Find out the whole story:
How does your company compare to your competitors and the industry?
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1. Introducing ICRFS-PLUS™ A.M. Best Schedule P 2013

You have ICRFS-ELRF™ A.M. Best Schedule P 2013 but know you need more modelling power?

Insureware has created ICRFS-PLUS™ A.M. Best Schedule P 2013 for you.

This premium service from Insureware includes all the functionality of ICRFS-ELRF™ A.M. Best Schedule P 2013 and adds the innovative probabilistic modelling frameworks of ICRFS-PLUS™. For a detailed description of the features included in ICRFS-ELRF™ A.M. Best Schedule P 2013 please see the product brochure on the Insureware website.

The two probabilistic modelling frameworks of ICRFS-PLUS™ are:

- **Probabilistic Trend Family (PTF):**
  - Identify trends in the three directions (development, accident, and calendar);
  - Measure the volatility around the trends;
  - Use the modelling wizard to quickly generate starting models;
  - Create company profiles to visually compare performance;
  - Compare loss costs between companies; and
  - Much more!

- **Multiple Probabilistic Trend Family (MPTF):**
  - Measure correlation between multiple Lines of Business directly from the data;
  - Determine risk capital allocation and diversification credit for entire companies;
  - Calculate Solvency II one-year ahead statistics and associated risk for individual Lines of Business or whole companies; and
  - Much more!

See how ICRFS-PLUS™ empowers you to answer questions like:

- Are our company’s loss costs similar to our competitors?
- Was Tower Group’s collapse predictable years before?
- Are our company’s trends, risk diversification, and losses similar to our competitors?
- Is our company’s reinsurance effective?
- Which companies should we target for reinsurance or acquisition?
- What correlations should we use to calculate our risk diversification?

Example answers to these questions are elaborated for selected companies from the A.M. Best Schedule P 2013 data.
2. Are your company’s loss costs similar to your competitors?

In order to answer this question you first need to identify the trends in each time dimension (development, accident, and calendar) along with the volatility around the trends using the Probabilistic Trend Family (PTF) modelling framework.

Four of the top ten writers of Worker’s Compensation (in terms of held reserves) are:

- Liberty Mutual Group;
- CNA Ins Co-s;
- Travelers Group; and
- Hartford Insurance Group.

For each of these companies, a PTF model was designed for the paid losses adjusted by Earned Premium as exposure. All changes in trends are relative to the Earned Premium and thus reflect the loss costs of the business.

The calendar year trends are unique to each company and represent the net inflation – social and economic – above earned premium changes.

Liberty Mutual’s Net Workers Compensation losses do not exhibit any calendar year trend inflation since 2007, whereas the other three companies have varying levels of inflation – especially CNA where a high calendar year trend can be seen in the paid loss data since 2010. Further, changes in calendar year trends do not necessarily coincide between companies!

The calendar year trend of 17.63% in CNA WC is a huge inflationary trend above Earned Premium. The Case Reserve Estimates trend is negative over the same period while Number of Cases Reported is constant (next page). Perhaps the calendar year increase is a result of closing claims faster? The Number of Claims Closed would enable us to test this hypothesis.
The most important driver of calendar year trends is social inflation (including changes in claim handling strategy). This inflation can only be measured from the data and is unique to each company.

Do you know the inflation in your Lines of Business? What inflation trends are your competitors exposed to?

After identifying the trends in the three directions, you are positioned for projecting the future reserving (or pricing) periods. Without such decomposition, your understanding of the future losses is limited.

For comparison purposes, forecast scenarios were produced for each of these Worker’s Compensation lines to a run-off of 30 development years. The forecast scenarios were designed to approximately match the reserves held by each respective company for the line.

Survival ratios for Worker’s Compensation lines are typically very high since the losses are expected to continue for many years. Of the four companies, CNA Ins has the lowest survival ratio at 4.07. The other companies have survival ratios exceeding 5.

Liberty Mutual and Travelers seem to have almost identical reserve allocation profiles as do CNA Ins and Hartford. This is partly due to the sum of the final development trend and final calendar year trend being almost identical.

This similarity between Liberty Mutual and Travelers also holds when looking at risk capital allocation by calendar year. However, due to the differing trends identified in CNA Ins and Hartford, a comparable similarity in risk capital allocation does not apply.
Does this similarity in loss cost allocation and risk capital allocation imply these company’s lines are correlated? Let’s take a look.

Some volatility correlation is present, but not between the companies we might have expected. Looking at the profiles, we may expect Liberty and Travelers to have some correlation and Hartford and CNA to have some correlation. However, process correlation (correlation after detrending the data) is only found between Liberty and Hartford - See section 7 for more about correlations.

Let’s take a look at the loss ratios – based on Ultimates Held (Incurred losses including IBNR) and Earned Premium submitted to A.M. Best.

The reserving/pricing cycle along with market/economic pressure are both evident here as the four companies’ loss ratios move synchronously by accident year. This is sign of the market pressure on the portfolios rather than trends or volatility changes within the paid losses in either company. We have already seen the calendar year trends (net social inflation plus economic inflation) measured in each of the worker’s compensation lines are very different. This primarily reflects different social inflation pressures (economic inflation would be more uniform).
3. Was Tower Group’s collapse predictable as at year end 2011?

3.1. Tower Group can be seen to be woefully under-reserved. Data +11%; Reserves -16%!

Statistical analysis of Tower Group's year end 2011 A.M. Best Schedule P data reveals alarming reserve health indicators and woeful reserve inadequacy.

In short:

- Inflation (social and economic) of paid losses exceeded earned premium growth by 11% per year for the last five years (2006–2011);
- To reach Tower Group's reserves held and loss ratios, the assumed future calendar year trend must be -16% per year for all future calendar years;
- Tower Group's projected calendar year liability stream is far too low (by approximately $1B) as at year end 2011;
- Tower Group's survival ratio (1.33) was well below the industry average (2.41);
- We demonstrate that the traditional actuarial techniques including Mack (volume weighted average link ratios), applied to Paid and Incurred Losses, lack predictive power, do not quantify and measure inflation, and provide completely false indications.
- According to our analyses further significant reserve strengthening (or upgrades) are very likely.

Was too much reliance placed on traditional actuarial techniques for long-tail liability losses which were long past their use-by date? The Mack method, applied to Incurred Losses, yields a mean reserve estimate of $1.059 Billion which is not much higher than reserves held of $922 Million. Did the company maintain stable loss ratios because it was using Bornheutter Ferguson?

There would have been no adverse paid loss experience had the company identified the model that reflected the salient risk characteristics of the business.

The effective forecast assumptions employed by Tower Group were in complete contradiction of past trends (and volatility).

Significant reserve strengthening was entirely predictable.

The ensuing sequence of events was just a matter of time:

- August 2013: Tower Group announced the necessity of reviewing the estimation of its loss reserves and warned of loss reserve hits of $60 million to $110 million.
- October 2013: A.M. Best downgrades Tower Group's rating to B++. 
- November 2013: as a result of a comprehensive review, loss reserves were increased by $326.7 million in addition to other restatement adjustments.
- December 2013: Tower Group stock falls further. 10% of its workforce are cut.
- February 2014: adverse loss reserve changes were revised from the range $75 million - $105 million to be recorded as $143 million.

We are concerned reserve upgrades will be required for many years into the future unless the reserving methodology applied to Tower Group’s portfolios is seriously revised.

Here’s why.
3.2. Net inflation (social and economic) of paid losses exceeded earned premium growth by 11% per year for the last five years (2006~2011)

Let’s look at the optimal model identified in the Probabilistic Trend Family (PTF) modelling framework. The data are normalised by Earned Premium so any calendar year trends found are already adjusted for premium growth.

The model for the aggregate of the long tail liabilities is displayed above. We observe:

- Development trends demonstrate a strong decay;
- Accident years are stable after adjusting for earned premium;
- Calendar year trends show a 10.98% increase every year since 2006; and
- Volatility increases out in the tail of the development (like one would expect).

It is the third point that is the most critical. As we have already normalised by Earned Premium, this means that paid losses are increasing faster than earned premium by nearly 11% every year.

Ouch!

In order to reach the reserves held figure submitted by Tower Group for the data at year end 2011 ($921M), we have to apply the following future calendar year trend assumption (the vertical green line separates the past (left) from the future (right)).
That's right.

In order to reach Tower Group’s 2011 Held Reserves, the future calendar year trend must be negative 16.85% per year from 2011 onward.

Were the 11% calendar year trend to continue, under the above scenario losses would then be increasing faster than premiums by 27% per year!

3.3. A negative calendar year trend of -16% is required to reach Tower Group’s Held Reserves and Loss Ratios

The forecasted liability stream for the -16% trend scenario looks something like the table below.

For each observed cell (prior to calendar 2011), we have the pair of *observed* and *model mean* values.

For each future forecast cell (post calendar year 2011) we have the *projected distribution mean* and *distribution standard deviation*.

Aggregate means are also calculated for the future calendar period (bottom rows) and accident year aggregates (rightmost columns) along with their *distribution standard deviations*. Calendar year summaries of *observed* versus *fitted* are in the column on the left.

In the paid loss data, the losses are increasing across the accident years (blue dashed line) in development years zero and one. However, in the projected data (post 2011) for the development years six and seven (red dashed line), the mean losses are projected to decrease over the same accident years.

Let's compare the projected Tower Group reserve mean with the distributions obtained if the calendar year trend of 10.98% ±1.82% continues.
Note the Tower Group mean (dotted line) is well below the forecast distributions assuming the 10.98% trend continues (boxplots with connected means). The Tower Group reserve mean trend is outside the 1st percentile of this forecast for all calendar years. This is a further indication of the gravity of the Tower Group reserve deficiencies. **Reserve strengthening was inevitable.**

Now we compare the resulting cumulative losses by calendar year between the two forecasts.

If the paid losses actually followed the 10.98% trend line then we would expect average "adverse | development" of $293M by 2013.

This adverse development is not a result of unexpected losses arising from the data, but rather unexpected losses compared to the projected forecast. That is, adverse development arises as a result of poor methodology not truly unusual losses.

Did Tower Group know that in the past there was a 10.98% trend. Did they know the future trend required to obtain their ultimates and loss ratios by accident year and total is -16%?

We suspect not.

We show that the ultimates held by Tower Group at year end 2011 match closely with the forecast scenario designed to reach Tower Group’s reserve held.
What about the Case Reserve Estimates (CREs)?

Uh oh.
Let's enlarge that lower display.

Case Reserve Estimates are increasing over 2002–2007 and decreasing thereafter (calendar year 2009–2010 shows an increase, but is balanced by the decrease in level in the same accident year) by 8.8% per year.

These calendar year trends are in the opposite direction to the losses!!
What about Tower Group's loss ratios?

For the Tower Group scenario, the loss ratios look good. In fact there is no evidence from the numbers that losses are growing faster than Earned Premium.

The projected reserve losses look plausible compared to the Case Reserve Estimates as the Case Reserve Estimates are also too low!

Incurred But Not Reported (INBR) is 37.2% of reserves held.

How does this compare to the Industry? The industry IBNR is 48.7% for the same proportion of business volume.

Perhaps this is part of the problem. If the actuarial department was using a method such as Bornheutter-Ferguson to estimates the losses based on Earned Premium, then they would not see the growth in losses since the method calibrates the expected losses to the Earned Premium.

Unfortunately for Tower Group, the loss ratios are more likely to look like this (where the 11%±1.82% trend continues).
Note the huge increases in loss ratios in accident years 2008–2011 – right where Tower Group had so-called ‘adverse development’.

Let's look at the survival ratio.

### 3.4. Tower Group survival ratio is substantially lower than the industry average

A powerful metric is the survival ratio: how long the reserves would last if last year's payments were replicated in each subsequent year. That is, total held reserves divided by the total losses in the last calendar year.

For writers of P&C Insurance, especially long-tail lines like Worker’s Compensation, this ratio should be much higher than one.

Tower Group’s survival ratio for the whole company is only 1.33. This means that Tower Group could only survive one more year of losses, if these were to remain at the level of those observed in 2011. Perhaps Tower Group writes shorter long-tail lines – let’s check against the industry.

The industry ratio is 2.41. This is despite the same allocation of business (based on total earned premium). This means, on average, the industry would be reserving 80% more than Tower Group for the same business volume.

How could anyone justify such a low level of held reserves?

Let’s now take a look at traditional actuarial techniques such as the Mack method.

#### 3.5. Link Ratios have no predictive power and do not capture or quantify the calendar year trends.

Incremental Paid Losses (left) in development period two are not correlated to the previous cumulatives (development period one). Further, incremental Incurred Losses (right) in development period one are not correlated to the cumulatives in development period zero.

As Tower Group’s incremental losses are not correlated to the previous cumulatives, any link ratio method (including Mack) has no predictive power. Choosing link ratios by judgement cannot overcome lack of correlation.

The Mack method (equivalently volume weighted averages) estimates a trend lower than that in the data. So does the arithmetic average link ratio.
Mack is underestimating calendar year trends.

The seesaw pattern in the last calendar years is due to calendar year 2010 being better than expected.

As with the paid losses, the Mack method estimates a trend lower than that in the data.

Interestingly the Mack method applied to the incurred losses yields a mean reserve estimate of $1.059 Billion which is not much higher than reserves held of $922 Million.
3.6. Summary

With well established statistical tools available to verify the reasonableness of future forecast assumptions, this result is inexcusable. Earlier intervention and monitoring would not have jeopardised the company.

- Tower Group's projected calendar year liability stream is far too low (by approximately $1B) as at year end 2011;
- Inflation (social and economic) of paid losses exceeded earned premium growth by 11% per year for the last five years (2006~2011);
- To reach Tower Group's reserves held and loss ratios, the assumed future calendar year trends must be -16% per year for all future calendar years;
- Tower Group’s survival ratio (1.33) is well below the industry average (2.41). No wonder it isn't surviving;
- Standard actuarial techniques have no predictive power for the Tower Group’s long-tail LOBs, nor do they quantify the calendar year inflationary trends. They therefore give false indications; and
- According to our analyses using the PTF modelling framework, further significant reserve strengthening (or upgrades) are very likely.

This is why Tower Group arrived at the situation it did in 2013.

Whatever methods were used to estimate the total loss reserves were woefully inadequate and put shareholders’ funds at risk.

Poor decisions were made by management on what reserves should be allocated and the premiums to charge on new/renewal business.

Just like HIH, Tower Group should serve as a warning to insurance (and reinsurance) companies.

Is your insurance (reinsurance) company using the right reserving methodology?

Are you at risk of adverse development arising from defective loss reserve methodology?

Are you insuring a company that has misrepresented its risk exposure?
4. A tale of two companies: trends, risk diversification, and losses

We demonstrated that an individual company’s loss cost trends are distinctive. All trends measured from each company’s data are unique based on the individual loss experience.

Here we continue this illustration by showing that even for companies with similar reserves held, total earned premium, and survival ratios, the trends and volatility within the companies are completely unique. Based on this finding, it would be equally unwise to generalise calculations from the Industry for the purpose of application to individual companies. Exploring this last point is reserved for the last section.

Consider companies A and B. These two companies have similar long-tail liabilities held reserves ($27.8B vs $26.9B), similar total earned premium ($216B vs $218B), similar total loss ratios (63.7% vs 63.2%), and similar survival ratios (3.63 vs 3.46).

Below are model displays for the top eight lines by (expected ultimates) in common for each company.
The trends in each line are distinct for each company. Trend changes, if they occur, are not necessarily coincident between companies. Each company writes its own set of policies with a unique mix of risks. The drivers of the parameters and/or the process correlations are unique to each company.

The process correlation matrices below for the two companies show a completely different structure. The matrix is simplified by not displaying correlations of zero. Any LOBs containing only zero correlations between other LOBs are collapsed to a single entry of 1.

The lines in Company A are correlated to different lines than in Company B. These correlations can only be calculated after detrending the data and correspond to the residual correlations. Equivalently, the correlations in randomness.

Therefore we can expect different risk diversification credit results and differing strategies for asset-liability matching and capital management. There is no one single model that is applicable to all companies.

4.1. Reserve capital allocation by Line of Business

The proportion of total reserves allocated to different lines of business is different between the two companies.
For Company A, almost 50% of the total reserve allocation is consumed by Private Passenger Auto (PPA) liabilities. Company B also has substantial PPA liabilities, but with a significantly increased workers’ compensation portfolio the effect of PPA on the total reserve allocation is reduced.

Furthermore, Company A has substantial reinsurance lines (ReA, ReB) which are almost negligible for Company B in terms of reserve allocation.

There are many other such differences. However, in spite of these differences, the reserve allocation profile is very similar between the two companies. With Company B holding on average only a slightly higher percentage of reserves unallocated year-by-year. That company B has a longer tail is to be expected, given that WC comprises the greatest proportion of the company, compared to the PPA line in the case of Company A, which generally has a much shorter tail. However, by the end of 10 years, both companies are holding roughly an equal percentage of reserves.

![Cumulative % Reserve (year end 2013) Allocated by Calendar Year](image-url)
4.2. Risk capital allocation by Line of Business

Let’s now look at capital allocation. Since the reserve allocation is different, we similarly expect risk capital allocation to be different for the two companies.

Company A is clearly dominated by risk capital allocated to its Reinsurance lines, with secondary allocation to PPA (the largest line written by this company). In contrast, Company B’s risk capital is almost solely allocated to Worker’s Compensation – which also happens to be the largest line for allocation of reserves.

Further, note that Company A needs more risk capital as a proportion of mean reserves held.

This leads to differences in the risk capital allocation profile, with Company B on average holding significantly more of its risk capital unallocated year-by-year. This is consistent with the long-tail nature of the Worker’s Compensation line versus the ReA, ReB, and (especially) PPA lines of company A.
Intuitively, we may expect less risk diversification credit for Company B compared to Company A. After all, the company’s primary risk capital is dedicated to Worker’s Compensation and this line forms the bulk of the reserves held also. However, when the time value of money is considered, Company A has less time to invest capital and therefore is not able to diversify losses with assets in the same way.

This is best illustrated by the Solvency II metrics and associated economic balance sheet.

For more information on the analytical power of the Multiple Probabilistic Trend Family modelling framework please see the ‘Modelling Multiple Long-Tail Liability Lines’ brochure on the Insureware website.
4.3. Solvency II metrics and the Economic Balance Sheet

The Solvency II metrics and accompanying Economic Balance Sheet are shown below for companies A and B respectively. Company A requires more risk capital and subsequent incurs a higher risk capital charge for holding it. This is because the discounting effect is greater for Company B.

For the purpose of this calculation, the risk free rate is set to 4% and the spread to 6%.

When considering diversification, risk capital, and asset liability matching, it is important to consider the whole picture. The measures should be driven from the data, not imposed from a methodology or from the Industry.

4.4. Summary

Every company is unique; models, forecast scenarios, and other calculations should be derived from a solution tailored to the company.

The Probabilistic Trend Family modelling frameworks (PTF and MPTF) fit distributions to every cell according to the drivers present in the individual Lines of Business. In MPTF, correlations measured from the residuals incorporate correlations in the randomness – the most critical component for measuring risk diversification credit and impact of Solvency II (one-in-200-year) events.

Even for companies with similar total reserves held, premium earned, survival ratios, and other metrics, on closer examination, the underlying risks associated with each company are unique to that company.
5. Gross versus Net of Reinsurance – is reinsurance effective?

Let’s now examine two Reinsurance A lines written by different companies.

5.1. Company A: Not capital efficient for the Insurer, trending loss ratios

We use the Probabilistic Trend Family (PTF) modelling frameworks to decompose the data into the trends in the three directions along with the volatility around the trends. A model is designed for the Gross data then the Net data.

We find that model parameters coincide almost perfectly. Furthermore, the final calendar year trends are very similar. Were we to run the models in MPTF (rather than PTF as above) we could test to see whether any trends were the same.

The two pieces are highly correlated; both parameter and process (or volatility) correlation. This result is not surprising since Net (right) is a subset of Gross (left).

By examining Net and Gross independently, we can identify the trends in each component. We can then compare the respective forecasts to determine whether there is any gain in capital efficiency or cost benefit of holding the reinsurance. If the reinsurance is beneficial to the insurer we expect the expected loss ratios for the Net to be lower than the expected loss ratios for the Gross.
Note the higher in the coefficient of variation for the Gross (0.24) than for the Net (0.39). This suggests the reinsurance is not capital efficient.

That the reinsurance is usually effective is evident from the following table where the respective loss ratios for the Gross and Net show improvement for most accident years. The total loss ratio for Net (89.6%) is better than the total loss ratio for Gross (93.9%).

What is of primary concern in this table is the increasing trend in the loss ratios – both Gross and Net. Assuming this remains unmodified by changes in calendar year trends in the near future, this does not augur well for this Line of Business in this company.

The Multiple Probabilistic Trend Family (MPTF) provides the means for not only identifying trends in each segment (Net and Gross in this case), but also includes the volatility and parameter correlations when computing the total reserve distributions.

Forecasts can also be calculated for the difference (Gross - Net), all using the trends identified in the respective Net and Gross segments.

One composite model unites the pieces to produce the estimates of Gross - Net.
In 2010 there is a clear shift in the expected ultimate losses versus the ceded premium. Prior to this accident year, the premium well exceeds the ultimate losses whereas after this point, the reinsurer is expected to pay a much higher proportion of the ceded premium.

Perhaps the company negotiated their reinsurance agreement more aggressively?

5.2. Company B: Capital efficient and cost effective for the Insurer

We use the Probabilistic Trend Family (PTF) modelling frameworks to decompose the data into the trends in the three directions along with the volatility around the trends. A model is designed for the Gross data then the Net data.
The change in calendar year trends in the Net data probably just indicates a change of reinsurance or claim handling strategies. There is no evidence of these calendar year trends in the Case Reserve Estimates.

As previously, the correlation between the Gross data and the Net data is high.

Unlike the previous example, the forecast scenarios suggest that the reinsurance arrangement is capital efficient for the insurer. The total coefficient of variation is smaller for the Net data (0.27) than the Gross data (0.34).

But is the deal also cost effective?
From the expected loss ratios, we observe that the loss ratios for 2011 onward are higher in the Net than the Gross. This indicates the cost of the reinsurance has increased relative to the risk covered, but with no gain to the insurer.

This is consistent with the earned premiums relative to the expected losses for the excess layer (Gross – Net).

With the exception of the first two accident years, the reinsurer is doing well in respect to losses relative to premiums earned.
6. Would you target these companies for reinsurance or acquisition?

Where they can be calculated, Survival Ratios and %IBNR are provided for each company’s Line of Business at the database level. Companies and Lines can be quickly sorted by these metrics to facilitate quick profiling of potential target companies.

ICRFS-PLUS™ A.M. Best Schedule P 2013 extends this further by providing a modelling wizard to aid model identification. The wizard creates initial models which describe the trends and volatility in the data. Although these wizard models may need further manual enhancement, they typically provide an excellent first cut at extracting the critical trends in the data.

Forecast scenarios can be generated from these models and the total reserves can be compared with the reserves held by individual companies. In this way, you can quickly identify which companies require further investigation according to your objectives.

In this example, the modelling wizard was applied to all company groups – aggregation code: AMB Group. Forecast scenarios were created automatically with some adjustments applied to future trends (automatically) to ensure their reasonableness. Names of companies withheld.

The further away the companies are from the solid diagonal line, the larger the degree of over or under capitalisation (lower or upper triangle respectively.

Companies with higher reserves than anticipated are potential targets for reinsurance, acquisition, or investment. The company with higher held reserves than the PTF wizard suggests has minimal reinsurance in place.
Companies with lower reserves than expected are also of interest – particularly to rating agencies. Of course, this is but one indicator of the health of a company. Since both the models and forecasts are automatically generated, it is always necessary to analyse the data, models, and forecasts to confirm the results are reasonable. We apply the same diagnostic criteria to validating PTF models as we do link ratio models. That is, the model must describe the features of the data.

For the companies marked under-reserved outside the dashed line, manual modelling confirmed the wizard’s indications.

The modelling wizard can be run in batch mode in ICRFS-Plus™ A.M. Best Schedule P 2013, however COM access (used to interface to these external charts and assign additional metrics automatically) is only available in the stand alone version of ICRFS-Plus™.

To find out more about the stand alone version of ICRFS-Plus™ please see the brochures on the Insureware website.
7. Industry trends and correlations

In order to calculate risk diversification, correlation measures are often taken from the Industry data published by third parties. Further, these correlations are often very high (>80%).

There is no reason to think Industry wide correlations, even if measured accurately, are relevant to any individual company. Why is this?

7.1. Correlations: The business end

We often come across statements such as “the correlation between these two lines of business, CAL and PPA is, 87%”. What does this mean?

Is there indeed such a thing as a correlation between two lines of business in the abstract?

From the above statement one might be led into thinking that correlation is a measure of the similarity between two lines, as one might expect that the overlap of concerns between someone responsible for a portfolio of CAL and someone else responsible for one of PPA might be 87%. This may be of interest to a manager thinking to move an actuary or assessor over from PPA to CAL or vice versa. Or it might be thought that a model for PPA outstanding liabilities should resemble a model for CAL outstanding liabilities about 87%, if indeed such resemblances could be quantified or were to be of any use to anybody.

All of this is vague and subjective.

There is only one sense in which correlation is meaningful and relevant to a portfolio manager. Only one sense in which the use of the term is consistent with its origin in mathematical statistics, and that is as a measure of the synchronisation of the differences between predicted and actual loss values. The correlation that matters is the correlation in the volatility component of forecasts.

7.2. Correlation is model dependent; there are no industry-wide correlations

The two time series in the graph below have a linear correlation of 99%.
However it is also clear that both series are subject to increasing trends. Once the trends are accounted for, the correlation in the random component effectively vanishes.

Are the two series correlated?

The answer depends on the model. If they are each modelled as a constant plus a random factor, then the two “random factors” show a startling parallelism, justifying a correlation of 99%. Clearly this misrepresents the situation; it fails to account for the fact that each series is increasing on average.

If the model consists of linear trends plus random factor then the variability in the observations is accounted for without the need to introduce a correlation.

How can we know that two long-tail lines are correlated?

The first step is called detrending the data. This can be understood as smoothing the data down to a pattern of statistically significant trends and then replacing each data point by its difference from the respective smoothed point, the differences being known as “residuals”.

This is accomplished in the Probabilistic Trend Family (PTF) modelling framework by the placement of parameters at identified change points along the development, accident or calendar axes. Once this has been accomplished the residuals for each of the two lines should appear to be randomly scattered around zero. We can then carry out a standard statistical test for correlations in the residuals.

7.3. Correlations are in the volatility component of a model

Two lines are (positively) correlated when their results tend to miss their target values in the same way. This is what should concern business planners, because it affects the unpredictable component of the forecasts. What is predictable does not count towards correlation, because its effects are already incorporated into the model and forecast.

A forecast must include a volatility measure, ideally in the form of a loss distribution but at least in the form of a standard deviation.

7.4. Common accident year and common calendar year drivers

Common drivers of volatility are a prima facie source of correlation. However, they are not typically found outside closely related losses. For example, Gross versus Net (Net is a subset of Gross so common drivers are expected), layers (layers are subsets of ground up losses), and segments of the same line.

In this respect, detection of common drivers is as important as understanding correlations. The two effects must be correctly distinguished and adjusted for as management strategies of these risk components differ.

To learn more about correlations, accident year drivers, and calendar year drivers, please see the brochure 'Understanding correlations and common drivers' on the Insureware website.
7.5. Correlations before and after detrending

These plots clearly demonstrate the relationship evident in the original data prior to detrending (top right) is no longer present, or in greatly reduced magnitude, after detrending the series. The correlation in the randomness is minimal. This is important not only for the Industry, but also individual companies.

Correlations between two LOBs are only meaningful after detrending. Further, as correlations are model dependent, they must be measured in the context of the model fitted to the company and cannot be obtained from external sources. The only exception is when insufficient data are available, in which case use of Industry correlations (or trends for that matter) as an interim measure is appropriate.

To read more on what ICRFS-Plus™ offers as a stand alone product, please see the brochures on the Insureware website.