

# RPM Workshop 3: Basic Ratemaking

## Development of an Overall Indication

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# Basic Ratemaking Equation and Its Considerations:

- How is data organized?
- What are the two main methods of ratemaking and what are their equations?
- What adjustments need to be made to premium?
- What adjustments need to be made to losses?
- How do we incorporate expenses?
- What are some other considerations?

# HOW IS DATA ORGANIZED?

## *I. CALENDAR YEAR DATA*

*(standard accounting year)*

## *II. POLICY YEAR DATA*

## *III. ACCIDENT YEAR DATA*

# HOW IS DATA ORGANIZED?

## *I. CALENDAR YEAR DATA*

Premium and Loss transactions that occur during the year.

Premiums:

Written Premium—Total Premium for policies written during the calendar year.

Earned Premium—Total Premium earned during the calendar year.

$\text{Incurred Loss} = \underline{\text{Payments}} + \textit{change}$  in reserves *during year*

# HOW IS DATA ORGANIZED?

## *I. CALENDAR YEAR DATA*

### Advantages:

- ❖ Matches financial statements
- ❖ Data available quickly
- ❖ Never changes after it is calculated at the end of a year.

### Disadvantages:

- ❖ Premium and Loss transactions *DO NOT* match
- ❖ Reserve changes from prior years can distort the reliability of the data for ratemaking and management purposes.

# HOW IS DATA ORGANIZED?

## *II. POLICY YEAR DATA*

Premium and Loss transactions *on policies with effective dates (new or renewal)* during the year.

Incurred Loss = Payments on these policies +  
Reserves on these policies

# HOW IS DATA ORGANIZED?

## *II. POLICY YEAR DATA*

### Advantages:

- ❖ Premium and Loss transactions DO match
- ❖ Transactions from policies effective in prior years do not distort the data for ratemaking

### Disadvantages:

- ❖ Data with the greatest time lag (not available until one term after end of the year.)
- ❖ Exact ultimate losses cannot be finalized until all losses settled.

# HOW IS DATA ORGANIZED?

## *III. ACCIDENT YEAR DATA*

Loss transactions *for accidents occurring* during the year. Premium transaction during the same 12 months.

Incurred Loss = Payments on accidents occurring in that year + Reserves for accidents occurring in that year.

# HOW IS DATA ORGANIZED?

## ***III. ACCIDENT YEAR DATA***

### Advantages:

- ❖ Premium and Loss transactions *generally* match
- ❖ Transactions from accidents occurring in prior years do not distort the data for ratemaking

### Disadvantages:

- ❖ Data with slight time lag
- ❖ Exact ultimate losses cannot be finalized until all losses settled.

# HOW IS DATA ORGANIZED?

## *Example:*

*A policy is written on 7/1/2008. The premium is \$1000. The policy has the following activity:*

*-12/1/08—Accident occurs and \$5000 is reserved to pay the claim.*

*-3/1/09--\$4500 is paid on the above claim and the claim is closed, thus releasing the remaining \$500 from reserves.*

*-6/1/09—Second accident occurs--\$500 is paid out immediately and the claim is closed.*

# HOW IS DATA ORGANIZED?

## *Example:*

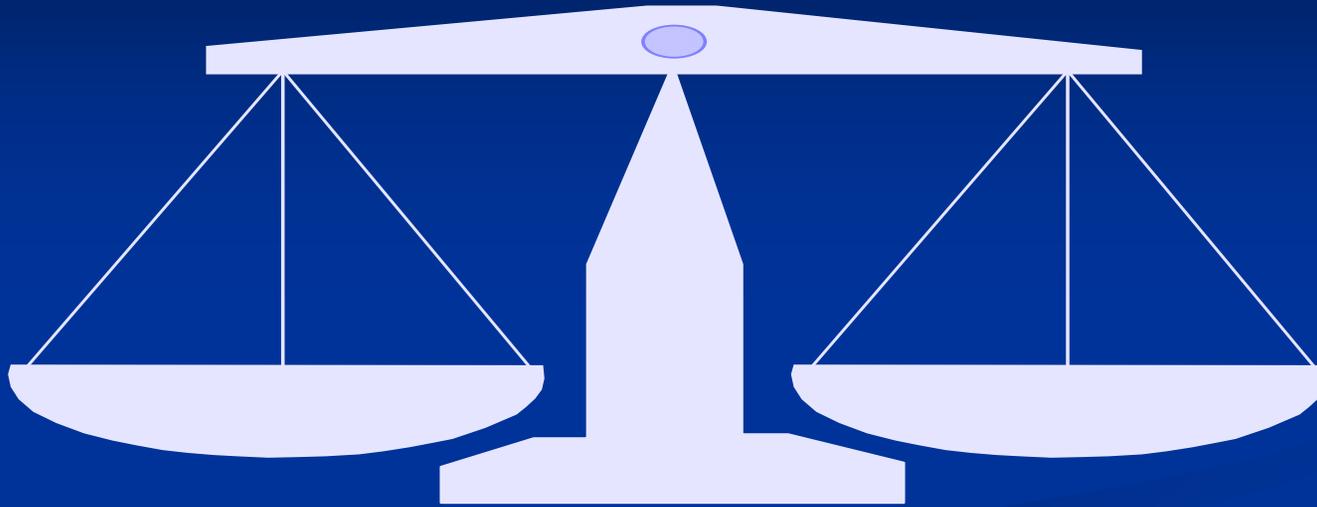
*Calculate the following items for this policy for Calendar Years 2008 and 2009, Policy Years 2008 and 2009, and Accident Years 2008 and 2009.*

*-Written Premium*

*-Earned Premium*

*-Incurred Losses*

## Basic Ratemaking Equation:



$$\begin{aligned} \text{Future Premiums} = & \\ & \text{Future Losses} + \\ & \text{Future Expenses} + \\ & \text{Underwriting Profit and Contingency Provision} \end{aligned}$$

# BASIC RATEMAKING METHODS

## ➤ **Loss Ratio Method**

- ✓ develops indicated rate change (A)
- ✓  $A = \text{Experience LR} / \text{Target LR} - 1.0$

## ➤ **Pure Premium (PP) Method**

- ✓  $PP = \text{Loss} / \text{Exposure Units}$
- ✓ develops indicated rate per unit of exposure (R)
- ✓  $R = [PP + FE] / [1 - \text{VER} - \text{Profit Ratio}]$

NOTE: THE TWO METHODS PRODUCE IDENTICAL RESULTS WHEN IDENTICAL DATA AND ASSUMPTIONS ARE USED.

# LOSS RATIO METHODOLOGY

**INDICATED (needed) RATE LEVEL CHANGE**

=

$$\frac{\text{Projected Experience Loss} + \text{Fixed Expense Ratio}}{\text{Expected (Target) Loss} + \text{Fixed Expense Ratio}} - 1.0$$

For Example:  $\frac{90.3\%}{76.6\%} - 1.0 = +17.9\%$

# LOSS RATIO METHODOLOGY

Experience Loss + Fixed Expense Ratio Projection

- ✧ Premium Adjustments
  - Adjust to Current Rate Level
  - Premium Trend
- ✧ Loss Adjustments
  - Loss Development
  - Loss Trend
  - Catastrophe Adjustments

# RATE INDICATION WORKSHEET

## Loss Ratio Methodology

- A. EXPERIENCE Loss + Fixed Expense Ratio =  $(9 + 10 + 12) / (4)$ .....
- (1) 2008 Earned Premium .....
  - (2) Current Rate Level Factor .....
  - (3) Premium Trend Factor .....
  - (4) Trended Premium @ Current Rate Level =  $(1) * (2) * (3)$  .....
  - (5) Accident Year 2008 Ultimate Losses & ALAE .....
  - (6) Unallocated Loss Adjustment Expense (ULAE) Factor .....
  - (7) Annual Loss Trend \_\_\_% Trend Period:
  - (8) Exponential Trend Factor  $[1.0 + (7)] * \text{Trend Period}$  .....
  - (9) Trended Ultimate Losses and LAE =  $(5) * (6) * (8)$  .....
  - (10) Expected Catastrophe Loss & LAE for Projection Period .....
  - (11) Fixed Expense Ratio (FER) .....
  - (12) Fixed Expenses =  $(1) * (11)$  .....
- B. EXPECTED (Target) Loss + Fixed Expense Ratio .....
- C. INDICATED RATE LEVEL CHANGE =  $(A / B) - 1.0$  .....

# Sample Rate Level Indication

## *Assumptions*

- Annual Policies. Rates to be revised as of JANUARY 1, 2010
- Loss Ratio Methodology
- EXPERIENCE PERIOD: ACCIDENT YEAR 2008
  - 2008 Earned Premium \$7,380,000
  - Reported Incurred Losses as of 12/31/08: \$3,800,000

# PREMIUM ADJUSTMENTS

## *Current Rate Level Adjustment*

- ❖ Loss Ratio Method analyzes the appropriateness of the **CURRENT RATES** for use in the future.
- ❖ CRL adjustment reflects rate changes **NOT** already included in historical recorded premium.

# PREMIUM ADJUSTMENTS

## *Current Rate Level Adjustment - Common Techniques*

### ① Extension of Exposures

- Re-rate each exposure (policy)
- Requires extensive detail and mechanization
- Most accurate method

### ② Parallelogram Method

- Easier method
- Specific policy information not required
- Assumes even distribution of policies written throughout the year

# CURRENT RATE LEVEL ADJUSTMENT

## Extension of Exposures Method

### *2008 Earned Exposures*

	Class 1	Class 2
Territory 1	1,500	2,260
Territory 2	1,995	3,010
Territory 3	2,700	2,500

### *Current Rates*

	Class 1	Class 2
Territory 1	\$400	\$600
Territory 2	\$420	\$700
Territory 3	\$440	\$880

### *Premium @ Current Rates*

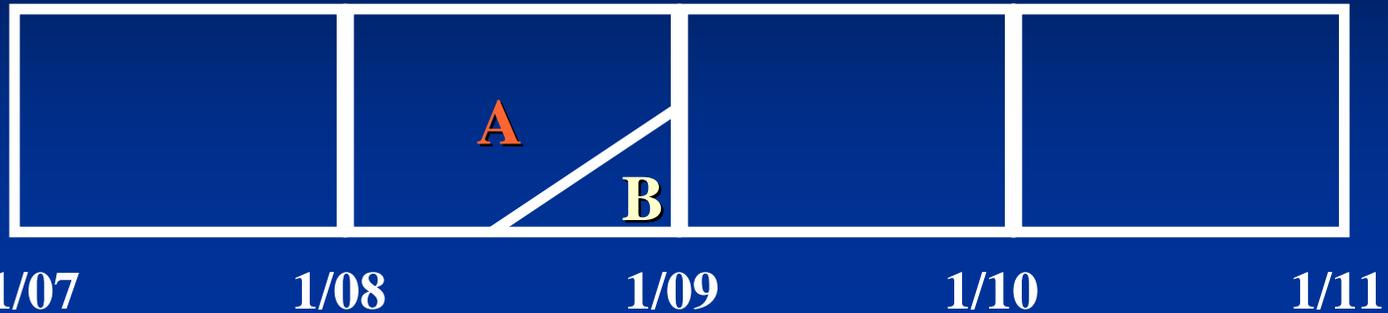
	Class 1	Class 2
Territory 1	\$600,000	\$1,356,000
Territory 2	\$837,900	\$2,107,000
Territory 3	\$1,188,000	\$2,200,000

**Statewide total**

**\$8,288,900**

# CURRENT RATE LEVEL ADJUSTMENT

## Parallelogram Method



### *Rate Change History*

<u>Date</u>	<u>Change</u>	<u>Rate Index</u>	
From 1/1/07 to 6/30/08	None	1.000	A
7/1/08	+ 16%	1.16 (1 * 1.16)	B

--Assume policies are in effect for one year.

# CURRENT RATE LEVEL ADJUSTMENT

## Calculation of On-Level Factor - Parallelogram Method

### I. Rate Index for 2008:

<u>Area</u>	<u>Percent of 2008</u>	<u>Rate Index</u>
A	87.5	1.000
B	12.5	1.160
<b>TOTAL</b>	<b>100.0</b>	<b>1.020</b>

### II. On-Level Factor for 2008:

(1) Current Index	<b>1.160</b>
(2) 2008 Index	<b>1.020</b>
(3) On-Level Factor <b>(1) / (2)</b>	<b>1.137</b>
(4) 2008 Earned Premium	\$7,380,000
(5) 2008 Earned Premium @ Current Rate Level	\$8,391,060

# RATE INDICATION WORKSHEET

## Loss Ratio Methodology

A. EXPERIENCE Loss + Fixed Expense Ratio = (9 + 10+ 12) / (4).....

(1) 2008 Earned Premium ..... 7,380

(2) Current Rate Level Factor ..... 1.137

(3) Premium Trend Factor .....

(4) Trended Premium @ Current Rate Level = (1)\*(2)\*(3) .....

(5) Accident Year 2008 Ultimate Losses & ALAE .....

(6) Unallocated Loss Adjustment Expense (ULAE) Factor .....

(7) Annual Loss Trend \_\_\_% Trend Period:

(8) Exponential Trend Factor [1.0 + (7)] \* Trend Period. ....

(9) Trended Ultimate Losses and LAE = (5) \* (6) \* (8).....

(10) Expected Catastrophe Loss & LAE for Projection Period. ....

(11) Fixed Expense Ratio (FER).....

(12) Fixed Expenses = (1) \* (11).....

B. EXPECTED (Target) Loss + Fixed Expense Ratio.....

C. INDICATED RATE LEVEL CHANGE = (A / B) - 1.0 .....

# PREMIUM ADJUSTMENTS

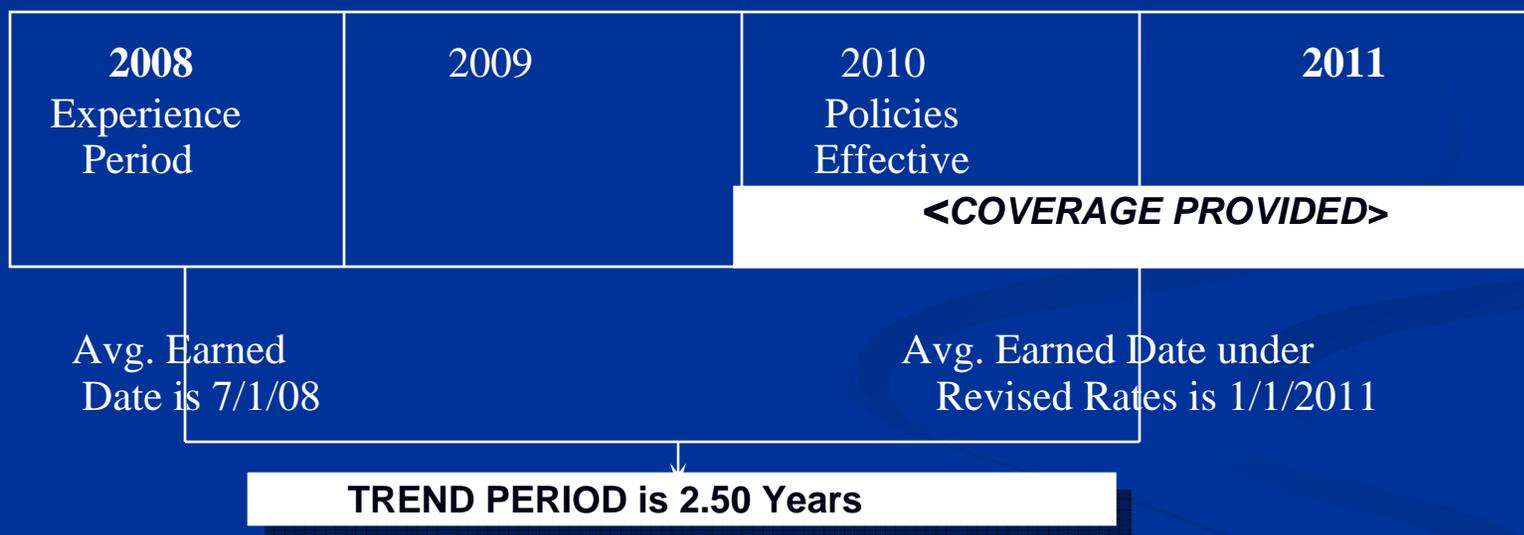
## *Premium Trend*

- ◆ To *project* the premium level which will exist during the period being priced. The premium trend accounts for distributional shifts of business that will also impact the losses.
- ◆ Must adjust for items such as:
  - ◆ Average car model year or price group
  - ◆ Average home value
  - ◆ Territorial distribution shift
  - ◆ Any item that would impact future premium or both premium and losses in the future *except policy count or rate changes.*

# Premium Adjustments

## *Premium Trend – Determination of Trend Period*

- Annual Policies. Rates to be revised as of JANUARY 1, 2010
- EXPERIENCE PERIOD: ACCIDENT YEAR 2008



Assuming an average annual trend of 2% for this example, the premium trend would be:  $(1.02)^{2.5} = 1.051$

# RATE INDICATION WORKSHEET

## Loss Ratio Methodology

A. EXPERIENCE Loss + Fixed Expense Ratio =  $(9 + 10 + 12) / (4)$ .....

(1) 2008 Earned Premium .....	7,380
(2) Current Rate Level Factor .....	1.137
(3) Premium Trend Factor .....	1.051
(4) Trended Premium @ Current Rate Level = $(1)*(2)*(3)$ .....	8,819

(5) Accident Year 2008 Ultimate Losses & ALAE .....	
(6) Unallocated Loss Adjustment Expense (ULAE) Factor .....	
(7) Annual Loss Trend ___% Trend Period: <u>2.5</u> years	
(8) Exponential Trend Factor $[1.0 + (7)] * 2.5$ .....	
(9) Trended Ultimate Losses and LAE = $(5) * (6) * (8)$ .....	
(10) Expected Catastrophe Loss & LAE for Projection Period .....	

(11) Fixed Expense Ratio (FER) .....	
(12) Fixed Expenses = $(1) * (11)$ .....	

B. EXPECTED (Target) Loss + Fixed Expense Ratio .....

C. INDICATED RATE LEVEL CHANGE =  $(A / B) - 1.0$  .....

# LOSS RATIO METHODOLOGY

Experience Loss + Fixed Expense Ratio Projection

## Loss Adjustments

- Loss Development
- Loss Adjustment Expenses
  - Allocated Loss Adjustment Expense (ALAE)
    - Generally included with loss
  - Unallocated Loss Adjustment Expense (ULAE)
    - Generally loaded to Loss & ALAE
- Loss Trend
- Catastrophe Adjustments

# ***LOSS ADJUSTMENTS***

## **Loss Development Analysis**

- Adjust historical losses to an expected *ULTIMATE* value
- Reflects revisions to claim values as claims are settled
- Used with policy and accident year data
- Reflects IBNR reporting.
- Reflects development on reported claims.

## Accident Year Loss Development Analysis

**INCURRED METHOD** - Recognizes *SYSTEMATIC* inaccuracy of case reserves

### INCURRED LOSSES & ALAE

Adjusted for Cats, (000's)

#### ACCIDENT

#### Reported as of:

YEAR	<u>12 mos</u>	<u>24 mos</u>	<u>36 mos</u>	<u>48 mos</u>
2003	2,400	2,976	3,096	3,096
2004	2,600	3,510	3,686	3,686
2005	2,800	3,416	3,382	3,382
2006	<u>3,000</u>	<u>3,600</u>	3,672	
2007	3,200	3,936		
2008	<u>3,800</u>			

Age to Age Development Factor =

Incurred Loss @ Later Report Period divided by Loss @ Prior Report Period

AY 2006 12 mos TO 24 mos Factor =  $\$3,600 / \$3,000 = 1.20$

# Accident Year Loss Development Analysis

## INCURRED AGE-TO-AGE FACTORS

### ACCIDENT

YEAR                      12-24 mos                      24-36 mos                      36-48 mos

<b>2003</b>	1.24	1.04	1.00
<b>2004</b>	1.35	1.05	1.00
<b>2005</b>	1.22	0.99	1.00
<b>2006</b>	1.20	1.02	
<b>2007</b>	1.23		

**Average**                      **1.248**                      **1.025**                      **1.000**

**Selected**                      **1.248**                      **1.025**                      **1.000**

**Cumulative**  
**Age-to-Age Factors**                      **1.279**                      **1.025**                      **1.000**

x

x

x

x

# LOSS DEVELOPMENT ANALYSIS

<b>Accident Year</b>	<b>(1) Incurred Loss &amp; ALAE @ 12/08</b>	<b>(2) Cumulative Age to Ultimate Factor</b>	<b>(3) Estimated Ultimate Loss (1) * (2)</b>
<b>2005</b>	<b>3,382</b>	<b>1.000</b>	<b>3,382</b>
<b>2006</b>	<b>3,672</b>	<b>1.000</b>	<b>3,672</b>
<b>2007</b>	<b>3,936</b>	<b>1.025</b>	<b>4,034</b>
<b>2008</b>	<b><u>3,800</u></b>	<b>1.279</b>	<b><u>4,860</u></b>

# RATE INDICATION WORKSHEET

## Loss Ratio Methodology - Fixed Expense Approach

A. EXPERIENCE Loss + Fixed Expense Ratio =  $(9 + 10 + 12) / (4)$  . . . . .

- (1) 2008 Earned Premium . . . . . 7,380
- (2) Current Rate Level Factor . . . . . 1.137
- (3) Premium Trend Factor . . . . . 1.051
- (4) **Trended Premium @ Current Rate Level = (1)\*(2)\*(3)** . . . . . **8,819**
  
- (5) Accident Year 2008 Ultimate Losses & ALAE . . . . . 4,860
- (6) Unallocated Loss Adjustment Expense (ULAE) Factor . . . . .
- (7) Annual Loss Trend \_\_\_% Trend Period: 2.5 years
- (8) Exponential Trend Factor  $[1.0 + (7)] * 2.5$  . . . . .
- (9) **Trended Ultimate Losses and LAE = (5) \* (6) \* (8)** . . . . .
- (10) **Expected Catastrophe Loss & LAE for Projection Period.** . . . . .
  
- (11) Fixed Expense Ratio (FER). . . . .
- (12) **Fixed Expenses = (1) \* (11).** . . . . .

B. EXPECTED (Target) Loss + Fixed Expense Ratio. . . . .

C. INDICATED RATE LEVEL CHANGE =  $(A / B) - 1.0$  . . . . .

# EXPENSE ANALYSIS

## Unallocated Loss Adjustment Expense

Countrywide Figures  
(in \$ millions)

<u>Year</u>	<u>Incurred Losses &amp; ALAE</u>	<u>Unallocated Loss Adjustment Expenses</u>	<u>ULAE to Losses &amp; ALAE Ratio</u>
2006	\$61,200	\$6,500	10.6%
2007	79,000	7,800	9.9%
2008	82,300	8,300	10.1%

Estimated Future ULAE Percentage  
as a percentage of Incurred Losses & ALAE

10.0%

# RATE INDICATION WORKSHEET

## Loss Ratio Methodology - Fixed Expense Approach

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- B. EXPECTED (Target) Loss + Fixed Expense Ratio.....
- C. INDICATED RATE LEVEL CHANGE = (A / B) - 1.0.....

# ***LOSS ADJUSTMENTS***

## **Loss Trend Analysis**

☆ **Project** to the loss level predicted to exist during pricing period

☆ **Data Issues**

- Separate Claim frequency and Severity Trends?
- Internal Vs. External Data ?
- Paid, Incurred, Reported data ?
- Calendar Vs. Accident year ?
- Length of Historical period ?
- Credibility ?
- Extrapolations of Historical Data? (Least Squares Regression, Time Series, Econometric Models)

## LOSS TREND ANALYSIS

<u>Calendar Year</u>	<u>Paid Losses (\$ 000's)</u>	<u>Earned Exposures (000's)</u>	<u>Pure Premium</u>
2001	2,424	26.0	\$ 93.23
2002	2,712	26.4	\$102.73
2003	2,992	26.6	\$112.48
2004	3,452	26.8	\$128.81
2005	3,460	27.2	\$127.21
2006	3,678	27.4	\$134.23
2007	3,968	27.6	\$143.75
2008	4,216	28.0	\$150.57

Annual Trend based on Least Squares (exponential )	<b>6.6%</b>
Most Recent Annual Change (150.57 / 143.75)	<b>4.7%</b>

### *Other Possible Trend Sources*

C.P.I. Medical Care Index	3 - 4%
C.P.I. Auto Body Work Index	4 - 5%
C.P.I. Home Maintenance & Repair Index	3 - 4%

# RATE INDICATION WORKSHEET

## Loss Ratio Methodology - Fixed Expense Approach

A. EXPERIENCE Loss + Fixed Expense Ratio =  $(9 + 10 + 12) / (4)$ .....

(1)	2008 Earned Premium .....	7,380
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(3)	Premium Trend Factor .....	1.051
(4)	<b>Trended Premium @ Current Rate Level = (1)*(2)*(3) .....</b>	<b>8,819</b>
(5)	Accident Year 2008 Ultimate Losses & ALAE .....	4,860
(6)	Unallocated Loss Adjustment Expense (ULAE) Factor .....	1.10
(7)	Annual Loss Trend <u>5.0</u> % Trend Period: <u>2.5</u> years	
(8)	Exponential Trend Factor $[1.0 + (7)] * 2.5$ .....	1.13
(9)	<b>Trended Ultimate Losses and LAE = (5) * (6) * (8) .....</b>	<b>6,041</b>
(10)	<b>Expected Catastrophe Loss &amp; LAE for Projection Period. ....</b>	
(11)	Fixed Expense Ratio (FER) .....	
(12)	<b>Fixed Expenses = (9) * (11) .....</b>	

B. EXPECTED (Target) Loss + Fixed Expense Ratio .....

C. INDICATED RATE LEVEL CHANGE =  $(A / B) - 1.0$  .....

# *LOSS ADJUSTMENTS*

## CATASTROPHES

- \* Catastrophes should be eliminated from losses
- \* Average provision should be used as a loss loading

### Example:

(1) Expected Annual Catastrophe Loss & ALAE for Projection Period	842
(2) Projected Premium	8,819
(3) Catastrophe Load (1) / (2)	9.55%

# RATE INDICATION WORKSHEET

## Loss Ratio Methodology - Fixed Expense Approach

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(4) Trended Premium @ Current Rate Level = (1)*(2)*(3) .....	8,819
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(6) Unallocated Loss Adjustment Expense (ULAE) Factor .....	1.10
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(9) Trended Ultimate Losses and LAE = (5) * (6) * (8) .....	6,041
(10) Expected Catastrophe Loss & LAE for Projection Period .....	842
(11) Fixed Expense Ratio (FER) .....	
(12) Fixed Expenses = (1) * (11) .....	

B. EXPECTED (Target) Loss + Fixed Expense Ratio .....

C. INDICATED RATE LEVEL CHANGE = (A / B) - 1.0 .....

# UNDERWRITING EXPENSE ANALYSIS

## Direct Expenses Other Than Loss Adjustment

Countrywide Figures (In \$ Millions)

	2006		2007		2008		Selected
	\$	%	\$	%	\$	%	%
Written Premium	107,400	100	121,600	100	142,400	100	
Commissions	16,647	15.5	18,850	15.5	22,100	15.5	15.5
Other Acquisition	6,703	6.2	7,250	6.0	8,235	5.8	5.8
General	7,332	6.8	7,977	6.6	9,101	6.4	6.4
Taxes, Licenses & Fees	3,652	3.4	4,100	3.4	4,900	3.4	3.4

- Commissions and Premium Taxes vary directly with premiums
- Other Acquisition and General Expenses are “fixed” expenses
  - Not really fixed - vary with inflation

## DEVELOPMENT of EXPECTED LOSS RATIO & FIXED EXPENSE RATIO

	Total	Variable	Fixed
Commissions	15.5%	15.5%	0.0%
Other Acquisition	3.8	0.0	3.8
General	5.4	0.0	5.4
Taxes, Licenses & Fees	3.4	3.4	0.0
Profit & Contingency	7.0	7.0	0.0
Other Costs *	0.5	0.5	0.0
<b>TOTAL</b>	<b>35.6%</b>	<b>26.4%</b>	<b>9.2%</b>

**TARGET Loss, LAE & Fixed Expense Ratio = 100.0% - 26.4% = 73.6%**

\* Policyholder Dividends, Involuntary Market Costs, Guaranty Fund Assessments, Etc. (if allowable)

# RATE INDICATION WORKSHEET

## Loss Ratio Methodology - Fixed Expense Approach

A.	EXPERIENCE Loss + Fixed Expense Ratio = (9 + 10+ 12) / (4).....	85.7%
	(1) 2008 Earned Premium .....	7,380
	(2) Current Rate Level Factor .....	1.137
	(3) Premium Trend Factor .....	1.051
	(4) Trended Premium @ Current Rate Level = (1)*(2)*(3) .....	8,819
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	(9) Trended Ultimate Losses and LAE = (5) * (6) * (8) .....	6,041
	(10) Expected Catastrophe Loss & LAE for Projection Period .....	842
	(11) Fixed Expense Ratio (FER) .....	9.2%
	(12) Fixed Expenses = (1) * (11) .....	679
B.	EXPECTED (Target) Loss + Fixed Expense Ratio .....	73.6%
C.	INDICATED RATE LEVEL CHANGE = (A / B) - 1.0 .....	<b>+16.4%</b>

# PURE PREMIUM METHOD

$$\text{Indicated Premium} = [\text{Pure Premium} + \text{Fixed Expenses}] / [1 - \text{VE Ratio} - \text{Profit Ratio}]$$

How is this calculated?

☞  $\text{Indicated Premium} = \text{Future PP} + \text{Future FE} + \text{Future VE} + \text{Future Profit}$

☞ Since VE and Profit vary with premium, this equation becomes

☞  $\text{Indicated Premium} = \text{Future PP} + \text{Future FE} + \text{Indicated Premium} (\text{VER} + \text{Profit Ratio})$

☞  $\text{Indicated Premium} - \text{Indicated Premium} (\text{VER} + \text{Profit Ratio}) = \text{Future PP} + \text{Future FE}$

☞  $\text{Indicated Premium} (1 - \text{VER} - \text{Profit Ratio}) = \text{Future PP} + \text{Future FE}$

☞  $\text{Indicated Premium} = [\text{Future PP} + \text{Future FE}] / [1 - \text{VER} - \text{Profit Ratio}]$

**Indication Example!**