

C-2: The Biggest Problem with Your Pricing Model is Your Reserving Model

CAS Spring Meeting

May 15th

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The Pricing Problem

- Estimate discounted value of ultimate claim costs and expenses
- Estimate differences across available rating characteristics

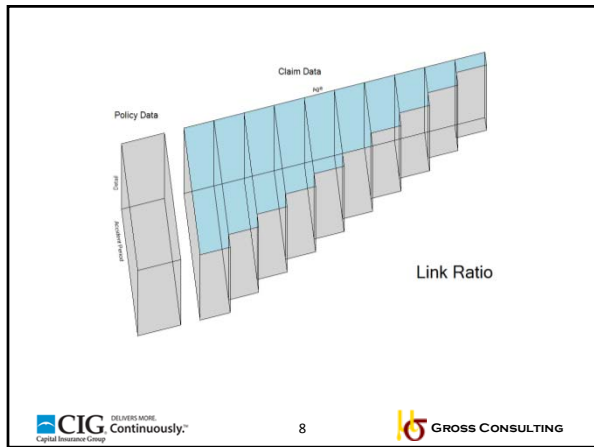
The (incomplete) Solution

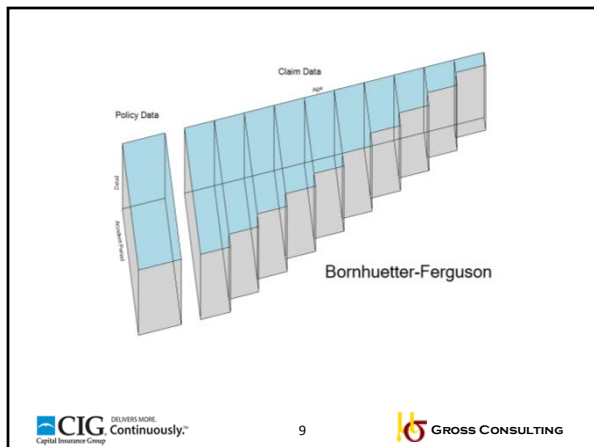
- Build models based on the current diagonal only
- Build models based on a common age of development

(incomplete) Treatment of Loss Development

- Develop all losses with a factors based on age
- Reduce premium/exposure based on age
- Include policy effective date as a variable
- Only use the process to rank policies
- **Generally assumes all development is the same (wrong!)**



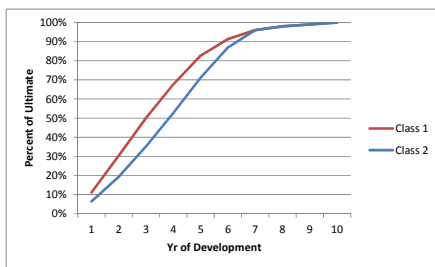




The Mix Problem... An Example

- Two classes of business
 - Class 1.
 - Faster developing
 - Lower ultimate loss ratio (60%)
 - Class 2
 - Slower developing
 - Higher ultimate loss ratio (90%)
- Class 2 has always been there, but only recently started growing significantly

Different Development



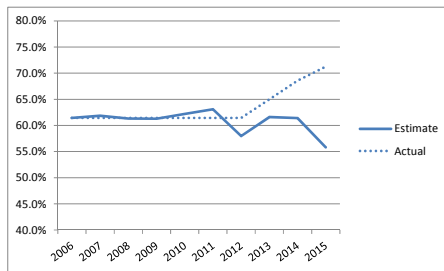
The Triangle

| Year | Premium | Loss as of: | | | | | | | | | |
|------|---------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| | | Age 1 | Age 2 | Age 3 | Age 4 | Age 5 | Age 6 | Age 7 | Age 8 | Age 9 | Age 10 |
| 2006 | 105 | 7.53 | 20.40 | 32.67 | 43.49 | 52.72 | 58.08 | 61.20 | 62.36 | 63.28 | 64.50 |
| 2007 | 105 | 8.06 | 20.72 | 32.65 | 43.52 | 54.68 | 60.16 | 63.87 | 64.15 | 63.71 | |
| 2008 | 105 | 6.48 | 19.23 | 30.80 | 42.47 | 52.70 | 58.32 | 60.99 | 62.91 | | |
| 2009 | 105 | 7.21 | 19.21 | 30.81 | 42.44 | 52.93 | 59.54 | 61.78 | | | |
| 2010 | 105 | 7.43 | 21.88 | 34.36 | 43.89 | 53.76 | 59.81 | | | | |
| 2011 | 105 | 6.76 | 19.19 | 33.07 | 43.90 | 54.42 | | | | | |
| 2012 | 105 | 7.11 | 18.49 | 30.01 | 40.40 | | | | | | |
| 2013 | 120 | 8.44 | 22.18 | 37.25 | | | | | | | |
| 2014 | 140 | 8.65 | 25.87 | | | | | | | | |
| 2015 | 160 | 9.81 | | | | | | | | | |

Development Factors

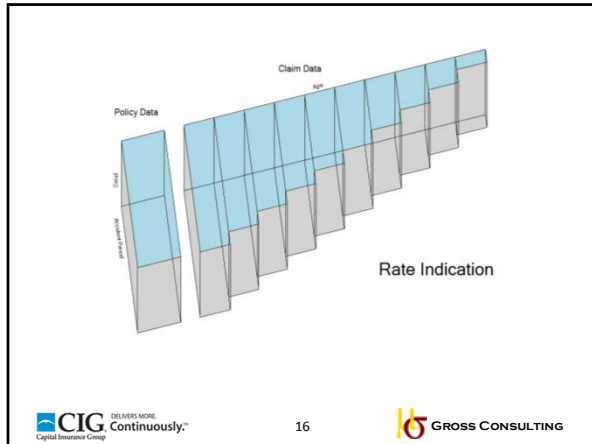
| | | | | | | | | | |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 2006 | 2.709 | 1.602 | 1.331 | 1.212 | 1.102 | 1.054 | 1.019 | 1.015 | 1.019 |
| 2007 | 2.571 | 1.576 | 1.333 | 1.256 | 1.100 | 1.062 | 1.005 | 0.993 | |
| 2008 | 2.967 | 1.602 | 1.379 | 1.241 | 1.107 | 1.046 | 1.031 | | |
| 2009 | 2.666 | 1.604 | 1.378 | 1.247 | 1.127 | 1.036 | | | |
| 2010 | 2.944 | 1.570 | 1.277 | 1.225 | 1.113 | | | | |
| 2011 | 2.840 | 1.724 | 1.327 | 1.239 | | | | | |
| 2012 | 2.602 | 1.622 | 1.346 | | | | | | |
| 2013 | 2.630 | 1.679 | | | | | | | |
| 2014 | 2.990 | | | | | | | | |
| Last 3 | 2.740 | 1.675 | 1.317 | 1.237 | 1.115 | 1.048 | 1.018 | 1.004 | 1.019 |
| Cumulative | 9.108 | 3.324 | 1.984 | 1.506 | 1.218 | 1.092 | 1.042 | 1.023 | 1.019 |

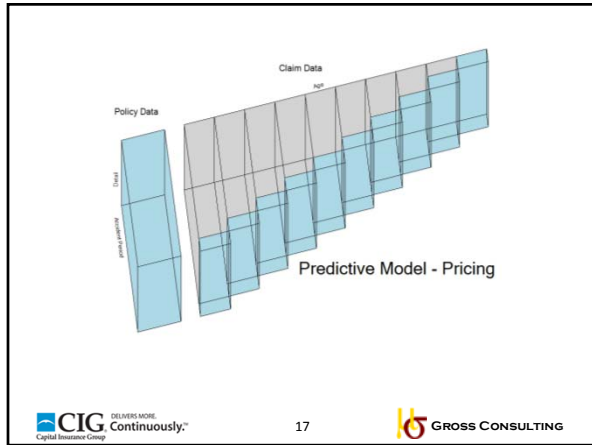
True Loss Ratio vs Estimate

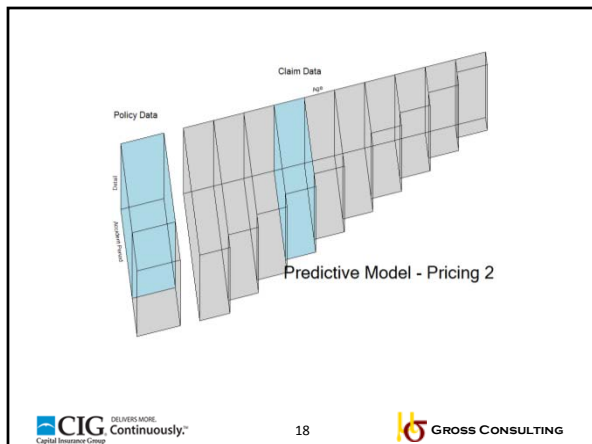


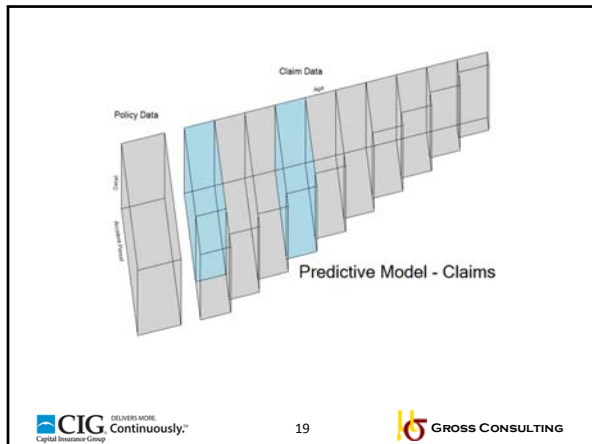
Potential Differences

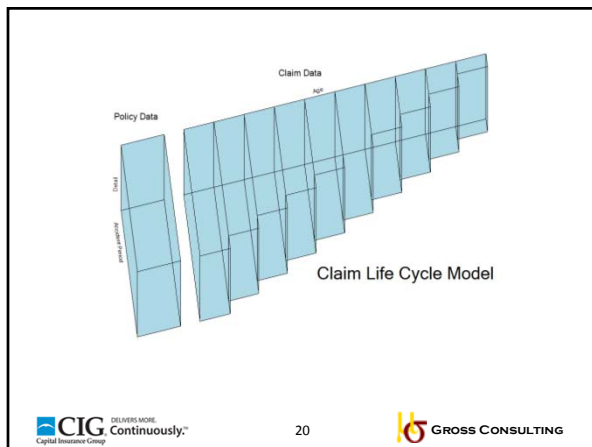
- Industry classification
- Geography
- Deductible/Limit Profile
- Size of account
- Type of Claims
- Etc.











Challenges to Building a Complete Model

- An age old problem
 - Loss development occurs over time, mature periods are old
 - Immature claims contain information
- Many facets of loss development
- Helpful to concentrate on a single time-step (e.g. beginning of quarter to end of quarter)

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Data

Financial Data

Beginning Case Reserve
Ending Case Reserve
Payment in Period

Exposure Characteristics

Type
Product
ZIP Code

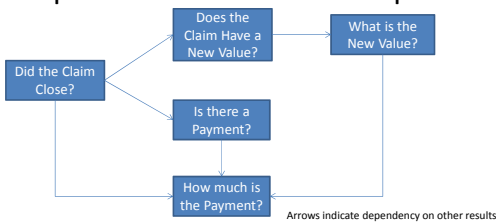
Timing Data

Accident Quarter
Report Quarter
Valuation Quarter

Claim Characteristics

Loss Cause
Loss Cause - Detail

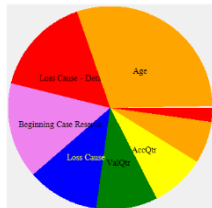
Claim activity from the beginning of the quarter to the end of the quarter



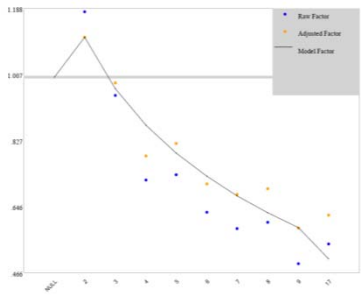
A number of available claim or exposure characteristics may have predictive value for any of these questions.

Probability of a Claim Closing

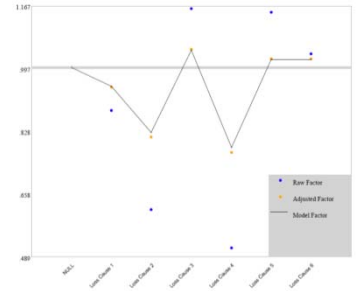
- Base probability of 71%
- Modification of this probability by various claim characteristic values that were found to have predictive value



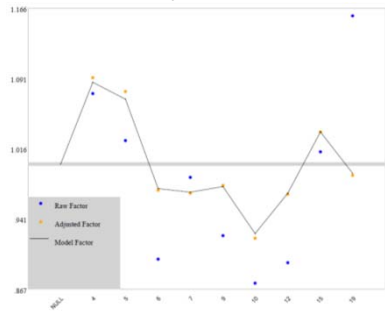
Close Probability – Claim Age

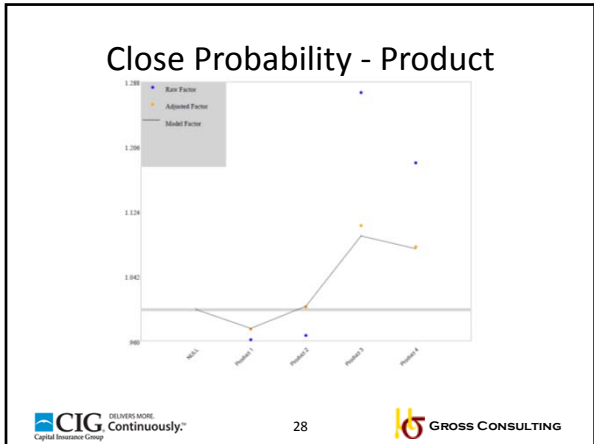


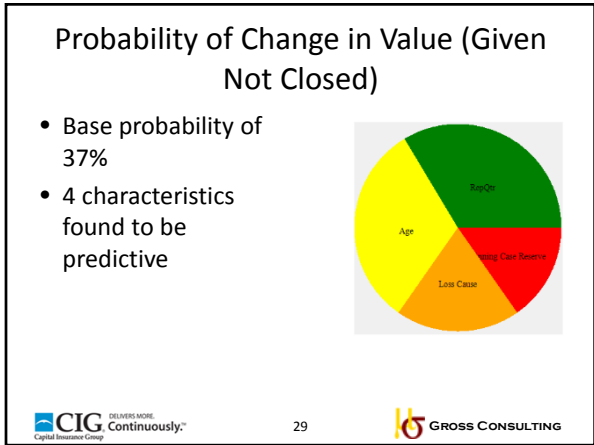
Close Probability – Loss Cause

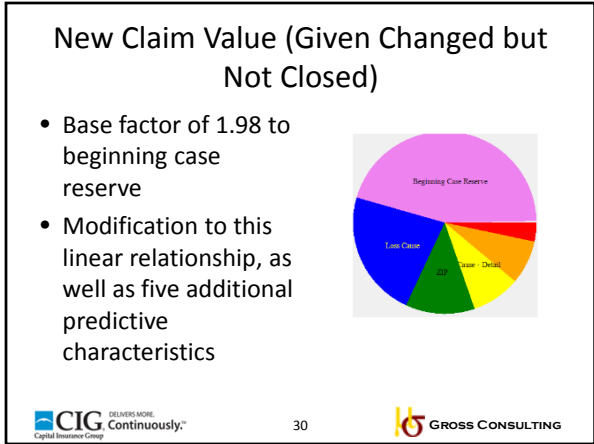


Close Probability – Accident Quarter

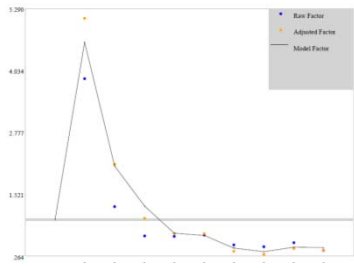




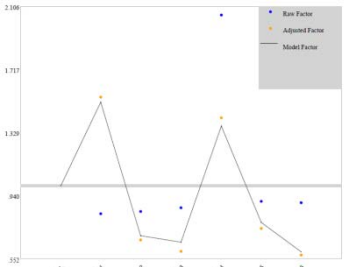




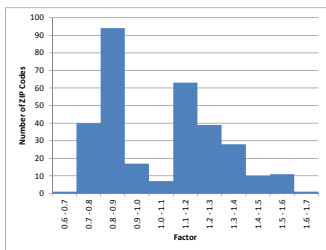
New Claim Value - Case Reserve



New Claim Value – Loss Cause



New Claim Value – ZIP Code



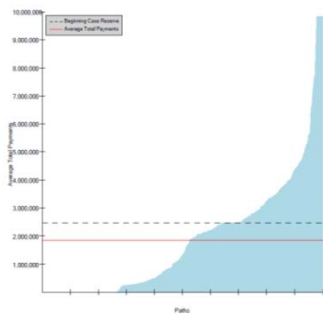
Bringing it together

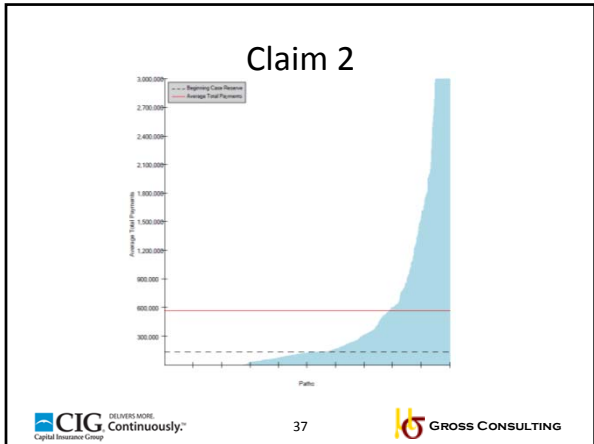
- Simulation can be used to project activity in the next quarter
- It is necessary to project not only the predictive relationships, but also the residual error term.
- Chain through quarters using information from the previous simulated quarter.
- Store results, preferably at the claim level.

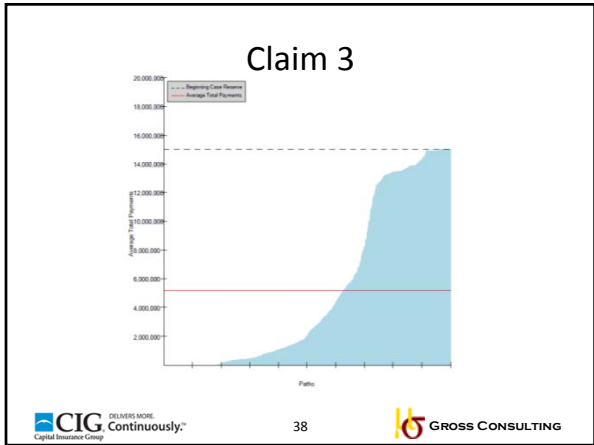
Simulate Going Forward

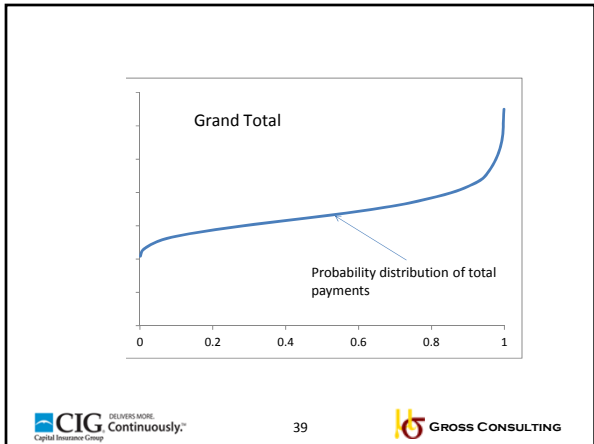
- Claim Development
 - Start with current inventory of open claims
 - For each open claim simulate a number of potential outcomes for the next time-step (using the claims' characteristics)
 - For those simulated claim-paths that are still open simulate forward another time-step.
 - Continue until all simulated claim-paths are closed

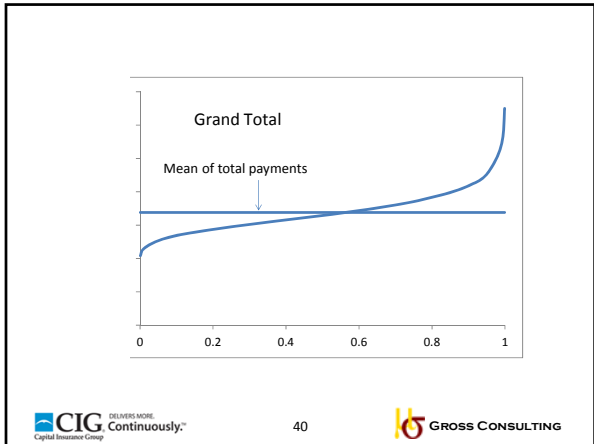
Claim 1

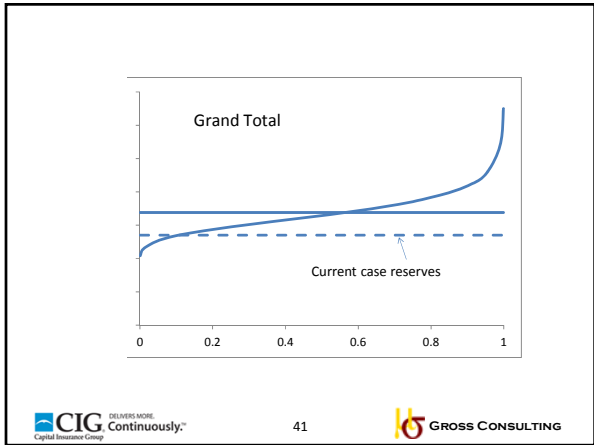


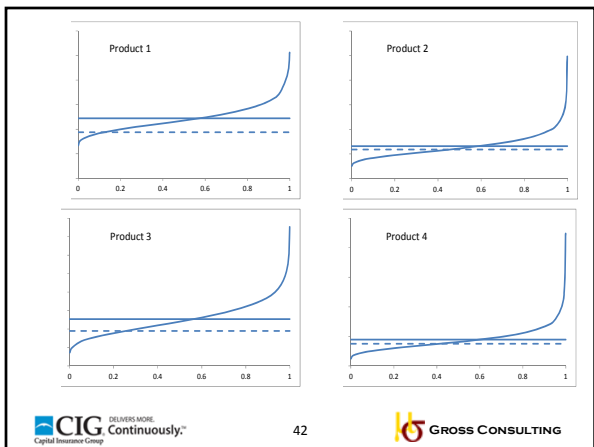


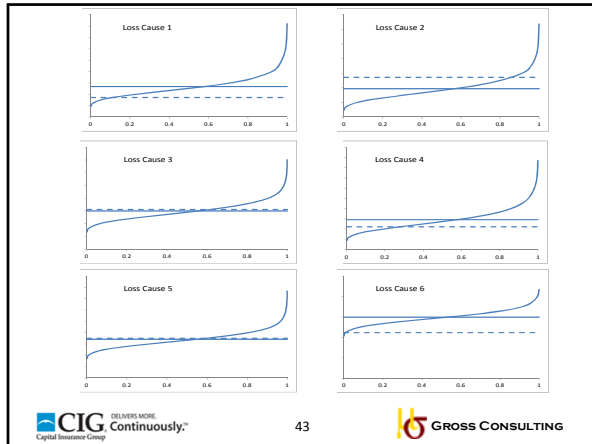












Emergence

- After simulating claim development to ultimate, model emergence
- Frequency
- Severity
- Report Lag

Claim Emergence

Claim Development Simulation

→

Ultimate Claim Severity

Report Lag

↓

Claim Frequency

Arrows indicate dependency on other results

A number of exposure characteristics may have predictive value for any of these questions.

Emergence Simulation

- Use written policies (w/ characteristics) simulate remaining emergence.
- Generating loss date within this process allows accident period calculations
- Also get losses associated with unearned premium
- Inforce loss ratio distribution.

Case Study - Background

- Capital Insurance Group
- Reasons for interest in the approach
 - Validate ultimate selections made from traditional triangle-based methods
 - Insights that can be gained by applying predictive modeling to reserving
 - Triangle segmentation ideas
 - Support pricing predictive modeling by using estimated ultimate claims as the target variable

Case Study - Background

- Began the process in Q4 of 2015
- Analyzed Q4 2014 (1 Year Lag) to be able to compare against traditional approach
- Involved three individuals in the actuarial department
- Single line of business
- Longer-tailed LOB

Learning Curve

- Chris came for an initial in-house training session
- Met every couple of weeks to answer questions on software and get valuable feedback on progress

Learning Curve

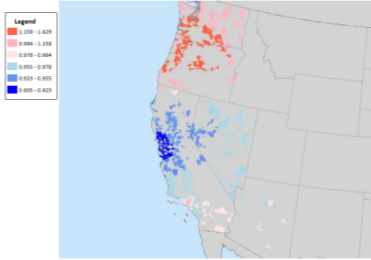
- Main challenge was getting all the data into an acceptable format and gaining familiarity of the software functionality
- Easy to use and really fast automated results after getting over the initial learning curve hump

Case Study - Process

- Organized data
- Built and refined the predictive models
- Simulated development and emergence
- Analyzed output vs. current reserve model vs. actual development

Case Study – Selected Highlights

Characteristic: ZIP_CODE
Pricing Comparison: GLSM-Based vs Cash-Inured-Based



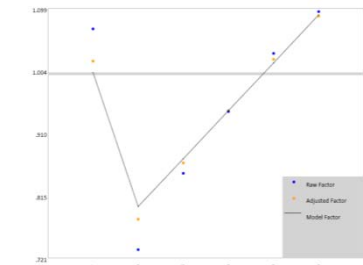
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Case Study – Selected Highlights

Characteristic: DEDUCTIBLE
Pricing Comparison: GLSM-Based vs Cash-Inured-Based

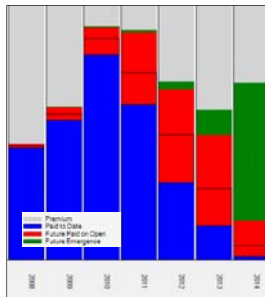


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Case Study – Selected Highlights



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Case Study – Overall Impressions

- Challenges
 - Reconciliation with other analysis
- Value
 - Depth of information available
 - Statistically significant segmentation
 - Visual aids for decision making are an invaluable part of the process
 - Easy to evaluate performance of one model iteration to the next

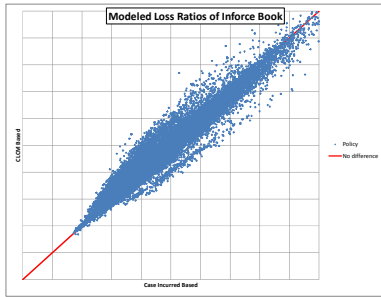
Case Study – Thoughts for the future

- Reserving
- Pricing
- Other

Additional Comparisons of “Traditional” Predictive Modeling for Pricing vs. Claim Life Cycle Model

- 3 other real examples
- Using the same rating variables
- Only difference is use of CLCM ultimate vs Case-Incurred.
- Compared modeled loss ratio by policy from the current inforce book.

Example 1

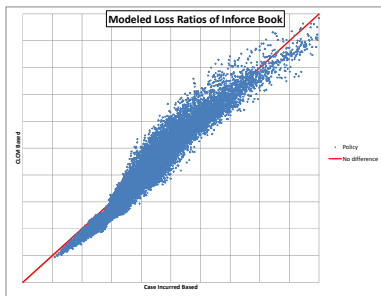


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Example 2

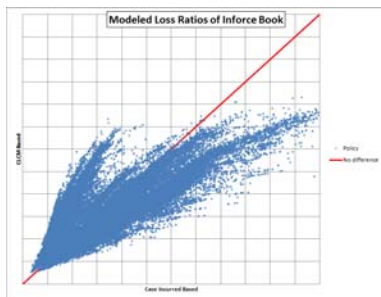


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Example 3



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Some Observed Differences

- Geography
- Industry Classification
- Size of Account
- Agency
- Deductible/Limit
- Year Built

Conclusion

- Reserve development matters for pricing!
- Different exposures develop differently!
- Models that do not reflect these differences will be inferior!
