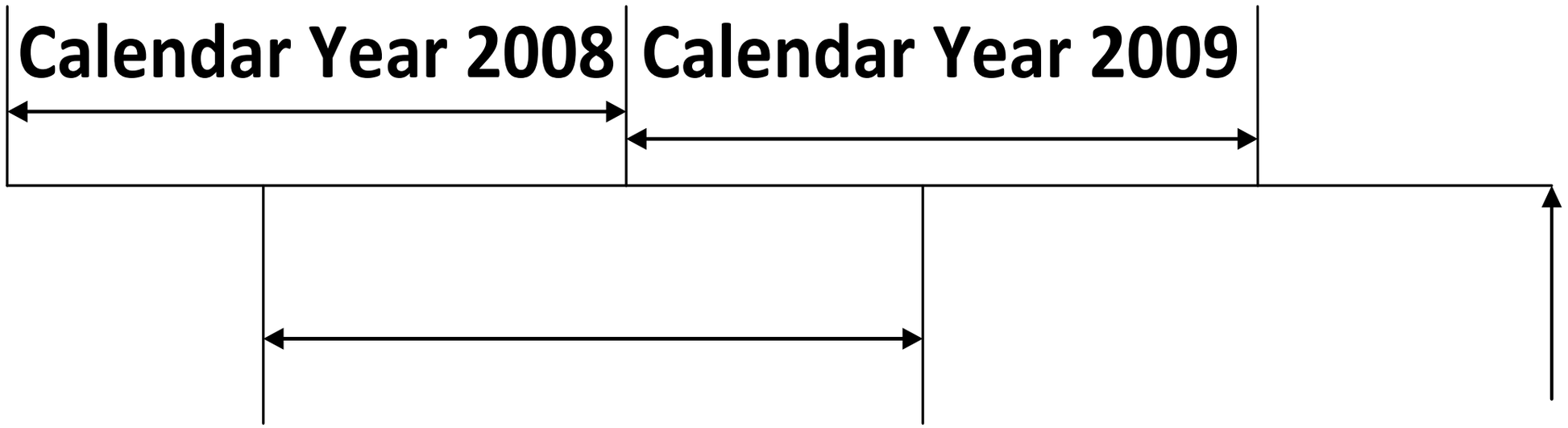
- Multiple methodologies are accepted actuarial practice and used for collecting data
- SOA report methodology (Also used for LIMRA lapse)
  - Primary method is two Calendar Year data submission for one policy year exposure per policy
- NYSID / NAIC report methodology
  - One Calendar Year data submission for two partial policy year exposures per policy
- Other methodologies exist

SOA Report Methodology

- Collects face amount at issue
- Two calendar years → one policy duration
  - Consecutive calendar years
  - Only use policy information for policy year ending in 2ND calendar year
- Only uses base policy information
  - For $250,000 WL with $250,000 term rider only $250,000 WL included

SOA Report Methodology

Uses Base Policy Only and Face Amt of Ins at Issue



Policy Year 2009

Data Call

Issue Age Y, Duration X

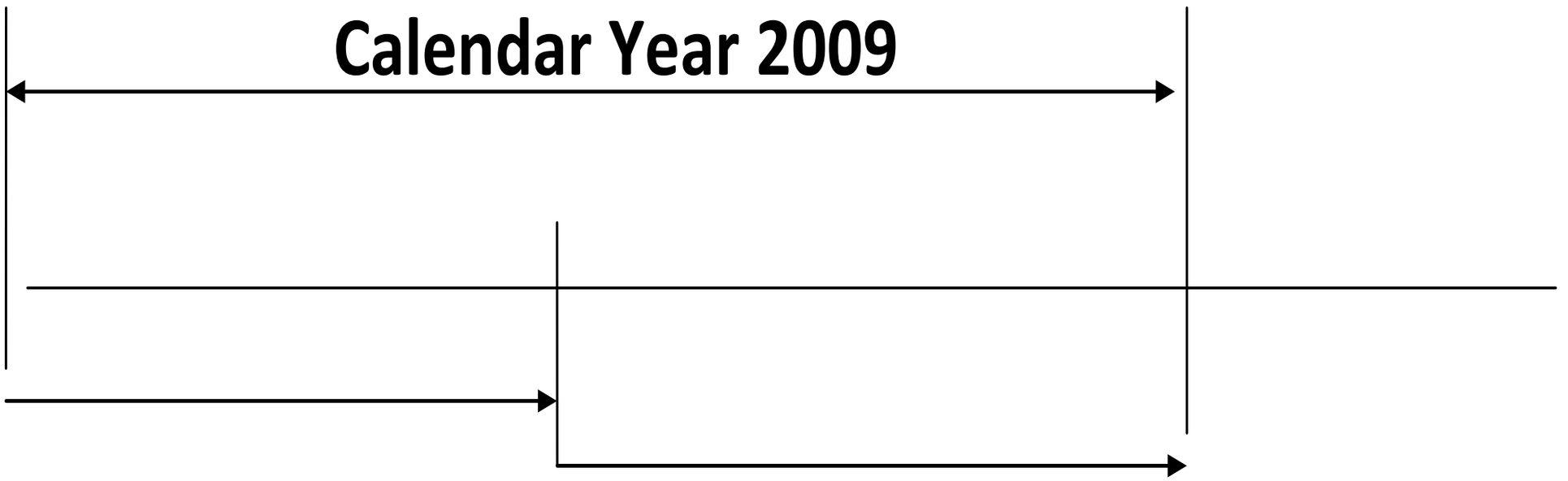
NYSID/NAIC Methodology

- Collects face amount at beginning and end of calendar year as well as at issue face amount
- One calendar year → Two policy durations
  - From beginning of calendar year to policy anniversary uses beginning of year face amount
  - From policy anniversary to end of calendar year uses end of year face amount (or death claim)
- Includes both base policy and rider: $250,000 WL and $250,000 term rider

NYSID/NAIC Methodology

Uses Base Policy and Riders and has

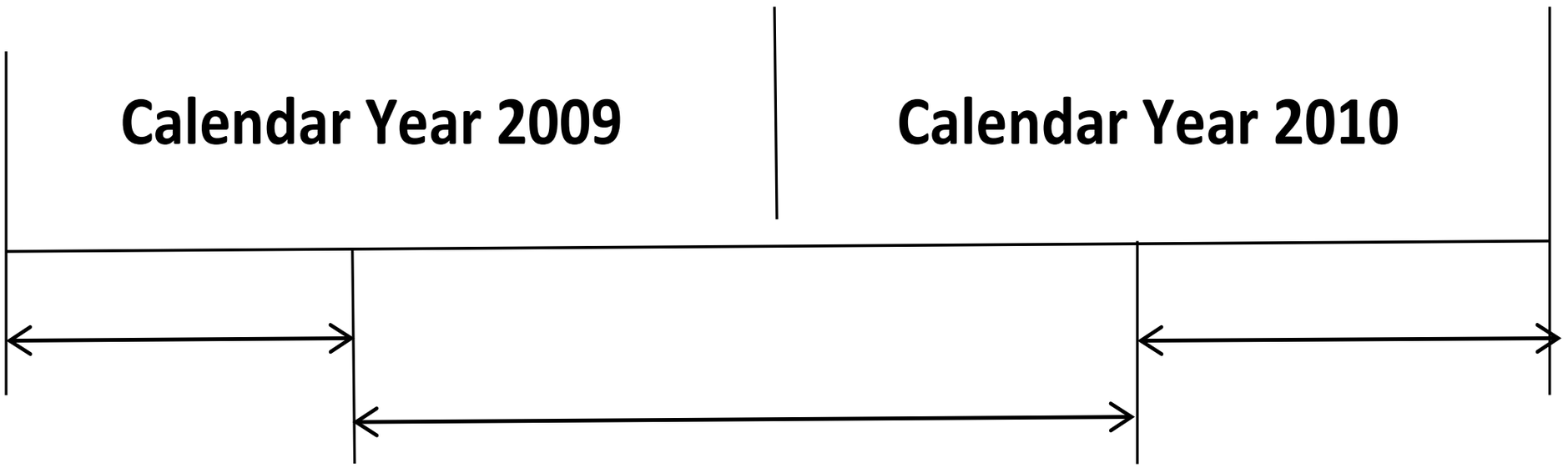
Face Amt of Ins at Issue & Begin, End of Cal Yr



NYSID/NAIC Methodology
After Two Calendar Year Data Calls

A Full Two Calendar Years of Exposure

Is Split between Three Durations



I A Y, Dur X **Issue Age Y, Dur X+1** **I A Y, Dur X+2**

Study Methodologies

- Important point is measuring the variability of underlying decrement – methodology is the technique for that measurement
- Multiple methodologies are accepted actuarial practice and used for collecting data
- Significant company expense to implement
- NYSID/NAIC Methodology currently being implemented by 57 companies

What?

VM-20 approach to mortality and use of credibility

- VM-20 Paradigm of PBR mortality
  - Industry based mortality
  - Industry mortality is credibility adjusted by company mortality experience
  - Margin added
- Two Well Established Credibility Methods
  - Bühlmann Empirical Bayesian
  - Limited Fluctuation

VM-20 Paradigm of Mortality

- Industry Basic Table
  - Determined by Underwriting Criteria Scoring
  - Can adjust by up to 2 tables lower or higher
- For fewer than 30 deaths in credibility set
  - Prudent estimate mortality is Industry basic table plus margin
- For 30 or more deaths in credibility set
  - As above but credibility adjusted mortality
- But what is Credibility Set?, Margin? Credibility Adjusted Mortality?

VM-20 Credibility Set of Mortality

- Policies with similar underwriting and same risk classification procedures
- Use actual mortality experience directly applicable to the credibility segment
- Use most recent 3 years of experience up to 10 years of experience
- Outside of credibility set one merges to industry basic table

Examples of Credibility Sets of Mortality

- Three Credibility Sets for 3 NS Preferred Classes
  - Best Preferred Class,
  - Preferred Class, and
  - Residual Standard
- Each Credibility Set only has duration 1-10
- Credibility set limited to duration 1-10, grade to applicable industry table beginning at durations 11+

Margins for VM-20 Mortality

- VM-20 indicates margin is for Random Fluctuation Risk and Company Variation Risk
- Margin is a percentage increase In the range of 1% to 10%
- Study on SOA website ‘Analysis of Methods for Determining Margins for Uncertainty under a Principle-Based Framework for Life Insurance and Annuity Products’

Credibility Adjusted Mortality
Simple Explanation

Standard Credibility Formula

H = Initial Estimate (Industry Basic Table)

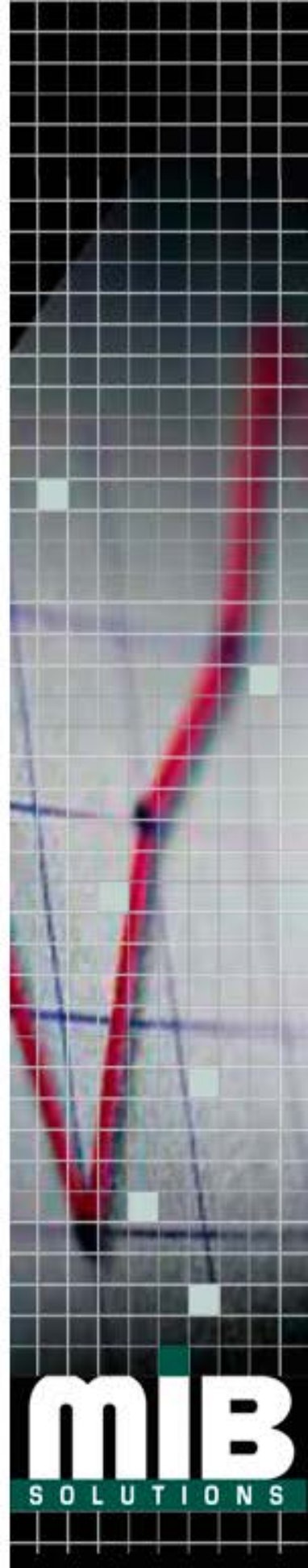
X = Additional Data (Company Experience)

Z = Credibility Factor (ranges between 0 and 1)

ZX + (1 - Z)H = Revised Estimate (Credibility Adjusted Mortality)

Credibility Adjusted Mortality
In Depth Explanation

- The following report is on the SOA website:
  - 'Application of Credibility to Company Lapse and Mortality Experience' by Klugman and Rhodes
- Derivation of Formulas
- Applied to overall mortality and lapse experience for 10 co's in SOA 2004-05 experience study
- Results in paper and Excel sheets
- Step by step process shown in appendices



NS Preferred Class Structure of 2 (NS PCS 2)
Limited Fluctuation Method
From Klugman and Rhodes

Overall 2001 VBT A/E Ratio by Amount	Company	Company 2001 VBT A/E Ratio by Amount	Credibility Factor Z	Number of Deaths	Limited Fluctuation A/E Ratio by Amount
65.6%	B	66.4%	.060	9	65.7%
65.6%	D	109.3%	.075	17	68.9%
65.6%	E	46.2%	.108	36	63.6%
65.6%	F	84.9%	.134	65	68.2%
65.6%	H	65.3%	.152	554	65.6%
65.6%	I	57.8%	.205	153	64.0%
65.6%	J	112.4%	.102	63	70.4%

VM-20 Includes Step of Selecting Credibility Method

Two Well Established Credibility Methods vary by how much of variance included

- Limited Fluctuation
- Bühlmann Empirical Bayesian

<u>Limited Fluctuation</u>

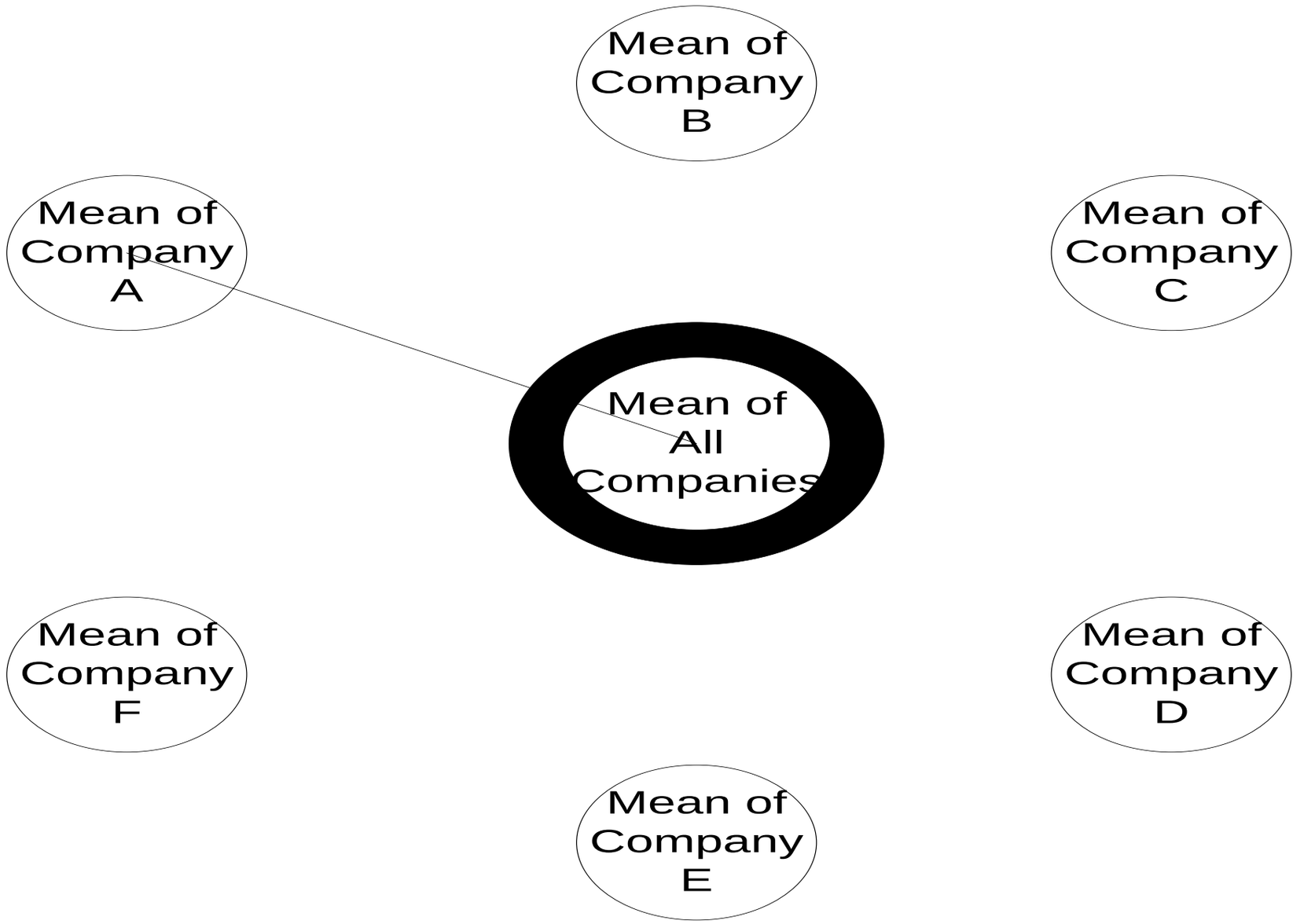
- Simpler: Only one company ‘s data required

<u>Bühlmann Empirical Bayesian</u>

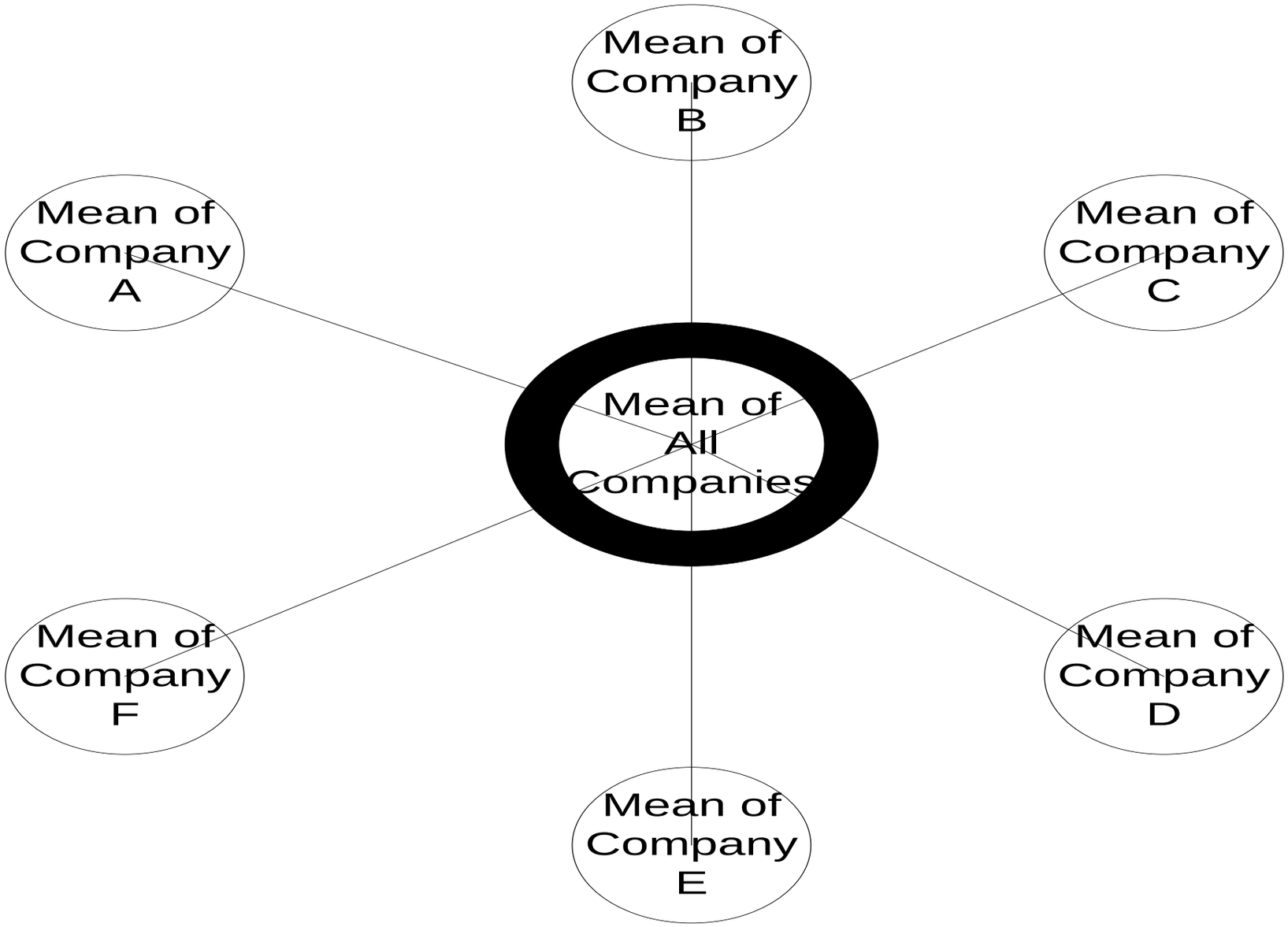
- More Robust: All companies’ data required

For Company A's Credibility Factor Limited Fluctuation Method

Uses the variation of a Co A's observations about Co A's mean & the variation between Co A's mean and the overall mean



For Company A's Credibility Factor Bühlmann empirical Bayesian Method Uses the variation of a Co A's observations about Co A's mean & the variation between each Co's mean and overall mean



Choosing Credibility Method

Getting Ready for VM-20

- Limited Fluctuation Method
- Company actuary uses experience data and Excel sheet from Credibility Practices report by Klugman and Rhodes on the SOA website

Final Implementation Work for VM-20

- May want more robust credibility factors from Bühlmann Empirical Bayesian Method

How?

Practical steps to gauge company's mortality under VM-20

- Systematic application of credibility procedure
- Routinely apply variations:
  - Industry basic table
  - Experience data
- Cost justify variations
- Based on above, select approach to determine VM-20 prudent estimate mortality

Systematic Credibility Procedure

Determine for each Credibility Set

Best class of NS PCS of 2 during 2005 - 2009

- X is *experience data for best mortality class*
- H is *industry mortality table for best class*
- Use *Excel sheet, Limited Fluctuation Method* - determine 'Z', credibility factor for *best class*
- *Credibility adjusted mortality* for *best class*

  = ZX + (1—Z)H

Routinely Apply Variations

- Baseline for each credibility set
  - UCS determined Industry Basic Table
  - Company's experience study
- Variation for Industry Basic Table:
  - 2 tables below UCS determined Industry Basic Table
  - Provision in VM-20
- Variation of Experience Data
  - Increase credibility by doubling/tripling data
  - VM-20 allows comparable pooled mortality
  - Save time/money by resampling company experience

Cost Justify Variations

- Extent of mortality difference between credibility adjusted baseline and credibility adjusted variations
- Is there a decreased margin due to increased credibility?
- If differences do NOT justify extra cost /effort:
  - Stop. Use your company's experience and UCS Industry Basic Table
- If differences DO justify extra cost/effort:
  - Develop, prove and document VM-20 prudent estimate mortality

Get Set: Mortality Studies Under Principles-Based Reporting

Variability is the Key

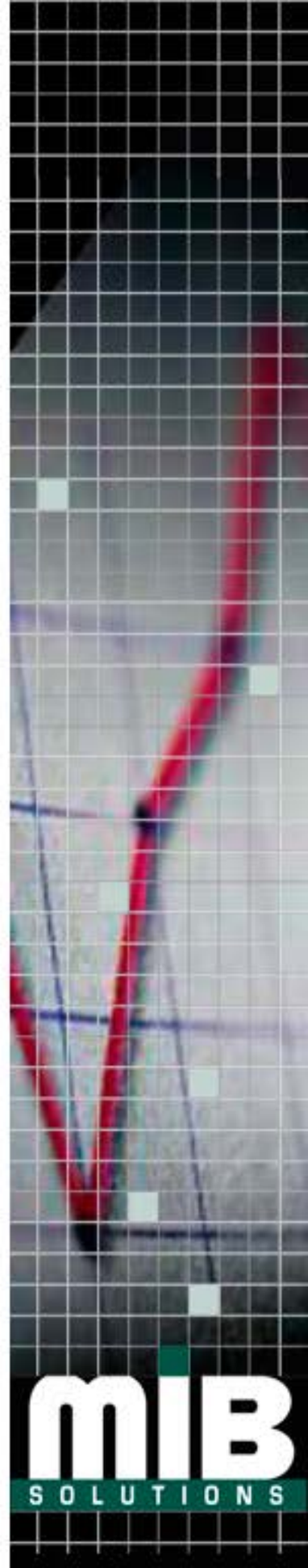
Why? Transition from rules to principles-based reserves

- Overview, Organization and Study Methodologies

What? VM-20 approach to mortality/credibility

- VM-20 Paradigm of PBR Mortality
- Two Well Established Credibility methods

How? Practical steps to gauge company's mortality under VM-20



Questions????

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PowerPoint posted on

http://www.mibsolutions.com/thought_leadership/