

# IAA Health Section

## Stochastic Modeling Webcast

### Theory and Reality from an Actuarial Perspective

Presented by Milliman, Inc.

Jim Stoltzfus, FSA, MAAA, CERA

Andrew Dalton, FSA, MAAA

Richard Kipp, MAAA

November 16, 2010



This work product was prepared solely for IAA Health Section. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends the recipient be aided by its own actuary or other qualified professional when reviewing the Milliman work product. This is not intended to be an actuarial opinion or actuarial advice.

# Overview of Discussion

- General Concerns and Health Insurance Specific Issues
- Stochastic Modeling for Health Actuaries
- Examples
- Questions

# Overview of Discussion

- Based on the recently published book by the IAA
- Stochastic Modeling: Theory and Reality from an Actuarial Perspective
- Available on the IAA website

# General Concerns

- What factors should be stochastically generated?
- When should I be using stochastic models?
- When should I not use stochastic models?
- Are there alternatives to stochastic models?
- What are the disadvantages of stochastic models?

# General Concerns

## When should I be using stochastic models?

- Are these required by regulation or professional guidelines?
- Do we need a better understanding of the effects of extreme outcomes?
- Do we need a better understanding of the tail risk or risks in general?
- What is the probability of an event?
- What is the probability of ruin?
- Are certain risk measures needed for reporting?

# General Concerns

## When should I **not** use stochastic models?

- Can you calculate a probability distribution?
- Can you calibrate the model?
- Can you validate the model?

# General Concerns

## Are there alternatives to stochastic models?

- Stress Testing/Scenario Testing
- Static Factors/PADs/MADs
- Range testing

# General Concerns

## What are the disadvantages of stochastic models?

- “Black Box”
- Inappropriate distributions
- Inappropriate parameters
- Improper calibration
- Validation – Beware of False Positives
- Model size
- Computer power

# General Concerns

## Model Calibration

- Two General Approaches
  - Calibration to Historical Experience
  - Calibration to Current Market Conditions
- Considerations
  - Does the model track to expected assumptions?
  - Reflect expectations today?
  - Experience period
  - Range of possible outcomes?
  - Extremes

# General Concerns

## Model Calibration

- Calibration to Historical Experience
  - Can you create a distribution?
  - Expected
  - Correlations
  - Volatility
  - Mean reversion

# General Concerns

## Model Calibration

- Calibration to Current Market Conditions
  - Observed market prices or conditions
  - Closed form formula
  - Market consistent results

# General Concerns

## Model Validation

- How do I validate a model?
  - Cellular checking
  - Reasonableness review
  - Assumption review
  - Formula testing
  - Calibration review
  - Distribution of outcomes

# General Concerns

## Model Validation

- Documentation Review
  - Source of data
  - Experience period
  - Testing
  - Audit/Checking/Peer Review

# General Concerns

## Model Peer Review

- Reviewed for Accuracy?
- Credible data?
- Model and parameter development?
- Correlations?
- Testing
- Validation

# General Concerns

## Model Communication

### General Ideas

- Average
- Outliers – Worst Case and Best Case
- Specific Scenario
- Type of Audience

# General Concerns

## Model Audit

## Parameter Development

- Source of Information
- Development of Assumptions
- Development of Correlations
- Expected Assumptions

# General Concerns

## Model Audit

## Stochastic Generator Analysis

- Cell Checking
- Review of Distributions, range of outcomes, extreme cases
- Correlation checking
- New set of scenarios produce similar results

# General Concerns

## Health Specific Issues

- Identification of All Factors
- Identification of Key Material Factors

# Example of Long Term Health Insurance Risk Model



This presentation and Q&A is not intended to be an actuarial opinion or advice, nor is it intended to be legal advice. Any statements made during the presentation and subsequent Q&A shall not be a representation of Milliman or its views or opinions.

# Risk Factors of Interest to Health Actuaries

General Categories of Risk Factors of Interest to Health Actuaries:

- Economic Factors
- Demographic Factors
- Morbidity/Claims Factors

All categories include assumptions that could be modeled stochastically

# Risk Factors of Interest to Health Actuaries

- Economic Factors Include:
  - Interest Rates
  - Unemployment
  - Inflation

# Risk Factors of Interest to Health Actuaries

- Demographic Factors Include:
  - Policy Terminations (Claim termination considered separately)
  - Shock Lapses
  - Mortality

# Risk Factors of Interest to Health Actuaries

- Morbidity/Claims Factors Include:
  - Claim Costs (or Incidence and Severity)
  - Morbidity Improvement
  - Medical Trend

# Economic Risk Factors

- Interest Rates

- Many commonly used interest rate generators are available.
- Approach to selecting an interest rate generator:
  - How will the projection be used?
  - Should scenarios be “real-world” or “risk-free”?
  - Is mean-reversion incorporated in the model?
  - Do you want to model stochastic volatility?
  - Evaluate arbitrage-free properties of the model
  - If appropriate, validate scenarios produced by the model against observable market prices or conditions.

# Commonly used Interest Rate Generators: Equilibrium Models

## Commonly used Interest Rate Generators - Equilibrium Models

Model	Formulaic Description	Comments
Rendleman and Bartter Model	<ul style="list-style-type: none"> <li>■ <math>dr = \mu r dt + \sigma r dz</math></li> </ul>	<ul style="list-style-type: none"> <li>■ <math>\mu</math> and <math>\sigma</math> constant</li> <li>■ <math>r</math> follows geometric Brownian motion</li> <li>■ <math>\mu</math> is a drift component. <math>\sigma</math> is a volatility parameter.</li> <li>■ No mean reversion</li> <li>■ Negative interest rates are possible</li> <li>■ Drift is time-independent</li> </ul>
Vasicek Model	<ul style="list-style-type: none"> <li>■ <math>dr = a(b-r) dt + \sigma dz</math></li> </ul>	<ul style="list-style-type: none"> <li>■ Incorporates mean reversion through the term <math>a(b-r)</math></li> <li>■ The <math>\sigma dz</math> term incorporates stochastic element</li> <li>■ Negative interest rates are possible</li> <li>■ Drift is time-independent</li> </ul>
Cox, Ingersoll and Ross Model	<ul style="list-style-type: none"> <li>■ <math>dr = a(b-r) dt + \sigma \sqrt{r} dz</math></li> </ul>	<ul style="list-style-type: none"> <li>■ Very similar to Vasicek model, except for the presence of <math>\sqrt{r}</math> in the second term</li> <li>■ The <math>\sqrt{r}</math> exists in order to preclude negative interest rates</li> <li>■ Drift is time-independent</li> </ul>

Note:  $dz$  is a Wiener process satisfying the following two properties:

- (1)  $dz = Z (dt)^{(1/2)}$ , where  $Z$  is standard normally distributed
- (2) Values of  $dz$  for separate time intervals are independent

This presentation and Q&A is not intended to be an actuarial opinion or advice, nor is it intended to be legal advice. Any statements made during the presentation and subsequent Q&A shall not be a representation of Milliman or its views or opinions.

# Commonly used Interest Rate Generators: No-Arbitrage Models

---

## Commonly used Interest Rate Generators - No-Arbitrage Models

Model	Formulaic Description	Comments
Ho-Lee Model	<ul style="list-style-type: none"> <li>■ <math>dr = \theta(t) dt + \sigma dz</math></li> <li>■ <math>\theta(t) = F_t(0,t) + \sigma^2 t</math></li> </ul>	<ul style="list-style-type: none"> <li>■ <math>\sigma</math> constant</li> <li>■ <math>\theta(t)</math> term exists to calibrate model to initial term structure</li> <li>■ Drift is time-dependent</li> <li>■ <math>F_t(0,t)</math> is the partial derivative with respect to <math>t</math> of the forward rate for a maturity <math>t</math>. This term helps ensure that future short rates move in line with initial term structure</li> </ul>
Hull-White Model	<ul style="list-style-type: none"> <li>■ <math>dr = [\theta(t) - ar] dt + \sigma dz</math></li> <li>■ <math>\theta(t) = F_t(0,t) + aF(0,t) + (\sigma^2/2a)(1-e^{-2at})</math></li> </ul>	<ul style="list-style-type: none"> <li>■ Effectively, a Ho-Lee model with mean-reversion</li> </ul>

*Note:  $dz$  is a Wiener process satisfying the following two properties:*

- (1)  $dz = Z (dt)^{(1/2)}$ , where  $Z$  is standard normally distributed
- (2) Values of  $dz$  for separate time intervals are independent

# Economic Risk Factors

- Inflation/Unemployment Models
  - Purchasing Power Parity
  - ARIMA (Autoregressive Integrated Moving Average Models)
  - Phillips Curve Models

# Economic Risk Factors

- Purchasing Power Parity
  - In a no-arbitrage world, forward exchange rates are completely determined by:
    - The current foreign exchange rate
    - Projection of US-denominated risk-free interest rates
    - Projection of Fx-denominated risk-free interest rates
  - Using this fact, we can model inflation stochastically without adding additional complexity to the model.
  - Key advantage: your model will be internally consistent and arbitrage-free

# Economic Risk Factors

- Purchasing Power Parity
  - Key Point:
    - Arbitrage is avoided if and only if:
      - Investing \$1 in USD for 5-years at the risk-free rate is expected (on a risk-free basis) to be equivalent to:
        - Converting \$1 to GBP
        - Investing for 5-years at the risk-free rate
        - Converting the cumulative value to USD at the end of 5-years

# Economic Risk Factors

- Purchasing Power Parity
  - Example

Time	US Dollar	GBP	Spot	No-Arbitrage
	Risk-Free	Risk-Free	Exchange	Forward
	Forward Rates	Forward Rates	Rate (USD/GBP)	Rate (USD/GBP)
0			1.4000	
1	0.75%	5.00%		1.3433
2	1.00%	5.00%		1.2922
3	1.25%	5.00%		1.2460
4	1.50%	6.00%		1.1931
5	1.50%	6.00%		1.1425

# Economic Risk Factors

- Purchasing Power Parity
  - Conclusions:
    - Over 5-years, USD has appreciated relative to GBP
    - This is due to relatively high GBP risk-free rates relative to USD risk-free rate
    - USD Inflation has been low (relative to GBP)
    - The implied forward exchange rate can be used to develop inflation relativities
    - Doing so requires some professional judgment, but this technique can be quite useful if you compare your currency to a currency where the central bank is known to target a certain inflation range (and does so credibly).

# Economic Risk Factors

- ARIMA Models
  - Many different variations of this approach using time-series/regression models
  - Both continuous-time and discrete-time models exist

# Economic Risk Factors

- Phillips Curve Models
  - Basic Idea: there is a trade-off between inflation and unemployment (i.e., the “Phillips Curve”)
    - If your model already incorporates a stochastic projection of unemployment, you can make use of a Phillips curve to extract the implied level of inflation given the projected unemployment
    - Alternatively, your inflation model (using either Purchasing Power Parity or an ARIMA model) can be used to project unemployment (again through use of the Phillips curve)

# Demographic Risk Factors

- Policy terminations and Shock Lapses
  - Generally modeled using commonly available distributions:
    - Normal distribution is the most commonly used
      - Establish a deterministic lapse assumption, which may vary by duration
      - Model additions/subtractions to the lapse rate as a stochastic, normally distributed random variable with mean 0 and standard deviation, ( $\Sigma$ )
      - $\Sigma$  generally estimated based on historical data (for the block of business being modeled or from general industry experience), but may involve element of judgment or provision for adverse deviation
    - Shock Lapses
      - The shock is sometimes modeled as a stochastic, normally distributed random variable (similar to routine lapses)
      - Other models may express shock lapse as a randomly-generated percentage of some other observed value (e.g., x% of rate increases)

# Demographic Risk Factors

- Mortality
  - Often a smaller concern for health products (relative to traditional life products)
  - Several approaches exist:
    - Normal distribution probably the most widely-used
      - May fail to capture “regime changes” (e.g., pandemics, terrorist attacks or other “1 in x-hundred year events”)
    - IAA Stochastic Modeling text presents a sophisticated 3-component approach
      - Baseline Model
      - Disease Model
      - Terrorism Model

# Morbidity/Claims Factors

- Claim Incidence
  - Commonly-used approaches:
    - “Pure” Monte Carlo
    - Normal Distribution
    - Log-Normal Distribution
    - Poisson Distribution
  
- Claim Severity
  - Stochastic models are generally constructed off of pre-existing continuance curves/tables
    - Stochastic generation of curves is generally complex and (often) unnecessary
  - Approach:
    - Generate random number from some distribution (e.g., uniform)
    - Use the random number to “choose” the severity of a particular claim from the appropriate continuance curve
    - Calculate total claim based on “chosen” severity

# Morbidity/Claims Factors

- Comments on Medical Trend
  - Medical trend may be linked to inflation
  - Can model medical trend stochastically as:
    - Inflation + “Real Cost Spread”
  - Some choose to model the “Real Cost Spread” stochastically, as well
  - Advantage: Model is internally consistent
  - Disadvantage: May desire a more “scientific” approach to determine the “Real Cost Spread.”

# Example: Long Term Care Product

- Illustrative Example for “Long-Tailed” Health Product:
  - Long Term Care Policy
  - Policy Characteristics:
    - 5-year Benefit Period
    - \$100/day benefit
    - No inflation protection or other special riders
    - Annual premium = \$1,000
  - Policyholder Data:
    - Female
    - Attained age 70 as of the valuation date
    - Purchased the policy 10 years ago (i.e., is in policy duration 10)
  - Other Information:
    - Policy is expected to have a rate increase of 50% in projection year 3
  - We will do a 5-year projection of premium and incurred claims for a single cell, under a single scenario

# Claims Modeling - Incidence

- Claim Incidence
  - Example (Poisson Distribution for Claim Incidence)
    - Estimated parameter for the Poisson Distribution
      - $\lambda = 0.3$

Probability of a Claim (Poisson)		0.2222
<hr/>		
Projection Year	Random Number Generated	Claim Incidence
1	0.901	0
2	0.930	0
3	0.164	1
4	0.363	0
5	0.007	1

# Claims Modeling - Continuance

- Claim Severity (Continuance)
  - Actuary has estimated claim continuance curve as follows:

Illustrative Claim Continuance Curve									
<b>Claim Duration (Years)</b>	0.5	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
<b>Probability of Survival</b>	98.00%	90.00%	80.00%	60.00%	30.00%	15.00%	7.50%	3.75%	0.00%

# Claims Modeling - Continuance

- Claim Severity (Continuance)

- Actuary selects a uniform distribution to stochastically model claim continuance
- Following considers claim continuance only; we will combine incidence and severity next:

Projection Year	Random Number Generated	Random		Modeled Claim Severity (Years)
		High	Low	
1	0.213	30.00%	15.00%	3.29
2	0.001	3.75%	0.00%	4.99
3	0.699	80.00%	60.00%	2.25
4	0.920	98.00%	90.00%	1.25
5	0.048	7.50%	3.75%	4.35

- For random numbers in between points on the claim continuance curve, we use linear interpolation

# Claims Modeling – Incurred Claims

- Incurred Claims

- To model total claim costs, we combine claim incidence and claim severity from the previous slides, as follows:

<b>Projection Year</b>	<b>Claim Incidence</b>	<b>Claim Severity (Years)</b>	<b>Annual Benefit</b>	<b>Total Incurred Claim (Undiscounted)</b>
1	0.000	3.29	36,500	-
2	0.000	4.99	36,500	-
3	1.000	2.25	36,500	82,191
4	0.000	1.25	36,500	-
5	1.000	4.35	36,500	158,947

# Claims Modeling – Incurred Claims

## ■ Policy Termination Rates

- We use the “stochastic addition” method discussed earlier
- The additive term is normally distributed with mean = 0 and standard deviation = 5%

Sigma 5.00%

Policy Year	Projection Year	Deterministic Voluntary Lapse	Random Number	Stochastic Adjustment to Lapse	Total Policy Termination Rate
10	1	5.0%	0.317	-2.4%	2.6%
11	2	5.0%	0.663	2.1%	7.1%
12	3	5.0%	0.812	4.4%	9.4%
13	4	4.0%	0.213	-4.0%	0.0%
14	5	3.0%	0.049	-8.3%	0.0%

*Note: The Voluntary Lapse is assumed to include mortality; Mortality is not modeled stochastically in this example.*

# Claims Modeling – Incurred Claims

## ▪ Rate-Increase Shock Lapses

– Modeled as follows:

- Deterministic assumption that shock lapse = 10% of Rate Increase Amount
- In the stochastic projection, the deterministic assumption is multiplied by a stochastic adjustment that is normally distributed with mean = 1, standard deviation = 25%

Projection Year	Deterministic		Random Number	Stochastic Adjustment to Lapse	Projected Shock Lapse
	Rate Increase	Shock Lapse			
1	0.0%	0%	0.317	0.881	0.0%
2	0.0%	0%	0.508	1.005	0.0%
3	50.0%	5%	0.632	1.084	5.4%
4	0.0%	0%	0.618	1.075	0.0%
5	0.0%	0%	0.832	1.240	0.0%

# Claims Modeling – Incurred Claims

- Cash Flow Projection Detail

- Based on the components developed on the previous slide, we have the following cash flow projections:

Time	Policy Count	Paid Premium	Incurred Claims
0	1.000		
1	0.974	987	-
2	0.905	939	-
3	0.775	1,260	82,191
4	0.775	1,162	-
5	0.775	1,162	158,947

- Example ignores accounting implications, expenses, etc.

# Example of Short Term Medical Insurance Risk Model



This presentation and Q&A is not intended to be an actuarial opinion or advice, nor is it intended to be legal advice. Any statements made during the presentation and subsequent Q&A shall not be a representation of Milliman or its views or opinions.

# Stochastic Risk Models for Short Term Medical Insurance

- What is Stochastic Modeling Used for in Short Term Medical Insurance?
  - Claim Level Estimation
  - Surplus Requirements (Economic Capital)
  - Distribution of Medical Loss Ratios
  - Stop Loss Rating
  - Other

# Stochastic Risk Models for Short Term Medical Insurance

- What are Major Risks to Insurance Companies Selling Short-Term Medical Insurance Products?
  - Rating Parameter Adequacy
  - Regulatory Issues / Delays
  - Catastrophic Events
  - Expense Recoupment
  - Other

# Stochastic Risk Models for Short Term Medical Insurance

- Is Stochastic Modeling Necessary to Establish Surplus Requirements?
  - No
  - However, it is superior to deterministic models that involve projection of a limited set of likely scenarios
  - Also, it is superior to peer group analysis
    - Where conclusions are drawn from companies with “similar” characteristics
  - Stochastic models allow for simultaneous consideration of multiple risk factors and ranges of possible outcomes

# Stochastic Risk Models for Short Term Medical Insurance

- What are some of the considerations in developing a Stochastic Model?
  - Establish risk level – high likelihood, sufficiency, virtual certainty – corresponding to 90<sup>th</sup>, 95<sup>th</sup>, 98<sup>th</sup> percentiles
  - Determine risks to include in model
  - Develop distributions of outcomes for each risk, based on ranges of potential outcomes
    - Some risks can be easily measured and parameterized
    - Other risks may be more subjective and harder to define
    - Interdependent risks need to be evaluated

# Stochastic Risk Models for Short Term Medical Insurance

- How are Stochastic Models Tested to Ensure Meaningful Results?
  - Sufficient number of iterations are run to ensure stability of result
  - Underlying distributions are calibrated to observed data history
  - Model results are validated by comparison to other independent approaches or results

# Stochastic Risk Models for Short Term Medical Insurance

- Examples of Stochastic Modeling Used in Short Term Medical Insurance:
  - Risk Associated with Catastrophic Events
    - Already established claim risk model
    - Need to evaluate additional risk due to pandemics
  - Develop Optimal Surplus Target Range
    - For non-profit Short Term Medical policies sold by a stand-alone health insurance company

# Risk Associated with Pandemics

- Claims Trend



# Risk Associated with Pandemics

## ■ Pandemic Cost Component

Event	Probability	Outcome
• No Pandemic	• 98.0%	• 0% Additional Cost
• Mild Pandemic	• 1.0%	• 2% Additional Cost in Year
• Major Pandemic (duration 1 year)	• .75%	• 14% Additional Cost in Year
• Major Pandemic (duration 2 years)	• .25%	• 14% Additional Cost in 1 <sup>st</sup> Year and 2% Residual Cost in 2 <sup>nd</sup> Year

# Risk Associated with Pandemics

- Premium Development

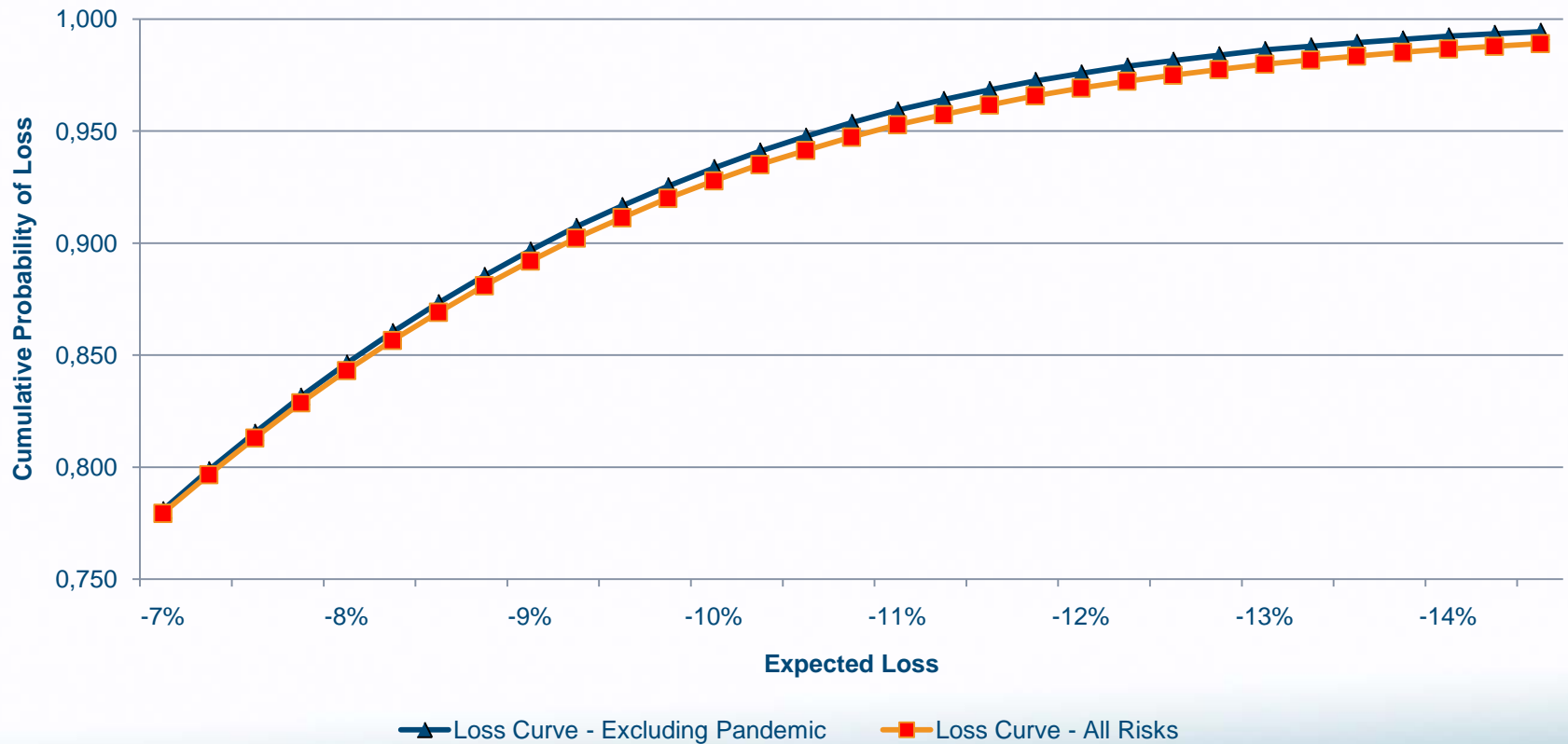


# Risk Associated with Pandemics

- Recovery of Losses from Pandemic
  - Recovery of Loss, if any, over 5 years after event
  - Potential for not being able to recover losses due to MLR limitations under Federal Health Care Reform
- Distribution of results with and without pandemic risk

# Risk Associated with Pandemics

- Illustrative Distribution of Losses



This presentation and Q&A is not intended to be an actuarial opinion or advice, nor is it intended to be legal advice. Any statements made during the presentation and subsequent Q&A shall not be a representation of Milliman or its views or opinions.

# Optimal Surplus

- Analytical Approach
  - Approach has been refined over time
  - Best described as a variant of Enterprise Risk Management
  - Involves the use of a model to reflect company-specific financial situation and risk exposure:
    - Forward looking projection of potential outcomes
    - Based on historical and anticipated loss distributions
    - Detailed approach to development and documentation of assumptions
  - Externally peer reviewed
    - Approach found to be reasonable and acceptable

# Optimal Surplus

- Analytical Approach
  - Basic Approach to the Evaluation:
    - Analysis of historical underwriting loss cycles
      - > Company-specific loss history
      - > Comparison (by relative size) set of Insurers
    - Identify and evaluate major risks
      - > Develop risk and contingent distributions
      - > Monte Carlo simulation of loss cycles
    - Identify reserve target thresholds and criteria
      - > Surplus target goals
      - > Loss cycle provisions to satisfy goals

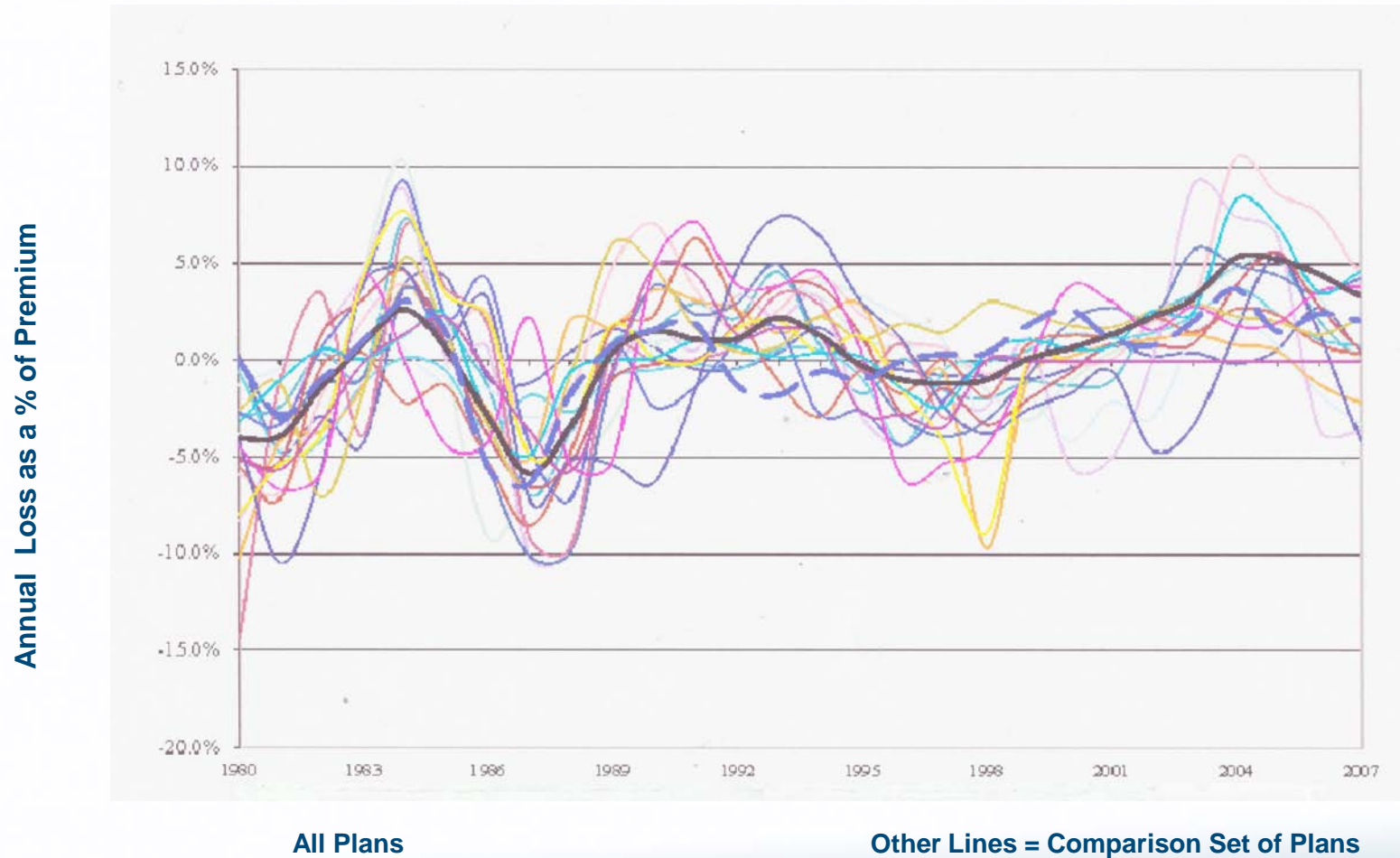
# Optimal Surplus

- Analytical Approach
  - Basic Approach to the Evaluation:
    - Develop and initialize pro forma projection model
      - > Pro forma assumptions for company
    - Develop reserve target range
      - > “Stress test” loss cycles against reserve thresholds
      - > Develop reserve levels necessary to withstand cycle losses

# Optimal Surplus

- Analytical Approach
  - Basic Approach to the Evaluation:
    - Analysis of historical underwriting loss cycles

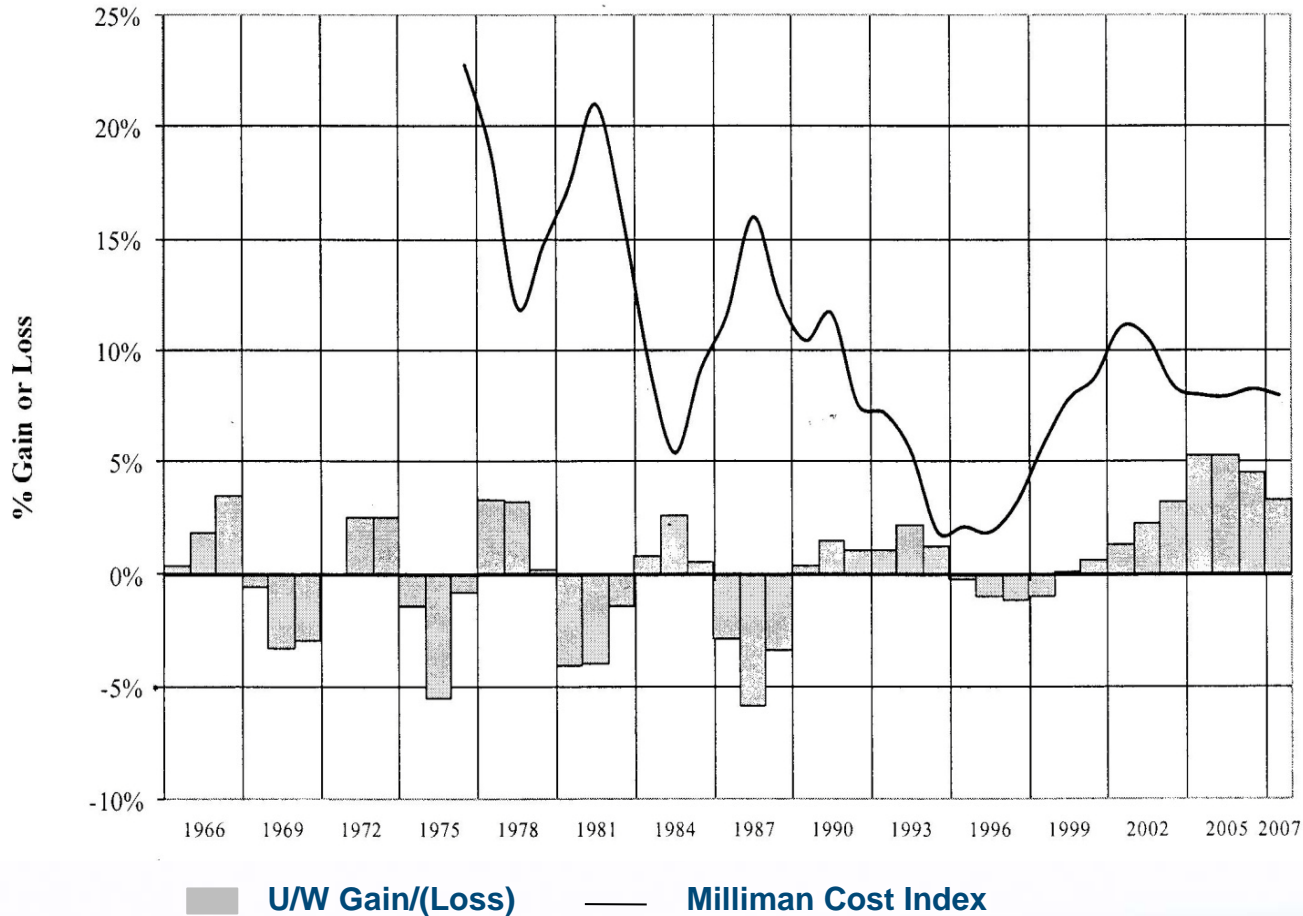
# Underwriting Gain/(Loss) for Selected Insurers



All Plans

Other Lines = Comparison Set of Plans

## Average Underwriting Gain / (Loss) for a Sample of Health Insurers



This presentation and Q&A is not intended to be an actuarial opinion or advice, nor is it intended to be legal advice. Any statements made during the presentation and subsequent Q&A shall not be a representation of Milliman or its views or opinions.

# Optimal Surplus

- Analytical Approach

- Basic Approach to the Evaluation:

- Identify and evaluate major risks

- Develop risk and contingency distributions

- > Rating adequacy and fluctuation

- > Unpaid claims and other estimates

- > Portfolio risks (equity market, interest rates, impairment)

- > Overhead expense recovery and fee income risk

- > Other business risks, including self-funded

- > Catastrophic events, including Health Care Reform

- > Provision for unidentified development and growth

- > Other factors

# Optimal Surplus

- Analytical Approach
  - Basic Approach to the Evaluation:
    - Identify reserve target thresholds and criteria
      - Surplus target goals
        - > Early warning monitoring threshold avoidance (375% RBC)
        - > Company Action Level (200% - 300% RBC)
        - > Loss of trademark avoidance (200% RBC)
      - Loss cycle provisions established to satisfy goals – for example:
        - > Early warning – 90<sup>th</sup> to 95<sup>th</sup> percentile of Monte Carlo simulated loss cycles
        - > CAL – 95<sup>th</sup> percentile of simulated loss cycles
        - > Loss of trademark – 98<sup>th</sup> percentile of simulated losses

# Optimal Surplus

- Analytical Approach
  - Basic Approach to the Evaluation:
    - Develop and initialize pro forma projection model
      - > Pro forma assumptions for company
        - Generally based on company forecast
        - Normalized assumptions to reflect longer term view of operations
        - GAAP to Stat adjustments

# Optimal Surplus

- Analytical Approach
  - Basic Approach to the Evaluation:
    - Develop reserve target range
      - > “Stress test” loss cycles against reserve thresholds
        - Use Pro Forma model to project company balance sheet
        - Based on various starting surplus amounts
        - Tested under a range of forecast projection assumptions
        - Ending surplus target goals
      - > Develop reserve levels necessary to withstand cycle losses
        - Expressed as ranges of RBC

# Optimal Surplus

## Recap of Resulting Surplus Ranges

- 11 Distinct Studies in Recent Years
- Circumstances of Individual Companies Different
- Range of Results 650% - 1250% of ACL-RBC

# IAA Health Section

Stochastic Modeling Webcast

Theory and Reality from an Actuarial Perspective

# Questions ??

This presentation and Q&A is not intended to be an actuarial opinion or advice, nor is it intended to be legal advice. Any statements made during the presentation and subsequent Q&A shall not be a representation of Milliman or its views or opinions.