

Eureka's Ah has, and Other Epiphanies

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 - Program Director of Actuarial Studies
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 - Actuarial Studies Program Assistant Director

49th ARC Money Quiz

Read $E[X] = n * p$

- \$5.00 Answer
- \$1.00 Answer
- -\$1.00 Answer
- -\$5.00 Answer

Scoring Rubric for $E[X] = n * p$

- \$5.00 Answer: “I am unable to read the mathematical expression because the variables have not been defined.”
- \$1.00 Answer: “The expected value of a binomial random variable with n independent attempts/trials and fixed probability of success p is equal to the number of trials times the probability of success.”
- -\$1.00 Answer: “The expected value of X is equal to n times p .”
- -\$5.00 Answer: “E of X is ennpee.”

Flipping Probability

- What is flipping?
- Goals for students
- Structure
 - Pre-class reading, synopsis, homework
 - In-class quizzes, team challenge questions, games, mini lectures
 - Post-class homework
- Takeaway – The Chance Cube

“If something is important that students do, then you had better grade it.”

-Ron Gebhartsbauer at the 48th ARC
held at Temple University

Actuarial Capstone Classes

Second semester classes for MLC and C exams

- “I’ll do whatever you like, except lecture.”
- Successes
 - 18-page syllabus with a table of contents
 - Student groups created pre-class assignment
 - Small presentations and frequent in-class games
 - Grades = 1/3 content + 1/3 communication + 1/3 contribution
- Opportunities for Future Successes
 - I need to communicate my expectations clearly (without limiting freedom)
 - E.g. Working groups 1) Determined subject relevant practice exam questions, created 2 exercises for peers, presented material to class, created a notebook for the next cycle.
 - Vetting of questions and presentations
 - Require at least 2 different presentation styles / teaching techniques

What's New at UT?

Alisa Havens Walch, M.A.

Actuarial Studies Program Assistant Director

University of Texas at Austin

New Classes

- Generalized Linear Models
 - Introduced Spring 2014

- Property & Casualty Case Studies
 - To be offered Fall 2015

CAS Case Studies

- Topics
 - Basketball Half-Court Shot (Probability)
 - Claims Liabilities
 - Warranty
 - Personal Auto Liability Rate Indication
 - CAT Modeling

CAS Case Studies

- Materials
 - Case Study Description
 - PowerPoint Presentation with Speaker Notes
 - Audio Recordings to Accompany PowerPoint
 - Problem Sets & Solutions
 - Additional Materials

Automobile Insurance Case Study

[Date of Presentation]
[Name of Presenter]





Learning Objectives

- Understand considerations in setting Automobile Liability Insurance Rates
- Adjust historical premium levels
- Adjust losses to ultimate loss levels
- Reflect expenses in rates



What does an Insurance Rate Cover?

- Losses
- Expenses
- Reasonable profit



What does the CAS say about ratemaking?

- **Statement of Principles Regarding Property and Casualty Insurance Ratemaking**
- **Principle 1:**
 - A rate is an estimate of the expected value of future costs.



What does the CAS say about ratemaking?

- **Statement of Principles Regarding Property and Casualty Insurance Ratemaking**
- **Principle 2:**
 - A rate provides for all costs associated with the transfer of risk.



What does the CAS say about ratemaking?

- **Statement of Principles Regarding Property and Casualty Insurance Ratemaking**
- **Principle 3:**
 - A rate provides for the costs associated with an individual risk transfer.



What does the CAS say about ratemaking?

- **Statement of Principles Regarding Property and Casualty Insurance Ratemaking**
- **Principle 4:**
 - A rate is reasonable and not excessive, inadequate, or unfairly discriminatory if it is an actuarially sound estimate of the expected value of all future costs associated with an individual risk transfer.



What do you need for a rate change indication?

- Current rates and historical premium
- Premium trend
- Loss experience
- Loss development triangles
- Loss trend
- Expenses
- Credibility measure



How do you determine a rate change indication?

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	
	Occurrence	Earned	Current Rate	Premium	Projected Earned	Reported Losses	Development	Loss	ULAE	Projected Ultimate	Projected Loss
	Year	Premium	Level Factor	Trend Factor	Premium at Current	and Paid ALAE	Factor	Factor	Factor	Losses and LAE	and LAE Ratio
					Rate Level						
	2011	\$1,122,372	1.2159	1.1318	\$1,544,559	\$856,495	1.0000	0.9907	1.143	\$969,869	62.8%
	2012	\$1,154,508	1.2175	1.1096	\$1,559,669	\$867,184	0.9799	0.9957	1.143	\$967,092	62.0%
	2013	\$1,280,545	1.1309	1.0878	\$1,575,318	\$835,120	1.0003	1.0008	1.143	\$955,592	60.7%
	2014	\$1,369,976	1.0891	1.0665	\$1,591,262	\$821,509	1.0282	1.0058	1.143	\$971,064	61.0%
	2015	\$1,397,750	1.0991	1.0456	\$1,606,321	\$797,866	1.0966	1.0109	1.143	\$1,010,957	62.9%
	Total	\$6,325,151			\$7,877,127	\$4,178,174				\$4,874,574	61.9%

[11]	Selected Projected Loss and LAE Ratio	61.9%
[12]	Fixed Expense Provision	11.3%
[13]	Variable Expense Provision	17.0%
[14]	UW Profit Provision	5.0%
[15]	Variable Permissible Loss Ratio	78.0%
[16]	Indicated Rate Change	-6.2%
[17]	Credibility	100.0%
[18]	Trended Present Rates Indication	6.2%
[19]	Credibility-Weighted Indicated Rate Change	-6.2%
[20]	Selected Rate Change	-6.2%



Adjustments to Premiums

	[1]	[2]	[3]	[4]
				Projected Earned
Occurrence Year	Earned Premium	Current Rate Level Factor	Premium Trend Factor	Premium at Current Rate Level
2011	\$1,122,372	1.2159	1.1318	\$1,544,559
2012	\$1,154,508	1.2175	1.1096	\$1,559,669
2013	\$1,280,545	1.1309	1.0878	\$1,575,318
2014	\$1,369,976	1.0891	1.0665	\$1,591,262
2015	\$1,397,750	1.0991	1.0456	\$1,606,321
Total	\$6,325,151			\$7,877,127

[5]	[6]	[7]	[8]	[9]	[10]
Reported Losses and Paid ALAE	Loss Development Factor	Loss Trend Factor	ULAE Factor	Projected Ultimate Losses and LAE	Projected Loss and LAE Ratio
\$856,495	1.0000	0.9907	1.143	\$969,869	62.8%
\$867,184	0.9799	0.9957	1.143	\$967,092	62.0%
\$835,120	1.0003	1.0008	1.143	\$955,592	60.7%
\$821,509	1.0282	1.0058	1.143	\$971,064	61.0%
\$797,866	1.0966	1.0109	1.143	\$1,010,957	62.9%
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Adjustments to Premiums

- Earned Premium

- Define Earned Premium

- Adjust for historical rate changes

- Want to calculate a factor to adjust historical premium to current rate levels

- Trend

- Premiums may increase year over year with inflation



Adjustments to Premiums

- Adjust historical premium to current rate levels

Rate Level	Effective Date	Rate Change	Rate Level Index	Cumulative Rate Level Index
A			1.0000	1.0000
B	4/1/2011	-5.0%	0.9500	0.9500
C	7/1/2012	10.0%	1.1000	1.0450
D	10/1/2013	5.0%	1.0500	1.0973
E	7/1/2014	-2.0%	0.9800	1.0753
F	10/1/2015	5.0%	1.0500	1.1291
G	1/1/2016	5.0%	1.0500	1.1855



Adjustments to Premiums

- Adjust historical premium to current rate levels

Calendar Year	[1a] Portion of Earned Premium Assumed in Each Rate Level Group							[2] Average Cumulative Rate Level	[3] Current Rate Level Index	[4] CRL Factor
	A	B	C	D	E	F	G			
2011	50.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.9750	1.1855	1.2159
2012	0.00%	75.00%	25.00%	0.00%	0.00%	0.00%	0.00%	0.9738	1.1855	1.2175
2013	0.00%	0.00%	93.75%	6.25%	0.00%	0.00%	0.00%	1.0483	1.1855	1.1309
2014	0.00%	0.00%	6.25%	68.75%	25.00%	0.00%	0.00%	1.0885	1.1855	1.0891
2015	0.00%	0.00%	0.00%	0.00%	93.75%	6.25%	0.00%	1.0787	1.1855	1.0991
[1b]	1.0000	0.9500	1.0450	1.0973	1.0753	1.1291	1.1855			



Adjustments to Premiums

- Adjust historical premium to current cost levels

	[1]	[2]	[3]
	Selected Projected Premium Trend	Projected Trend Period	Trend Factor
Calendar Year	Trend	Period	Factor
2011	2.0%	6.2500	1.1318
2012	2.0%	5.2500	1.1096
2013	2.0%	4.2500	1.0878
2014	2.0%	3.2500	1.0665
2015	2.0%	2.2500	1.0456



Adjustments to Losses

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Occurrence Year	Earned Premium	Current Rate Level Factor	Premium Trend Factor	Projected Earned Premium at Current Rate Level	Reported Losses and Paid ALAE	Loss Development Factor	Loss Trend Factor	ULAE Factor	Projected Ultimate Losses and LAE	Projected Loss and LAE Ratio
2011	\$1,122,372	1.2159	1.1318	\$1,544,559	\$856,495	1.0000	0.9907	1.143	\$969,869	62.8%
2012	\$1,154,508	1.2175	1.1096	\$1,559,669	\$867,184	0.9799	0.9957	1.143	\$967,092	62.0%
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Total	\$6,325,151			\$7,877,127	\$4,178,174				\$4,874,574	61.9%

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Adjustments to Losses

- Losses

- Losses include payments to the claimant and the loss adjustment expenses incurred by the insurer
- Loss Development
 - Use historical loss growth patterns to estimate future claims growth
- Trend
 - Historical losses adjusted to prospective cost levels
- ULAE
 - Unallocated Loss Adjustment Expense
 - Overhead costs for claims departments



Adjustments to Losses

- Loss Development

Accident Year	Reported Losses and Paid ALAE Evaluated as of				
	15 Months	27 Months	39 Months	51 Months	63 Months
2009	705,088	725,592	738,686	753,027	732,239
2010	712,475	753,295	782,248	800,258	813,949
2011	714,196	763,913	855,150	874,106	856,495
2012	764,101	861,114	884,498	867,184	
2013	774,384	846,167	835,120		
2014	785,068	821,509			
2015	797,866				

Age-to-Age Factors	<u>15-27</u>	<u>27-39</u>	<u>39-51</u>	<u>51-63</u>	<u>63-Ult</u>
2009	1.0291	1.0180	1.0194	0.9724	
2010	1.0573	1.0384	1.0230	1.0171	
2011	1.0696	1.1194	1.0222	0.9799	
2012	1.1270	1.0272	0.9804		
2013	1.0927	0.9869			
2014	1.0464				



Adjustments to Losses

- Loss Development

Age-to-Age Factors	<u>15-27</u>	<u>27-39</u>	<u>39-51</u>	<u>51-63</u>	<u>63-Ult</u>
2009	1.0291	1.0180	1.0194	0.9724	
2010	1.0573	1.0384	1.0230	1.0171	
2011	1.0696	1.1194	1.0222	0.9799	
2012	1.1270	1.0272	0.9804		
2013	1.0927	0.9869			
2014	1.0464				
[1] All Year Average	1.0703	1.0380	1.0113	0.9898	
[2] 3 Yr Average	1.0887	1.0445	1.0085	0.9898	
[3] 4 Yr Average	1.0839	1.0430	1.0113		
[4] Average x Hi/Lo	1.0665	1.0279	1.0208	0.9799	
[5] Geometric Average	1.0699	1.0371	1.0111	0.9896	
[6] Selected	1.0665	1.0279	1.0208	0.9799	1.0000
[7] Age to Ultimate	1.0966	1.0282	1.0003	0.9799	1.0000



Adjustments to Losses

- Trend

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Accident	Selected Current Year Trend	Current Cost Period Trend	Current Trend Factor	Selected Projected Trend	Projected Cost Period Trend	Projected Trend Factor	Loss Trend Factor
2011	-0.5%	4.00	0.9800	0.5%	2.25	1.0109	0.9907
2012	-0.5%	3.00	0.9849	0.5%	2.25	1.0109	0.9957
2013	-0.5%	2.00	0.9899	0.5%	2.25	1.0109	1.0008
2014	-0.5%	1.00	0.9950	0.5%	2.25	1.0109	1.0058
2015	-0.5%	0.00	1.0000	0.5%	2.25	1.0109	1.0109



Adjustments to Losses

- ULAE

	[1]	[2]	[3]
	Countrywide		
	Paid Losses and Countrywide		
Calendar Year	ALAE	Paid ULAE	ULAE Ratio
2013	\$283,299,252	\$41,170,520	14.5%
2014	\$290,213,410	\$41,262,210	14.2%
2015	\$293,934,810	\$41,959,671	14.3%
Total	\$867,447,472	\$124,392,401	14.3%

[4] Selected Ratio **14.3%**

[5] ULAE Factor 1.143



Expenses

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Occurrence Year	Earned Premium	Current Rate Level Factor	Premium Trend Factor	Projected Earned Premium at Current Rate Level	Reported Losses and Paid LAE	Loss Development Factor	Loss Trend Factor	ULAE Factor	Projected Ultimate Losses and LAE	Projected Loss and LAE Ratio
2011	\$1,122,372	1.2159	1.1318	\$1,544,559	\$856,495	1.0000	0.9907	1.143	\$969,869	62.8%
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Expenses

- Fixed Expenses
 - Do not vary with premium or loss volume
- Variable Expenses
 - Vary with premium or loss volume
- Profit
 - Target profit expressed as a percent of written premium



Expenses

	2013	2014	3 Year Weighted 2015 Average	Selected
[1] General Expenses				
a Countrywide Expenses	\$29,143,368	\$29,940,978	\$30,763,160	
b Countrywide Earned Premium	\$466,001,205	\$478,971,842	\$491,904,082	
c Ratio (a/b)	6.3%	6.3%	6.3%	6.3%
d % Assumed Fixed				75.0%
e Fixed Expense % (c x d)				4.7%
f Variable Expense % (c x { 1.0 - d })				1.6%
[2] Other Acquisition				
a Countrywide Expenses	\$40,158,296	\$40,912,479	\$41,652,543	
b Countrywide Written Premium	\$468,850,020	\$482,345,783	\$495,356,701	
c Ratio (a/b)	8.6%	8.5%	8.4%	8.5%
d % Assumed Fixed				75.0%
e Fixed Expense % (c x d)				6.4%
f Variable Expense % (c x { 1.0 - d })				2.1%



Expenses

	2013	2014	3 Year Weighted 2015 Average	Selected
[3] Licenses and Fees				
a State Expenses	\$3,124	\$3,190	\$3,229	
b State Written Premium	\$1,289,484	\$1,380,129	\$1,407,811	
c Ratio (a/b)	0.2%	0.2%	0.2%	0.2%
d % Assumed Fixed				100.0%
e Fixed Expense % (c x d)				0.2%
f Variable Expense % (c x { 1.0 - d })				0.0%
[4] Commission and Brokerage				
a State Expenses	\$145,073	\$154,235	\$158,712	
b State Written Premium	\$1,289,484	\$1,380,129	\$1,407,811	
c Ratio (a/b)	11.3%	11.2%	11.3%	11.2%
d % Assumed Fixed				0.0%
e Fixed Expense % (c x d)				0.0%
f Variable Expense % (c x { 1.0 - d })				11.2%



Expenses

	2013	2014	3 Year Weighted 2015 Average	Selected
[5] Taxes				
a State Expenses	\$27,338	\$27,549	\$29,853	
b State Written Premium	\$1,289,484	\$1,380,129	\$1,407,811	
c Ratio (a/b)	2.1%	2.0%	2.1%	2.1%
d % Assumed Fixed				0.0%
e Fixed Expense % (c x d)				0.0%
f Variable Expense % (c x { 1.0 - d })				2.1%
[6] Fixed Expense Provision	[1e] + [2e] + [3e] + [4e] + [5e]			11.3%
[7] Variable Expense Provision	[1f] + [2f] + [3f] + [4f] + [5f]			17.0%



Indicated Rate Change

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Occurrence Year	Earned Premium	Current Rate Level Factor	Premium Trend Factor	Projected Earned Premium at Current Rate Level	Reported Losses and Paid LAE	Loss Development Factor	Loss Trend Factor	ULAE Factor	Projected Ultimate Losses and LAE	Projected Loss and LAE Ratio
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Credibility

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