ELRF™

Best's Schedule P 2019

ELRF™ Best's Schedule P 2019

Exclusive to Best's Financial Suite - P/C, US subscribers

Insureware and AM Best have created ELRF™ Best's Schedule P 2019. This application, freely available with a Best's Financial Suite - P/C, US subscription, is pre-loaded with Best's Financial Suite - P/C, US data in an ICRFS™ structured database primed for Insureware's analytical tools.

Structured access to Best's Financial Suite - P/C, US data

Secure the information you need fast!

Empowered with this application you will obtain:

- Offline access to Best's Financial Suite - P/C, US data and derived financial metrics in an ELRF™ structured database.

- Pre-calculated critical financial information:
  - o Reserves Held;
  - o %IBNR;
  - o Total Loss Ratio;
  - o Survival Ratios; and
  - o Much more!

   Drill down by classification variables and sort metrics to glean hidden insights.

- All available Best's Financial Suite - P/C, US triangles:
  - o Paid losses;
  - o Case Reserve Estimates;
  - o Incurred Losses (not including BULK and IBNR);
  - o Bulk and IBNR;
  - o Number of Claims Reported; and
  - o Number of Claims Closed.

   Acquire any Best's Financial Suite - P/C, US loss development array data for trend analysis instantly.

- Additional triangles:
  - o Reserves Held (CRE + BULK and IBNR); and
  - o Ultimates Held (Incurred Losses including BULK and IBNR).

Construct a complete picture of a company's reported liabilities, their holdings, and their financial positioning in the industry.

Analytical tools including the Mack method and the bootstrap technique

Two modeling frameworks are included: the Extended Link Ratio Family (ELRF) and Link Ratio Techniques (LRT). The ELRF module formulates link ratio methods as regression estimators and extends them.

ELRF models include:

- Mack (regression formulation of volume weighted average, chain ladder);
- Exclusion of whole periods or individual points from estimations;
- Murphy;
- Bornhuetter-Ferguson; and
- Much more!

Within an interactive, intuitive, graphical interface.

Comprehensive diagnostic tests validate that assumptions made by link ratio and related methods are carried by the data - including the bootstrap technique.

Link ratio techniques:

- Volume weighted average, Chain ladder;
- Arithmetic average;
- Last N diagonal weighted average;
- Two parameter smoothing;
- Three parameter smoothing;
- Bornhuetter-Ferguson; and
- Much more!

ELRF™ Best's Schedule P 2019 data organization

Best's Financial Suite - P/C, US data are grouped by company and Line of Business into triangle groups.

In Insureware parlance, triangle groups contain data (triangles, premiums, exposures, models, and more) related to the same Line of Business – or other grouping category. These building blocks are then provided to the modeling frameworks for analysis.
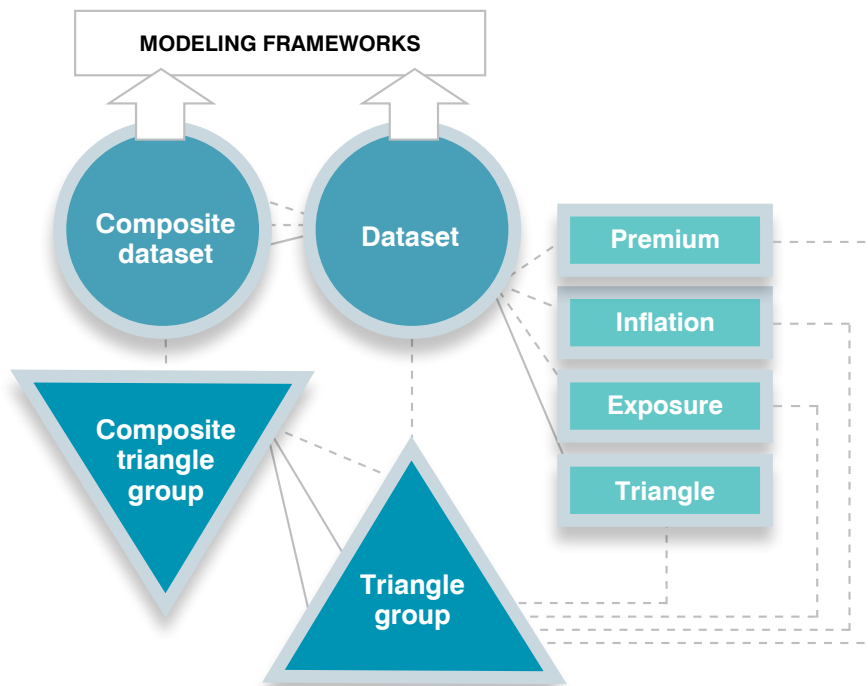
Triangle groups contain building blocks for easy analysis:

- Triangles (loss development arrays);
- Exposure, Inflation, Premium vectors; and
- Datasets which link triangles with [optional] exposure, inflation or premium vectors.

Net data are available in triangle format for ready analysis. The last calendar year of Gross data are stored in vector format where available).

Inside a Triangle Group

Some contents of the triangle groups are shown below:

Classification variables

ELRF™ Best's Schedule P 2019 allows up to 4000 top level variable classifications with unlimited sub-categories and sub-levels to be associated with triangle groups. The variable and value classification system ensures navigation to individual triangle groups (and triangles within triangle groups) is achieved with a few mouse clicks.

Pre-calculated critical financial information, such as:

- Reserves Held;
- %IBNR;
- %Premium ceded;
- Total Loss Ratio;
- Survival Ratios; and
- Reinsurance Loss Ratios are stored as classification variables.

The calculated values can be included in queries and sorted – serving to further speed up navigation through the system.

Users of the application can:

- Create their own variables and values;
- Create new triangle groups by combining existing Best's Financial Suite - P/C, US triangle groups allowing:
    - o Aggregations by company;
    - o Aggregations by Lines of Business; or
    - o Any other combination desired!

ICRFS™ users can utilize COM technology to run scripts to automatically create, assign, or otherwise calculate variables and values of interest from the Best's Financial Suite - P/C, US data.

Database navigation

Finding data is a quick and easy exercise.

Know the name of the company you wish to analyze? Simply begin typing the name in the triangle group window and the application will jump to triangle groups beginning with that name.

Two main views are presented to enable quick access of information: tree view and query view. These two views are structurally similar, but activate different combinations of exploratory filters in the ELRF™ Best's Schedule P 2019 database.

Navigation via Tree View

The tree view navigation panel empowers the user to drill down into the Best's Financial Suite - P/C, US data by selecting single values from any number of variable categories. Each subsequent filter further focuses the query.

For instance, the image below illustrates the sequential procedure to filter from the 30,000 triangle groups in the ELRF™ Best's Schedule P 2019 database to 70 triangle groups with particular characteristics.

1. Select a top level variable – here Line of Business.

2. Choose a subcategory – eg: B-Private Passenger Auto Liability.

3. Select Aggregation – AMB Group was chosen as the sub category.

4. Add the attribute Dimensions 10x10 to the filter.

5. Finally, choose Survival Ratios between 2 < SR <= 3 to complete the query.

6. Sort by Reserves Held to order the companies from largest to smallest by held reserves.

In tree view, any sub-category can be included once and acts as a refinement of the previous query. Within a few mouse clicks, a small number of Best's Financial Suite - P/C, US triangle groups can be identified matching the attributes selected.

The results of tree view queries are shown immediately on selection of the filter. All operations are designed for maximum performance enabling analysts to obtain the data quickly and effortlessly.

Navigation via Query View

The query view navigation panel provides a more flexible methodology of constructing queries into the ELRF™ Best's Schedule P 2019 database.

- Any variable can be searched with basic support for wild-cards;
- Single or multiple values can be selected from the same classification variable;
- Queries can be set to run automatically (default) or manually.

In the example shown above, a query is constructed to show triangle groups having the following features:

1. Display all triangle groups containing 'State' in their name.

2. Select the following three lines of business:
   - a. B-Private Passenger Auto Liability;
   - b. C-Commercial Auto/Truck Liability;
   - c. Z-All LOBs Combined.

3. Choose aggregation levels:
   - a. AMB Group;
   - b. Unaffiliated Single Company.

4. Finally, select only the triangle groups with 10x10 Dimensions.

Any variable column can be sorted as the user desires.

Analytical tools:

- The Extended Link Ratio Family
    - Mack
        - The bootstrap technique, and
- Link Ratio Techniques

ELRF™ Best's Schedule P 2019 incorporates the Extended Link Ratio Family (ELRF) and Link Ratio Techniques (LRT) modules.

The default model in ELRF is the Mack method (equivalently volume weighted averages). This method is currently the most popular method in use amongst actuaries. It is a statistical regression formulation of the Link Ratio method known as the chain-ladder.

The bootstrap technique can be applied to any link ratio model in ELRF (including Mack).

A ratio 'to ultimate' can also be specified.

Extended Link Ratio Family (ELRF)

The Extended Link Ratio Family (ELRF) modeling framework formulates average link ratios as regression estimators and is extended to include intercepts (Murphy) and constant trends down each development year across accident years.
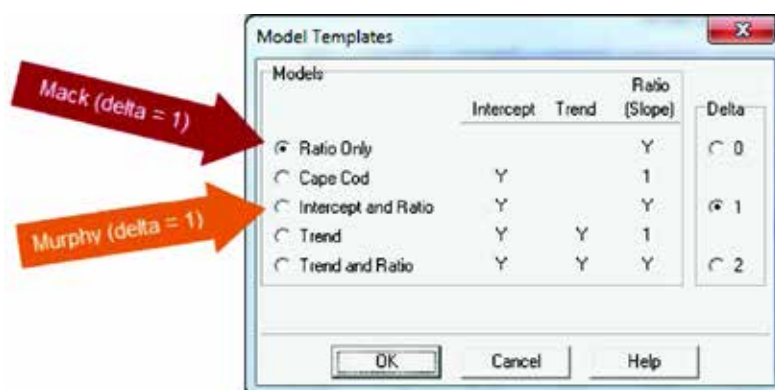
Any cumulative array, Incurred Losses, Paid Losses, Number of Claims Reported, and so forth can be analyzed in the ELRF modeling framework.
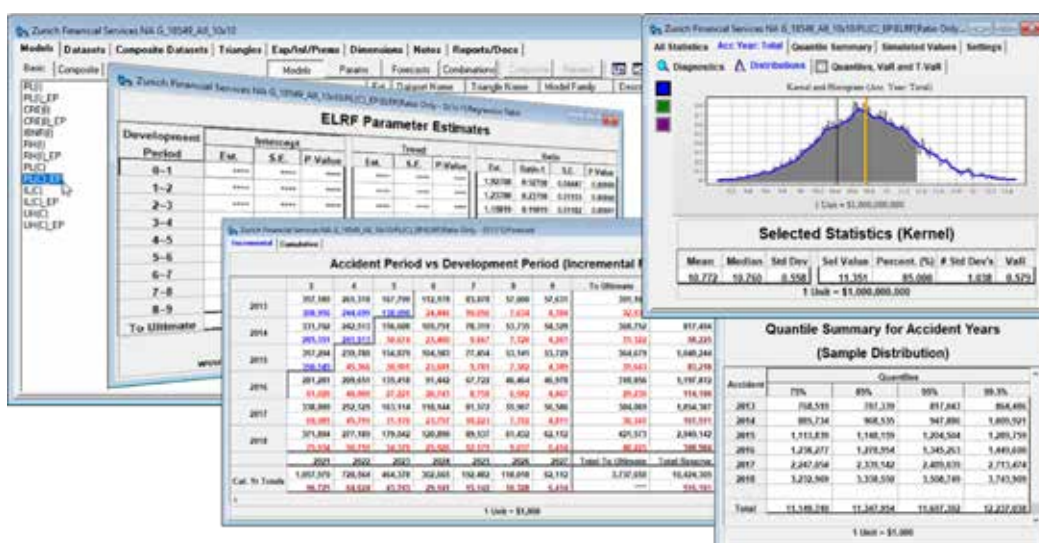
From dataset to estimating model parameters, calculating the forecast to running the bootstrap, the Extended Link Ratio Family (ELRF) is transparent, intuitive, and easy to use.

ELRF™ also contains a number of statistical model diagnostics that measure how well the respective model fits the data. These diagnostics are not as widely used in the actuarial community as they should be.

When using link ratio based methods, it is critical that actuaries verify that the corresponding assumptions apply for the data.

An illustration showing these diagnostics for the Mack method applied to a Paid losses dataset is provided below. The diagnostics all show that there are issues with the method: there is a clear change in the residuals in the calendar (and accident) direction [top-left], the residuals are not normally distributed [top-right], an intercept is required [lower-left], and structure remains in the residuals [lower-right].
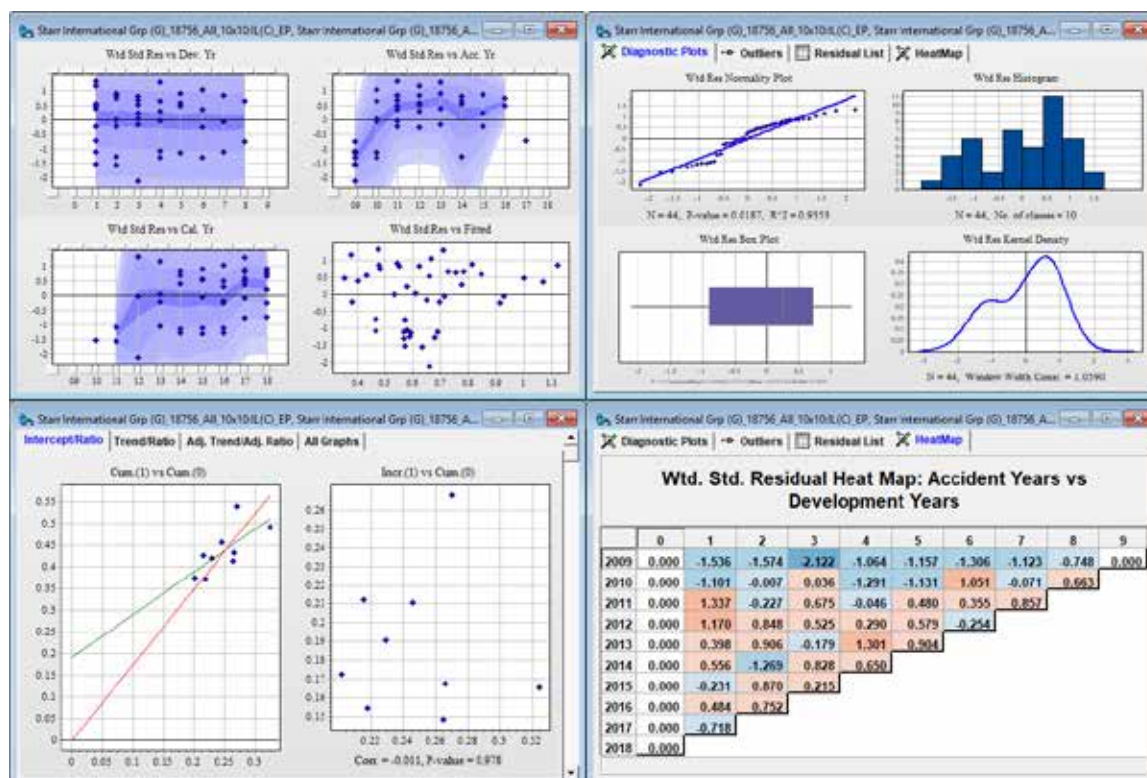
It is now common to supplement the use of the Mack or other similar methods with additional techniques used to derived a loss distribution. The most commonly used of such methods is called the bootstrap technique. The ELRF module also includes a bootstrapping module that obtains loss distributions for pure link ratio models (including Mack).

These analytical tools add significant power as:

- Standard actuarial methods are available within a flexible, easy to use graphical interface for all Best's Financial Suite - P/C, US loss triangle data;

- The ELRF™ database structure provides a complete warehousing solution for all associated data, models, and notes;

- Extensions of actuarial methods formulated within a regression framework allow more advanced application of the standard methods – including the bootstrap; and

- Comprehensive diagnostic tools are included to test whether models are appropriate for a company's data.

Brief examples of analytical tools

Comprehensive diagnostic tools assess link ratio methods applied within a regression framework. Link ratio methods are extended to include intercepts and trends. It is insufficient to simply compute an answer, rather the diagnostics should be used to assess whether the answer obtained from the method(s) are credible.

For instance, consider the Mack method applied to this Best's Financial Suite - P/C, US data.
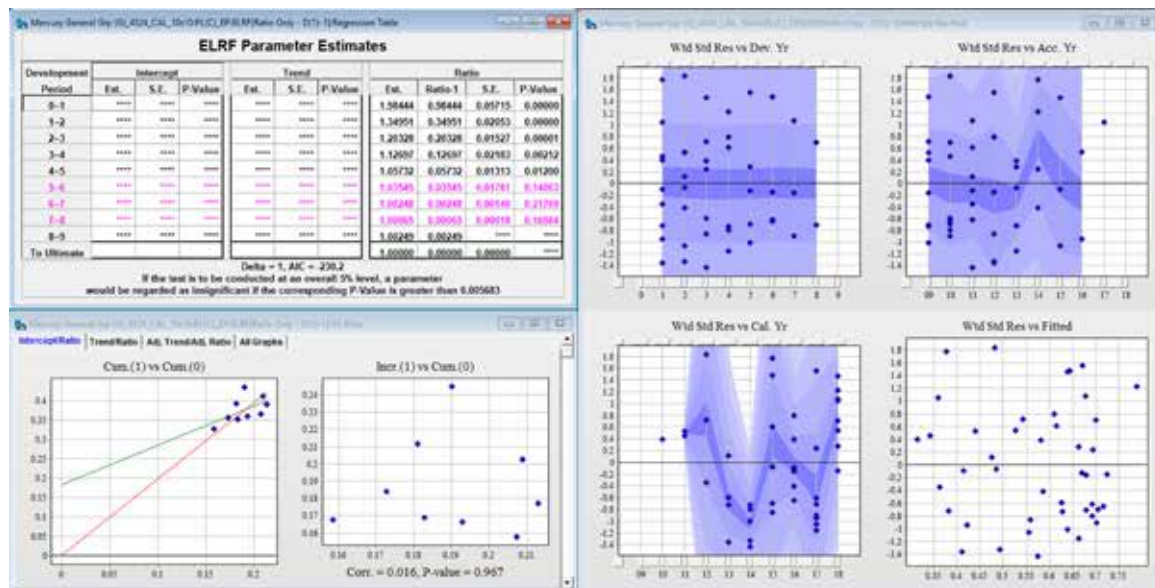
When the residuals (trends in the data – trends in the method) are plotted versus the three time dimensions (development, accident, and calendar) it is clear the residuals versus calendar year are very volatile. Further, the link ratios do not have predictive power (the correlation between the development periods 0 and 1 is not statistically significant).

The mean reserve (175M) produced by the Mack method when completing the square is likely too low. At the very least the actuaries using the Mack method (or any method) need to be able to support the projections from the method.

The left most column shows the totals, by calendar year, for the fitted model mean (black numbers) and the observed losses (blue numbers). As indicated by the volatility in the residuals, the fitted means by calendar year oscillate at being above or below the observed values. Risk capital allocation would be important for this line.

The Mack method was applied to the Best's Financial Suite - P/C, US (2017) data for the same company and line of business for the previous year. The projected mean for the 2018 calendar year (excluding the first development period) is 60M. The observed losses in 2018 for accident year 2017 and prior years are 76.6M.


The projected mean, 60M, is much lower than the actual losses for the 2017 and prior years, 76.6M.

This was no hint in the 2017 data, after the Mack method was applied, that the losses for the next calendar year were going to deteriorate this way. One would want to hope that the reasons for the change in trend were understood by the actuarial team in advance.

Just how bad is the 76.6M loss versus the projected Mack mean of 60M?

If the bootstrap is run for the Mack method on the 2017 data, and the simulations centered on the Mack mean, then the probability of observing a loss higher than 76.6M is about 2% (see below). If the Mack method had been applied in 2017 and used to set the reserves (and there was no hint of the losses coming in 2018), then the loss of 76.6M would have incurred a substantial loss of risk capital.
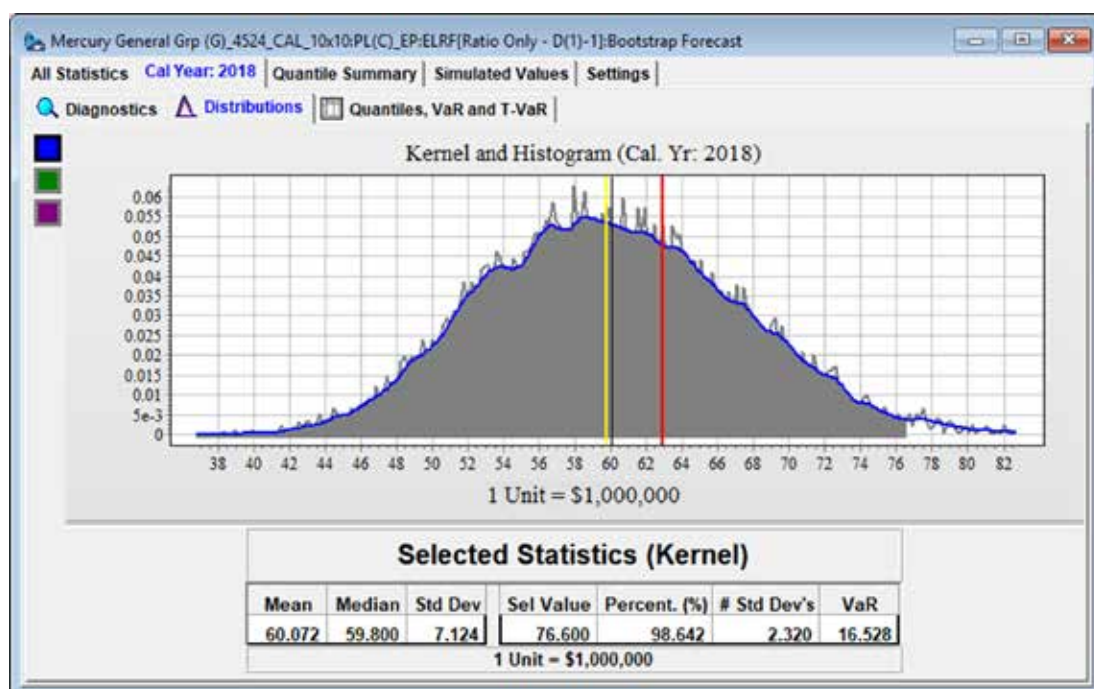
What if the average trend down each accident year is fitted along with intercepts, trends, and link ratios?
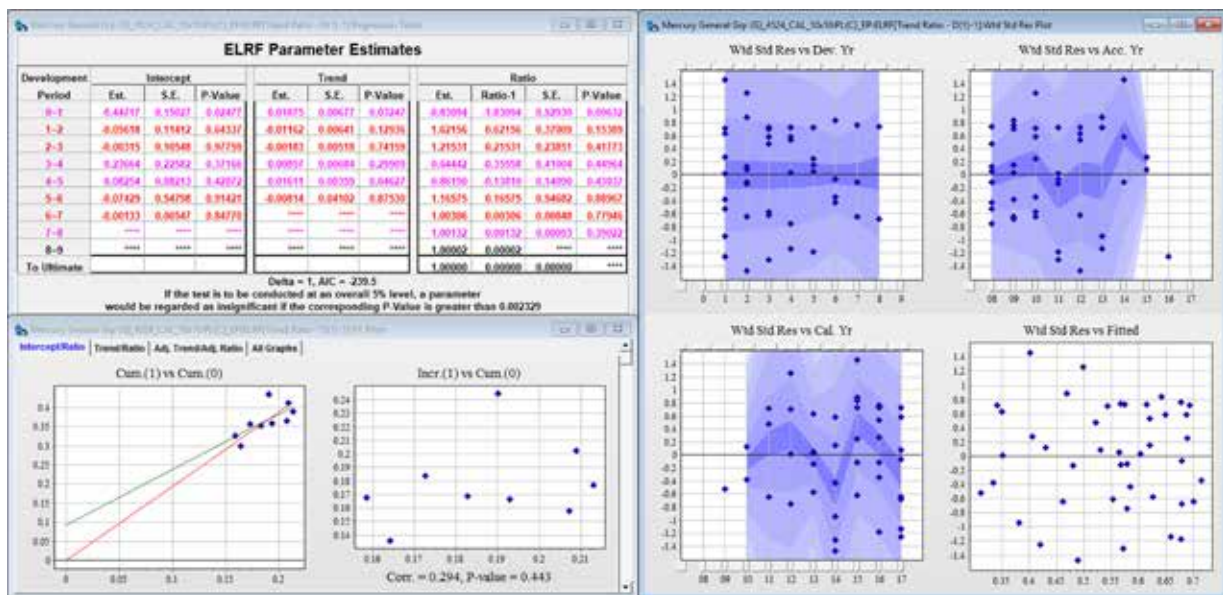
The residuals now appear random about a zero trend but still exhibit volatility. The total mean reserve projected from this model is 187M.

The difference between this estimate, 187M, and the Mack estimate, 175M, (13M) is not insubstantial relative to the total mean. Further, this is without taking into consideration a ratio to ultimate. Whichever total reserve amount is booked, a compelling narrative underscoring the choice is required.

However, if the full ELRF method was applied in 2017, then the losses observed in 2018 would still be higher than expected, but would not have been as adverse as if the Mack method was used.

The adverse development is not necessarily true adverse development but rather arises due to poor model selection.

The bootstrap technique

The bootstrap technique can be applied to any link ratio method. Further, the user can enter in suitable model means overwriting the projected means allowing the bootstrap sample distributions to be associated with arbitrary forecasts.

For instance, the bootstrap technique applied to the Mack method (left) shows the bootstrap sample with the Mack mean on the total. If instead, we use the means obtained from the full ELRF model (ratio, intercept and accident year trends) we can still run the bootstrap on the Mack residuals but use the means from this method instead. This produces the result on the right.

Simulations of the distributions can be examined by accident year, calendar year, or total (the latter is shown below).
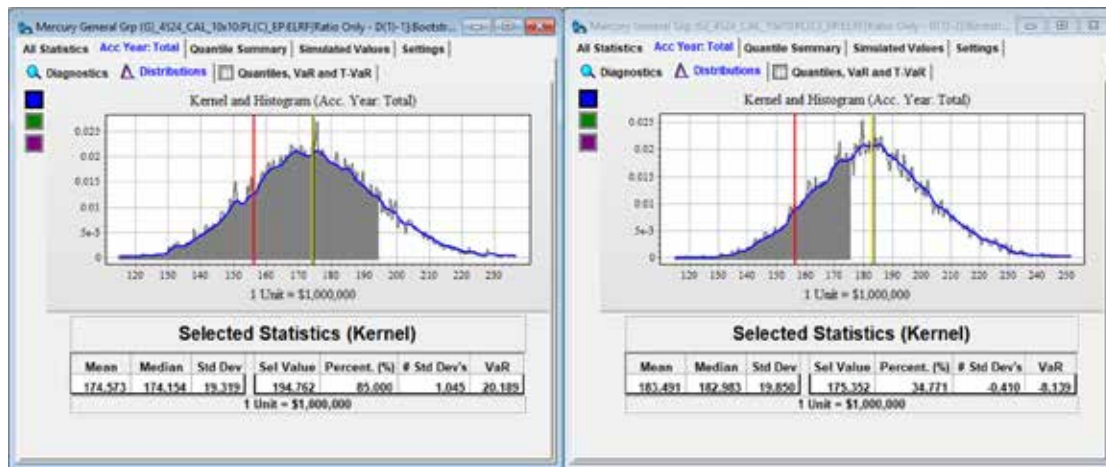
In this way, we observe that the Mack method severely under predicts the loss reserve distribution arising from the bootstrap samples – assuming the full ELRF model is generating reasonable results.

Value-at-Risk (V@Rs) and Tail-Value-at-Risk (T-V@Rs) are calculated for bootstrap distributions. An example is given for the Mack method below.

In addition to the analyses above, Bornhuetter-Ferguson calculations are also available.

Link Ratio Techniques (LRT)

The standard link ratio methods as calculated automatically in the LRT module are:

- Chain Ladder (Volume Weighted Average)
- Arithmetic Average
- Geometric Average
- Average Without Min/Max
- Last N Diagonal Weighted Average
- Last N Diagonal Average
- Last N Diagonal Geometric Average
- Maximum Ratio
- Minimum Ratio
- Weighted Excluding High/Low
- Average Without Min/Max of Last N
- Weighted Average Without Min/Max of Last N
- Two parameter smoothing
- Three parameter smoothing

By default, N is set to be 4 periods, but N can be changed to any calculable value. A ratio 'to ultimate' can also be set.

Brief examples of analytical tools

All commonly used standard actuarial methods are available. These methods can be applied to any data type including Incurred Losses (below) and Paid Losses. Smoothing techniques are also included.

Further information

To see the database and analytical tools in action please visit: www.insureware.com

If any modeling support is required for a particular segment by any Best's Financial Suite - P/C, US subscribers, Insureware can provide this support on a fee-for-service basis.

Contact info@insureware.com for more information.

Introducing ICRFS™ Best's Schedule P 2019

You have ELRF™ Best's Schedule P 2019 and want more modeling power?

Insureware has created ICRFS™ Best's Schedule P 2019 for you.

This premium application from Insureware adds the innovative probabilistic modeling frameworks of ICRFS™ to the functionality of ELRF™ Best's Schedule P 2019.

The Probabilistic Trend Family (PTF) modeling framework enables analysts to describe the trends in the data in all time directions (development, accident, and calendar) along with the volatility around those trends. The Multiple Probabilistic Trend Family (MPTF) modeling framework extends this further by also including correlations between lines of business – measured from the data.

A comparison of the list of features can be found below.

Data and modeling frameworks	ELRF™ Best's Schedule P 2018	ICRFS™ Best's Schedule P 2018	Data and modeling frameworks	ELRF™ Best's Schedule P 2018	ICRFS™ Best's Schedule P 2018
Database			**Extended Link Ratio Family (ELRF)**		
Best's Financial Suite - P/C, US data by LoB and total	Yes	Yes	Mack	Yes	Yes
Associated key fields	Yes	Yes	Murphy	Yes	Yes
Industry Totals	Yes	Yes	Trends (down accident years) and intercepts	Yes	Yes
Critical financial information including:			Optimisation	Yes	Yes
Reserves and Ultimates Held	Yes	Yes	Bornhuetter-Ferguson	Yes	Yes
Gross and Net Premium	Yes	Yes	Bootstrap	Yes	Yes
%IBNR	Yes	Yes	Quantiles, V@Rs, and T-V@Rs	Yes	Yes
Total Loss Ratios	Yes	Yes	**Probabilistic Trend Family (PTF)**		
Survival Ratios	Yes	Yes	Full trend identification (including calendar)		Yes
Ratios relative to Industry	Yes	Yes	Volatility quantification		Yes
All Best's Financial Suite - P/C, US triangles			Modeling wizard		Yes
Paid Losses	Yes	Yes	One year ahead statistics (CDR)		Yes
Case Reserve Estimates	Yes	Yes	Liability stream		Yes
Incurred Losses (not including BULK and IBNR)	Yes	Yes	Risk capital by Acc. or Cal. Year		Yes
Bulk and IBNR	Yes	Yes	Reinsurance		Yes
Premium	Yes	Yes	Variation in Mean Ultimate		Yes
Number of Claims Reported	Yes	Yes	Quantiles, V@Rs, and T-V@Rs		Yes
Number of Claims Closed	Yes	Yes	**Multiple Probabilistic Trend Family (MPTF)**		
Additional Triangles			Full trend identification (including calendar)		Yes
Reserves Held	Yes	Yes	Volatility quantification		Yes
Ultimates Held	Yes	Yes	Correlations		Yes
Link Ratio methods			One year ahead statistics (CDR)		Yes
Link Ratio Techniques (LRT)	Yes	Yes	Liability stream		Yes
Aggregate Link Ratio Techniques (ALRT)	Yes	Yes	Risk capital by Acc. or Cal. Year		Yes
Payment Per Claim Incurred (PPCI)	Yes	Yes	Reinsurance		Yes
Projected Case Estimates (PCE)	Yes	Yes	Variation in Mean Ultimate		Yes
Bornhuetter-Ferguson (BF)	Yes	Yes	Solvency II one-year ahead metrics		Yes
Fisher-Lange (FL)	Yes	Yes	Ultimate year risk horizon metrics		Yes

ICRFS™ Best's Schedule P 2019 empowers you to answer questions like:

- Are our company's loss costs similar to our competitors?
- How do our company's trends, risk diversification, and loss ratios rank in the industry?
- What correlations should be used to calculate our risk diversification?
- Which companies could be targeted for reinsurance or acquisition?
- What Lines of Business contribute to distress in the event of a 1/200 event next calendar year?

About Insureware

Insureware is not your typical long-tail liability risk management firm: we are R&D focused.
Our team of world-class statisticians originated many of the ideas that the industry now aspires to.
They have published numerous papers not only in actuarial journals but also in preeminent
statistical journals. Insureware creates and supports the only comprehensive, enterprise wide,
long-tail liability risk management software in the world.

Insureware has advised on a wide-range of insurance matters including:

- Reserve due diligence;
- Mergers and Acquisitions;
- Assessing risk capital and Solvency II capital requirements
  for submissions to regulators and rating agencies;
- Underwriting and pricing; and
- Reinsurance transactions.

Insureware creates unique collaborative partnerships with each client. The partnership facilitates
the growth of incomparable knowledge, benefits, and applications.

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Insureware
Innovative Statistical Solutions for P&C Insurance