# Introduction to Reinsurance Reserving

Casualty Loss Reserve Seminar

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## Applications, Complications and Considerations

- Application of projection methods
  - loss development method
  - loss ratio method
  - Bornhuetter-Ferguson technique
  - other methods
- Complications
  - parameter uncertainty
    - volatility in RTR factors
    - tail factor selection
    - loss trend factors
    - expected loss ratios
  - data constraints
    - line of business definition
    - lack of claim count information
- Other considerations
  - qualitative information

## Loss Development Method – Assumptions

- Assumes the relative change in a given year's reported loss & ALAE from one evaluation to the next will be similar to the relative change in prior years' reported loss & ALAE at similar evaluation points
  - age-to-age factors measure change in reported loss & ALAE at successive evaluations
  - tail factor allows for development beyond the observed experience
- Assumes the relative adequacy of the company's case reserves has been consistent over time
- Assumes no material changes in the rate claims are paid or reported







## Loss Development Method – Suggestions for Tail Factors

- Industry benchmarks
  - excess of loss reinsurance: Reinsurance Association of America (RAA)
    - reinsurance industry data going back 40+ years
    - available for treaty vs. facultative and by attachment range
  - pro-rata reinsurance: lagged primary sources
    - ISO
    - A.M. Best
    - NCCI
- Curve fitting
  - compare to benchmarks for reasonability



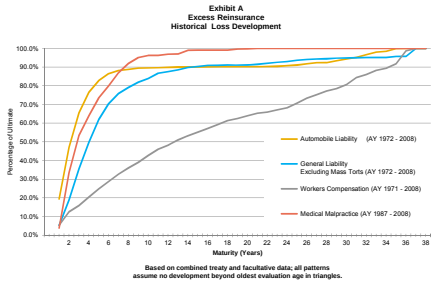




## Loss Development Method – How to deal with variability in historical development

- Data organization is very important
  - line of business mix
    - at the very least need to split property vs. casualty & pro-rata vs. excess
  - treaty vs. facultative
    - facultative often develops faster
  - attachment points/limits
    - need to understand attachment points on a "from ground-up" (FGU) basis
    - need to understand how attachment points/limits are changing over time
  - segregate catastrophes
  - assess whether or not data is still credible after making refinements
  - data granularity
    - quarterly evaluations may be appropriate for fast reporting lines of business like property but will be too volatile for casualty

## Development by Line of Business



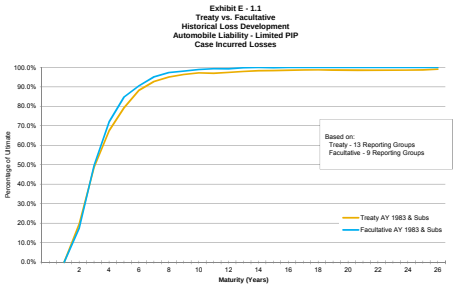

Source: 2009 RAA Historical Loss Development Study







## Treaty vs. Facultative – Automobile Liability



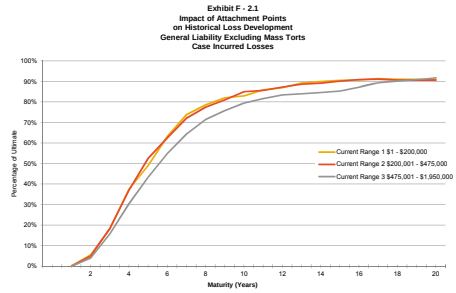

Source: 2009 RAA Historical Loss Development Study







## Impact of Attachment Points – General Liability




Source: 2009 RAA Historical Loss Development Study

## Loss Development Method

- Application same as for primary business

| Layer | Accident Year | Excess Loss & ALAE @ 12/31/2011 | LDF | Ultimate Loss & ALAE (3) x (4) |
|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) |
| 800 x 200 | 2006 | $1,543 | 1.355 | $2,091 |
| 800 x 200 | 2007 | 1,255 | 1.488 | 1,867 |
| 800 x 200 | 2008 | 1,988 | 1.755 | 3,489 |
| 750 x 250 | 2009 | 1,868 | 2.336 | 4,364 |
| 750 x 250 | 2010 | 863 | 3.473 | 2,997 |
| 700 x 300 | 2011 | 0 | 8.196 | 0 |
| | Total | $7,517 | | $14,808 |

- **Results leveraged**
  - no claims = no IBNR
  - large claims = large IBNR






## Loss Development Method

- Paid Loss Development Method not very common for reinsurance reserving
  - little data
  - no industry benchmarks on development
  - may be appropriate for property or low limit proportional business (e.g., nonstandard auto liability)






## Loss Ratio Method

- Useful for new business or immature years
- Need premium base and a-priori expectation regarding loss ratio
- Advantage: stability
  - ultimate loss estimate does not change unless the premium or loss ratio are revised
- Potential problem: lack of responsiveness
  - ignores actual loss experience as it emerges

## Loss Ratio Method

- Ultimate Loss = Earned Premium x ELR

| Accident Year | Earned Premium | Expected Loss Ratio | Ultimate Loss & ALAE (2) × (3) |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| 2006 | $3,994 | 66.5% | $2,656 |
| 2007 | 3,577 | 70.0% | 2,504 |
| 2008 | 4,161 | 73.5% | 3,058 |
| 2009 | 2,564 | 76.5% | 1,961 |
| 2010 | 2,769 | 78.8% | 2,182 |
| 2011 | 2,654 | 85.4% | 2,267 |
| Total | $19,719 | | $14,628 |







## Loss Ratio Method

- Selecting the loss ratio
  - historical experience
    - paid and incurred loss experience
    - loss development method indications
    - adjust to appropriate year based on rate changes, trends and coverage changes
  - underwriting considerations
    - underwriting files
    - actuarial pricing
    - market considerations
  - benchmarks (industry results)
- Don't be afraid to update based on actual results
  - How has ELR performed in actual vs. expected calculations?







## Bornhuetter-Ferguson Method -

- Created specifically for reinsurers
  - Needed a bridge between loss ratio method and development method
- Essentially a blend of loss development method and expected loss method
  - begins with an a-priori estimate of expected losses
    - IELR (Initial Expected Loss Ratio) × Earned Premium = Initial Expected Loss (IEL)
  - splits a-priori estimate into two pieces
    - expected reported losses = (IEL × % reported)
    - expected unreported losses (IBNR) = (IEL × % unreported)
  - replaces expected reported losses with actual reported (case incurred) losses
- Restated ultimate loss estimate equals
  - expected unreported (IBNR) plus actual reported (case incurred)

## Bornhuetter-Ferguson Method – an Example

| Layer | Accident Year | Earned Premium | Initial Expected L/R | Initial Expected Loss & ALAE (2) x (3) | Expected Percent Reported | Expected Reported Loss & ALAE (4) x (5) | Expected Unreported Loss & ALAE (4) - (6) |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 800 x 200 | 2006 | $3,994 | 66.5% | $2,656 | 73.8% | $1,960 | $696 |
| 800 x 200 | 2007 | 3,577 | 70.0% | 2,504 | 67.2% | 1,683 | 821 |
| 800 x 200 | 2008 | 4,161 | 73.5% | 3,058 | 57.0% | 1,743 | 1,316 |
| 750 x 250 | 2009 | 2,564 | 76.5% | 1,961 | 42.8% | 840 | 1,122 |
| 750 x 250 | 2010 | 2,769 | 78.8% | 2,182 | 28.8% | 628 | 1,554 |
| 700 x 300 | 2011 | 2,654 | 85.4% | 2,267 | 12.2% | 277 | 1,990 |
| **Total** | | $19,719 | | $14,628 | | $7,130 | $7,498 |

**Notes:**

(3) Based on analysis of historical accident year results adjusted for changes in retention.
(5) Expected percent reported based on excess loss development patterns.







## Bornhuetter-Ferguson Method – an Example (Con't)

| Layer | Accident Year | Initial Expected Loss & ALAE | Expected Reported Loss & ALAE | Expected Unreported Loss & ALAE (9) - (10) | Actual Case Inc'd Loss & ALAE | Ultimate Loss & ALAE (11) + (12) |
|---|---|---|---|---|---|---|
| | (8) | (9) | (10) | (11) | (12) | (13) |
| 800 x 200 | 2006 | $2,656 | $1,960 | $696 | $1,543 | $2,239 |
| 800 x 200 | 2007 | 2,504 | 1,683 | 821 | 1,255 | 2,076 |
| 800 x 200 | 2008 | 3,058 | 1,743 | 1,316 | 1,988 | 3,304 |
| 750 x 250 | 2009 | 1,961 | 840 | 1,122 | 1,868 | 2,990 |
| 750 x 250 | 2010 | 2,182 | 628 | 1,554 | 863 | 2,417 |
| 700 x 300 | 2011 | 2,267 | 277 | 1,990 | 0 | 1,990 |
| Total | | $14,628 | $7,130 | $7,498 | $7,517 | $15,015 |







## Bornhuetter-Ferguson Method - Advantages

- Allows for smoothing of results
  - LDF method understates when case incurred losses are small
  - LDF method overstates if losses large (ELR may understate in this instance)
- Incorporates changes in the environment
  - attachment point, coverage changes, layer restructuring, price strengthening/deterioration should be captured in the ELR
- Balances stability and actual loss emergence
- Estimates IBNR when loss activity is sparse
  - ideal for long tailed lines (umbrella, xs casualty)
  - less applicable for short tailed lines (approximates LDF method)

## Bornhuetter-Ferguson Method - Disadvantages

- Reporting pattern
  - expected percentage reported = 1 / LDF
  - difficulty in estimating pattern for LDF method also applies here
- Initial expected losses
  - IBNR is directly related to a-priori estimate
    - double the expected losses → double the IBNR
  - importance of IELR may be lost in the analysis
    - need to step back and determine % of total IBNR that is loss ratio driven
- Ultimate Premium
  - most recent year may be difficult to estimate
    - booked premium is probably under-reported due to timing lags
    - seek underwriting estimate
    - consider historical premium development







## Bornhuetter-Ferguson Method – Sources of Initial Expected Loss

- Loss Ratio Method (incorporates pricing indices)
- Underwriting estimate from pricing study
  - by definition it is the a-priori estimate
    - verify that parameters for pricing and reserving are consistent
- Increased limits factors and direct premium
  - may be used if you feel primary company's higher limits pricing is inadequate
    - should have been incorporated in pricing study
  - may also be used for changes in layer and/or attachment point
- Stanard-Buhlman estimates
- Frequency/Severity estimates







## Example of change in layer structuring – Effect on IELR

| Accident Year | Ultimate Loss & ALAE Ratio | Layer | Limits Adj Factor | Layer | Restated Loss & ALAE Ratio (2) x (4) |
|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) |
| 2006 | 66.5% | 800 xs 200 | 1.00 | 800 x 200 | 66.5% |
| 2007 | 70.0% | 800 xs 200 | 1.00 | 800 x 200 | 70.0% |
| 2008 | 73.5% | 800 xs 200 | 1.00 | 800 x 200 | 73.5% |
| 2009 | 72.7% | 800 xs 200 | 1.05 | 750 x 250 | 76.5% |
| 2010 | 74.8% | 800 xs 200 | 1.05 | 750 x 250 | 78.8% |
| 2011 | 77.1% | 800 xs 200 | 1.11 | 700 x 300 | 85.4% |

Notes: (4) assumes that loss ratio increases 5% due to change in retention.

## Stanard-Buhlman Estimate

- Essentially the Bornhuetter-Ferguson estimate with "on average" perfect information
- Uses actual loss ratio indices multiplied by average loss ratio
  - incorporates loss trend and pricing changes
- Balances the expected average loss ratio so that
  - expected reported losses = actual reported losses






## Stanard-Buhlman – an Example
## Traditional Calculation

| Acc Year | Earned Premium | Average Ultimate L/R | Pricing Index | Adjusted Ultimate L/R (3 x 4) | Expected Ultimate Loss & ALAE (2 x 5) |
|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) |
| 2006 | $3,994 | 70.0% | 0.95 | 66.5% | $2,656 |
| 2007 | 3,577 | 70.0% | 1.00 | 70.0% | 2,504 |
| 2008 | 4,161 | 70.0% | 1.05 | 73.5% | 3,058 |
| 2009 | 2,564 | 70.0% | 1.17 | 81.8% | 2,097 |
| 2010 | 2,769 | 70.0% | 1.23 | 86.2% | 2,387 |
| 2011 | 2,654 | 70.0% | 1.39 | 97.2% | 2,580 |
| Total | $19,719 | | | | $15,283 |






## Stanard-Buhlman – an Example (Con't)
## Traditional Calculation

| Acc Year | Earned Premium | Expected Ultimate Loss & ALAE (2 x 5) | Percent Reported | Expected Reported Loss & ALAE (6 x 7) | Actual Case Inc'd Loss & ALAE |
|---|---|---|---|---|---|
| (1) | (2) | (6) | (7) | (8) | (9) |
| 2006 | $3,994 | $2,656 | 73.8% | $1,960 | $1,543 |
| 2007 | 3,577 | 2,504 | 67.2% | 1,683 | 1,255 |
| 2008 | 4,161 | 3,058 | 57.0% | 1,743 | 1,988 |
| 2009 | 2,564 | 2,097 | 42.8% | 898 | 1,868 |
| 2010 | 2,769 | 2,387 | 28.8% | 687 | 863 |
| 2011 | 2,654 | 2,580 | 12.2% | 315 | 0 |
| Total | $19,719 | $15,283 | | $7,285 | $7,517 |
| | | | Ratio of actual to expected: | | 1.032 |
| | | | Restated Loss Ratio: | | 72.2% |

## **Stanard-Buhlman** – an Example (Con't)
### Traditional Calculation

| Acc Year | Earned Premium | Average Ultimate L/R | Pricing Index | Adjusted Ultimate L/R (3 x 4) | Expected Ultimate Loss & ALAE (2 x 5) | Percent Reported | Expected Reported Loss & ALAE (6 x 7) | Actual Reported Loss & ALAE |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 2006 | $3,994 | 72.2% | 0.95 | 68.6% | $2,740 | 73.8% | $2,022 | $1,543 |
| 2007 | 3,577 | 72.2% | 1.00 | 72.2% | 2,583 | 67.2% | 1,736 | 1,255 |
| 2008 | 4,161 | 72.2% | 1.05 | 75.8% | 3,156 | 57.0% | 1,798 | 1,988 |
| 2009 | 2,564 | 72.2% | 1.17 | 84.4% | 2,164 | 42.8% | 926 | 1,868 |
| 2010 | 2,769 | 72.2% | 1.23 | 89.0% | 2,463 | 28.8% | 709 | 863 |
| 2011 | 2,654 | 72.2% | 1.39 | 100.3% | 2,662 | 12.2% | 325 | 0 |
| Total | $19,719 | | | | $15,769 | | $7,517 | $7,517 |
| | | | | | | Ratio of actual to expected: | | 1.000 |
| | | | | | | Restated Loss Ratio: | | 72.2% |

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## **Stanard-Buhlman** – an Example (Con't)
### Practical Calculation

| Acc Year | Earned Premium | Actual Case Inc'd Loss & ALAE | Pricing Index | Restated Loss Ratio | Percent Reported | Expected Reported Loss & ALAE |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 2006 | $3,994 | $1,543 | 0.95 | 66.5% | 73.8% | $1,960 |
| 2007 | 3,577 | 1,255 | 1.00 | 70.0% | 67.2% | 1,683 |
| 2008 | 4,161 | 1,988 | 1.05 | 73.5% | 57.0% | 1,743 |
| 2009 | 2,564 | 1,868 | 1.17 | 81.8% | 42.8% | 898 |
| 2010 | 2,769 | 863 | 1.23 | 86.2% | 28.8% | 687 |
| 2011 | 2,654 | 0 | 1.39 | 97.2% | 12.2% | 315 |
| Total | $19,719 | $7,517 | | | | $7,285 |
| | | | | Difference Between Actual and Expected Reported (3) Total - (7) Total: | | 231.58 |

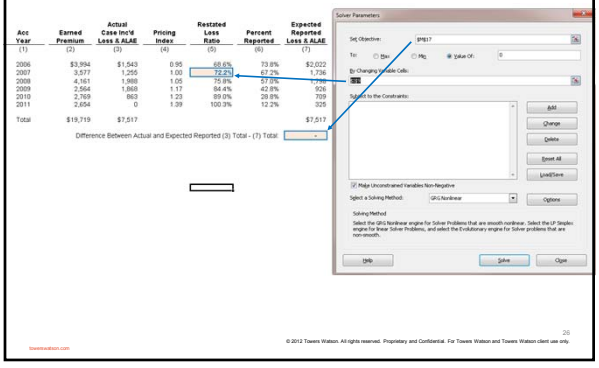
Notes: (5) = (5) value for 2007 * (4)
(7) = (2) * (5) * (6)







## **Stanard-Buhlman** – an Example (Con't)
### Practical Calculation



## Stanard-Buhlman – an Example (Con't)

| Acc Year | Initial Expected Loss & ALAE | Expected Reported Loss & ALAE | Expected Unreported Loss & ALAE (2) - (3) | Actual Reported Loss & ALAE | Ultimate Loss & ALAE (4) + (5) |
|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) |
| 2006 | $2,740 | $2,022 | $718 | $1,543 | $2,261 |
| 2007 | 2,583 | 1,736 | 847 | 1,255 | 2,102 |
| 2008 | 3,156 | 1,798 | 1,358 | 1,988 | 3,346 |
| 2009 | 2,164 | 926 | 1,237 | 1,868 | 3,105 |
| 2010 | 2,463 | 709 | 1,754 | 863 | 2,617 |
| 2011 | 2,662 | 325 | 2,337 | 0 | 2,337 |
| | $15,769 | $7,517 | $8,252 | $7,517 | $15,769 |







## Frequency/Severity Method – Basic Steps

- Pick a data limit where credible excess claims data exists
- Estimate the annual number of claims above the data limit
  - 37.5 claims greater than $150,000
- Use size-of-loss curves to project the number of claims above the reinsurance retention
  - 7.9 ( of 37.5 claims) greater than $300,000
- Use size-of-loss curves to project average severity of claims in reinsurance layer
  - $224,014 average severity of claims in $700,000 excess of $300,000 layer
- Multiply the frequency and the severity projections to estimate the total ultimate losses
- Incorporate frequency/severity estimate into Bornhuetter-Ferguson method
- Most common distribution used is the Single-parameter Pareto







## Frequency/Severity Method – Why use the Single-parameter Pareto Distribution?

- Shape of tail
- Ease of calculation (even though it's not built into Excel)
  - survival function S(X) = (Theta / X ) ^ Alpha
  - conditional limited expected value is a simple formula (see following pages)
  - simple to incorporate trend
- Easy to parameterize
  - Theta must be set in advance (equal to the data limit)
  - maximum likelihood estimated Alpha parameter is simple to calculate
    - normalize losses greater than the data limit by dividing by the data limit = X
    - take the natural log of the normalized losses = ln(X)
    - mle Alpha = the number of losses > the data limit / sum[ln(X)]
- Always a good idea to look at the graph of your observations and fitted distribution
  - beware over-weighting to smaller values
  - keep in mind what layer you are interested in

## **Frequency/Severity Method –** an Example
Estimate claim counts above data limit

| Accident Year | Detrended Data Limit | Act #> Detrended Data Limit | Claim Count Develpoment Factors | Individual Total Excess Counts (3 x 4) |
|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) |
| 2006 | $112,089 | 38 | 1.125 | 42.8 |
| 2007 | 118,814 | 34 | 1.282 | 43.6 |
| 2008 | 125,943 | 25 | 1.408 | 35.2 |
| 2009 | 133,499 | 31 | 1.555 | 48.2 |
| 2010 | 141,509 | 22 | 1.927 | 42.4 |
| 2011 | 150,000 | 11 | 2.618 | 28.8 |
| **Total** | | 161 | | 240.9 |

**(2) Assumes 6% trend.**







## **Frequency/Severity Method –** an Example
Estimate of claim counts above data limit (Con't)

| Acc. Year | Projected # of claims > Data Limit | Subject Earned Premium | On-Level SEP | Indicated Frequency (2 / 4) | Selected Frequency | Selected # of Excess Claims |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 2006 | 42.8 | $50,000 | $62,750 | 0.681 | | 42.8 |
| 2007 | 43.6 | 50,000 | 63,550 | 0.686 | | 43.6 |
| 2008 | 35.2 | 55,000 | 63,525 | 0.554 | | 35.2 |
| 2009 | 48.2 | 60,000 | 63,000 | 0.765 | | 48.2 |
| 2010 | 42.4 | 55,000 | 55,000 | 0.771 | 0.750 | 41.3 |
| 2011 | 28.8 | 50,000 | 50,000 | 0.576 | 0.750 | 37.5 |
| Total | 240.9 | $320,000 | $357,825 | 0.673 | | 248.5 |







## **Frequency/Severity Method –** an Example
Estimate excess losses using single-parameter Pareto distribution

| Accident Year | Layer Limit XS Retention | | Projected # > $150,000 | Projected # > Retention | Average Severity in Layer | Ultimate Loss & ALAE in Layer (4 x 5) |
|---|---|---|---|---|---|---|
| (1) | (2) | | (3) | (4) | (5) | (6) |
| 2006 | $800,000 | $200,000 | 42.8 | 12.5 | $171,963 | $2,147,832 |
| 2007 | 800,000 | 200,000 | 43.6 | 14.4 | 171,963 | 2,478,598 |
| 2008 | 800,000 | 200,000 | 35.2 | 13.2 | 171,963 | 2,265,462 |
| 2009 | 750,000 | 250,000 | 48.2 | 12.7 | 210,543 | 2,675,806 |
| 2010 | 750,000 | 250,000 | 41.3 | 12.3 | 210,543 | 2,591,561 |
| 2011 | 700,000 | 300,000 | 37.5 | 8.6 | 246,020 | 2,115,012 |
| **Total** | | | 248.5 | 73.7 | | $14,274,272 |

Notes: (4) from pareto size-of-loss curve frequency formula; (3) x [ Basic Limit / Attachment ] ^ Alpha
(5) from pareto size-of-loss curve severity formula;
[ Retention / (Alpha - 1) ] * [ 1 - [ Retention / ( Limit + Retention ) ] ^ (Alpha - 1 ) ]
Assumes Alpha parameter of 2.125, basic limit detrended at 6%.

## **Frequency/Severity Method –** an Example Bornhuetter-Ferguson Calculation

| Layer | Acc Year | Initial Expected Loss & ALAE | Expected Reported Loss & ALAE | Expected Unreported Loss & ALAE | Actual Reported Loss & ALAE | Ultimate Loss & ALAE (4) + (5) |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| 800 x 200 | 2006 | $2,148 | $1,585 | $563 | $1,543 | $2,106 |
| 800 x 200 | 2007 | 2,479 | 1,666 | 813 | 1,255 | 2,068 |
| 800 x 200 | 2008 | 2,265 | 1,291 | 975 | 1,988 | 2,963 |
| 750 x 250 | 2009 | 2,676 | 1,145 | 1,530 | 1,868 | 3,398 |
| 750 x 250 | 2010 | 2,592 | 746 | 1,845 | 863 | 2,708 |
| 700 x 300 | 2011 | 2,115 | 258 | 1,857 | 0 | 1,857 |
| **Total** | | $14,274 | $6,691 | $7,583 | $7,517 | $15,100 |









## **Recap of Methods –** Ultimate Loss and ALAE

| Acc. Year | LDF | Loss Ratio | Bornhuetter Ferguson (w/ IELR) | Stanard-Buhlman | Frequency/ Severity | Bornhuetter Ferguson (w/ F/S) |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 2006 | $2,091 | $2,656 | $2,239 | $2,261 | $2,148 | $2,106 |
| 2007 | 1,867 | 2,504 | 2,076 | 2,102 | 2,479 | 2,068 |
| 2008 | 3,489 | 3,058 | 3,304 | 3,346 | 2,265 | 2,963 |
| 2009 | 4,364 | 1,961 | 2,990 | 3,105 | 2,676 | 3,398 |
| 2010 | 2,997 | 2,182 | 2,417 | 2,617 | 2,592 | 2,708 |
| 2011 | 0 | 2,267 | 1,990 | 2,337 | 2,115 | 1,857 |
| Total | $14,808 | $14,628 | $15,015 | $15,769 | $14,274 | $15,100 |









## **Recap of Methods –** Ultimate Loss and ALAE Ratios

| Acc. Year | LDF | Loss Ratio | Bornhuetter Ferguson (w/ IELR) | Stanard-Buhlman | Frequency/ Severity | Bornhuetter Ferguson (w/ F/S) |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 2006 | 52.3% | 66.5% | 56.1% | 56.6% | 53.8% | 52.7% |
| 2007 | 52.2% | 70.0% | 58.0% | 58.8% | 69.3% | 57.8% |
| 2008 | 83.8% | 73.5% | 79.4% | 80.4% | 54.4% | 71.2% |
| 2009 | 170.2% | 76.5% | 116.6% | 121.1% | 104.4% | 132.5% |
| 2010 | 108.2% | 78.8% | 87.3% | 94.5% | 93.6% | 97.8% |
| 2011 | 0.0% | 85.4% | 75.0% | 88.1% | 79.7% | 70.0% |

## Final Selection of Ultimates – Rules of Thumb

- LDF methods for older, more mature accident/policy periods
  - look at LDF/percentage reported to determine maturity
  - Use when LDF is below 2.000, percent reported >= 50%
    - umbrella versus auto physical damage
- Expected loss techniques for newer, less mature accident/policy periods
  - most recent or two most recent accident years
- Bornhuetter-Ferguson/ Stanard-Buhlman, anywhere in between
  - requires judgment: (GL, umbrella, excess casualty)
- Frequency/Severity: similar to expected loss techniques
  - better estimate when loss ratio is unstable/unreliable
    - high layers, single treaties, single claims
- Benchmarks
  - IBNR to case O/S ratios







## Adjustment for Incomplete Years

- Recent underwriting or policy years may not be fully earned as of the evaluation date
  - may need to scale back loss development projections
  - various ways to project the earned portion of the ultimate loss
    - apply ultimate loss ratio to earned premium as of evaluation date
    - remove expected loss on the unearned premium
- Ultimate Loss Ratio = Ultimate Loss / Ultimate Premium
- Ultimate premium can be based on
  - projected premium development
  - seek underwriter input







## Other Considerations

- Look for trends, stability, shocks
  - are they reasonable ?
- Communicate with the underwriting and claims departments
  - good fodder for next underwriting audit or pricing season
- Gather knowledge on reserving philosophy (level of Additional Case Reserves or ACRs)
  - make adjustments where necessary to benchmarks
- Understand reserving process
  - may need to adjust benchmark loss development patterns
    - bordereau vs. individual reporting
    - early closing
- How to handle new lines of business with no history?
  - benchmarks, underwriting files, actuarial pricing analysis
- Difficult Coverage (Agg XS, deductibles, reinstatements)
  - requires modeling of underlying exposures

## Other Approaches

- Asbestos, Pollution, Construction Defect, Other Health Hazards
  - need to handle separately
    - cedent information, industry data, benchmarks
    - results of exposure based modeling techniques
  - consider a survival ratio analysis
- Large Events / Market Losses
  - seek input from claims department
  - utilize market information / knowledge
- Property Catastrophes
  - results of models (may need to adjust)
  - underwriter estimates
  - traditional top-down techniques
  - Ground-up analysis
  - other industry sources such as ISO's PCS







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