

Institute and Faculty of Actuaries

Approaches and Considerations in the Trending of Reserving Assumptions

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Quote

"....The trend is your friend "

University Finance Lecturer

"The trend is your friend except at the end where it bends.' (Full Quote) Ed Seykota – U.S. Investor

Agenda

- 1) Introduction and purpose
- 2) Importance of trending
- 3) Philosophical approaches towards trending
- 4) Practical approaches
- 5) Selecting material assumptions to trend
- 6) Trending and the reserving cycle
- 7) Questions

Introduction and Purpose

- Trending reserving assumptions is an area of actuarial work where the experience, judgement and career influences of the actuary will inform their preferred approach.
 - Some career influences can include: level of exposure to different lines of business, reserving approaches of senior colleagues, insurance industry financial climate, company type/culture, nature of actuarial experience (e.g. pricing vs. reserving experience)
- Given the above contributors towards a preferred trending approach, there are a wide variety of approaches that actuaries adopt when trending.
- The main purposes of this presentation are to discuss:
 - The importance of trending
 - The different philosophical approaches towards trending
 - Explore some common practical approaches
 - Explore the most material assumptions to trend
 - Examine the relationship between trending and the reserving cycle.

The Importance of Trending

- Why trend?
 - When reserving, we are trying to project the expected future cost of claims. These claims are subject to uncertain environmental features which may or may not be in the historical data we use to parameterise projection assumptions
 - Furthermore, these environmental features may be observed over different time periods and may be continuous or occur in bursts
 - If these trends are observed or are expected to appear, then it is reasonable to adjust key assumptions to ensure that the projected claims experience incorporates these trends.
- If the trends are not incorporated in key projection assumptions, the projections may be understated or overstated to the extent the trend expectations materialise.
 - Furthermore, no trending can lead to an inaccurate view of the adequacy of the reserving basis and projection methodology.
- There are a wide variety of views as to whether trending should capture trends that cannot be explained or observed.
 - Can the source of all trends be isolated?
 - If a trend cannot be observed should it be incorporated? What about a trend in continued case estimation deterioration?

The Importance of Trending - Universe of Assumptions

- The following assumptions are commonly trended in reserving:
 - Chain ladder factors (paid, incurred, claim number, ACPC)
 - Loss ratio
 - Frequency
 - Severity
 - Inflation
 - Non-reinsurance recoveries
 - Claim state transitions (e.g. percentage of Nil Claims, propensity, utilisation)
 - Rate change
- In pricing, many of these assumptions are trended as a matter of course e.g. severity picks will be trended to the average inception date, the average claim date and possibly to the average settlement date.
- Professional Standards usually require consideration of trends e.g. CAS ASOP No. 43 Property and Casualty Unpaid Claim Estimates, Actuaries Institute of Australia PS 300 Valuation of GI Claims.

The Importance of Trending - Simplified Example (1)

Paid Chain Ladd	er Factors (LDFs)				
AY/DY	2/1	3/2	4/3	5/4	6/5
2012	1.079	1.021	1.009	1.005	1.002
2013	1.086	1.019	1.010	1.004	
2014	1.103	1.021	1.009		
2015	1.126	1.019			
2016	1.152				
2017					

Simple Avg (5) -					
No Trend	1.11	1.02	1.01	1.00	1.00
Trended					
selection	1.17	1.02	1.01	1.00	1.00

- DY 2/1 factors exhibits a clear trend.
- The two DY 2/1 CDF's are 1.149 and 1.207 respectively.



• If the 2017 AY payment is initially 25m, then the difference between the two reserve projections is 1.44m or 38.6%.

The Importance of Trending - Simplified Example (2)

	Rate and	Ultimate			On-leveled L	Iltimate Loss	Ratios			Average of	IEI D
	Inflation	Loss								on-leveled	ILLN Coloction
UY	Index	Ratio	2007	2008	2009	2010	2011	2012	2013	loss ratios	Selection
2005		125%									
2006	100%	150%									
2007	108%	125%	125%								
2008	112%	125%	130%	125%						127%	
2009	125%	90%	145%	140%	90%					125%	
2010	127%	85%	147%	142%	91%	85%				116%	
2011	140%	90%	162%	156%	101%	94%	90%			110%	
2012	160%	60%	185%	179%	115%	107%	103%	60%		96%	
2013	145%	40%	168%	162%	104%	97%	93%	54%	40%	71%	
2014	130%		150%	145%	94%	87%	84%	49%	36%	64%	40%
2015	140%		162%	156%	101%	94%	90%	53%	39%	69%	45%
2016	145%		168%	162%	104%	97%	93%	54%	40%	71%	45%
							Trended	on-leveled l	oss ratio		
										Ŭ I	

Underwriting Years

The Importance of Trending - Simplified Example (2)



- The averages and the IELR selection are based on on-leveled loss ratios
- There is a clear decreasing trend in the ultimate loss ratio.
- On-leveling and taking averages of the loss ratios still shows a similar trend. However, a pure selection of the averages overstates the recent year IELR selections
- The selection has been trended to capture both on-leveling and the direction of recent claims performance (circa 20% difference in recent years).

The Importance of Trending - Financial Implications

- Given the importance of reserving to the balance sheet and the P&L, the trending of reserving assumptions has a key financial impact.
- Trending good or bad experience will capture future reserve strengthenings or deteriorations and thus bring forward profit or loss outcomes.
 - Is this an ideal outcome?
 - Can it be justified?
- One financial implication of not trending in a deteriorating claims environment is the consistent observance of reserving 'deteriorations' which can be misinterpreted as poor claims experience.
 - However, whilst poor claims experience is driving the reserve deteriorations, the absence of trending is leading to <u>consistent and</u> <u>continuous</u> reserve deteriorations.
- If trending is so important and the assumptions so subjective, how do key stakeholders get comfortable over the appropriateness of reserving estimates.

Philosophical Approaches Towards Trending

- As previously noted, trending reserving assumptions is an area of actuarial work where the experience, judgement and career influences of the actuary will inform their preferred approach.
 - To this end, as an actuary gains experience in reserving they develop a reserving philosophy
 - I define a reserving philosophy as a set of prejudgements or preconceived heuristics that a reserving actuary would apply when performing reserving or solving reserving related problems.
- A key area of judgment informed by an actuary's reserving philosophy is the differing speed at which good and bad experience is responded to.
 - This also encapsulates the choice of whether to trend bad experience and not trend good experience (or vice versa)
- Can it be a one way decision where only good or bad experience is trended?
 - What should inform this decision and what can be used to justify this decision?
 - How would this decision be communicated to a non-actuarial audience?

Philosophical Approaches Towards Trending – Differences by Actuarial Function

- It is interesting to consider whether the philosophy towards trending should differ by actuarial function.
- **Pricing**: A key requirement when pricing is to trend assumptions to the average underwriting, loss occurrence and loss payment dates.
 - Pricing assumptions are more influenced by the competitive environment. The lack of trending or delay in trending can result in
 pricing that is uncompetitive.
 - Consequently, it is reasonable that the philosophy towards trending pricing assumptions should differ to reserving assumptions.
- Capital Modelling (e.g. estimating internal model SCR): The two main insurance risks (underwriting and reserve risk) can be seen as modelling the full distribution of reserving and pricing results.
 - At the more extremes of the distribution (e.g. 1-200), it is debatable whether trending assumptions would be a key driver of capital intensity.
 - Accordingly, trending may not be as material to capital modelling.

Philosophical Approaches Towards Trending – Compatibility with Best Estimate Reserving

- A reasonable level of trending of common reserving assumptions can be considered to be in line with best estimate reserving and is supported by numerous professional standards.
- However, the situation is more nuanced when reserving for a deteriorating portfolio (especially a long-tail portfolio).
 - These deteriorations are often initially seen as a one-off charge to the balance sheet. In practise they often involve successive balance sheet charges due to the evolution of the claims experience.
- In these situations, 'excessive' trending of deteriorating assumptions may be warranted to capture the reasonable likelihood of further deteriorations.
 - However, this can lead to conflicts with the concept of best estimate reserving
 - In this scenario the difference in reserving philosophy between the reserving actuary and a reviewing actuary can be of importance.
- What if the situation was reversed and it was the 'excessive' trending of improving assumptions that was
 occurring?

Philosophical Approaches Towards Trending – Internal Consistency of Trending Approach

- One common observation in reserving analysis is the inconsistency in trending approaches
 - This is best exemplified where extensive analysis and trending is performed on loss ratios to select the current year IELR, however, LDF's are not trended
 - On the surface this is an internally inconsistent approach to reserving. This inconsistency is magnified depending on the amount of reserves estimated using loss ratio or chain ladder approaches
 - Is it appropriate to have this inconsistency?
 - What are the factors that allow/disallow this inconsistency?
- Assumptions that are less likely to be trended:
 - Economic inflation
 - Claim number assumptions (LDF's, frequency)
 - Claim state transitions
 - Case estimate strength
 - Non-reinsurance recovery rates

Practical Approaches

- Trending approaches can vary from visual inspection to more complex GLM based approaches.
 - Expectation: The approach should be proportionate to the materiality of the assumption
 - Reality: Reserving efficiency leans towards a more homogenised and industrial reserving approach and therefore more simple trending methods are usually adopted.
- This section will discuss some common approaches in trend measurement, analysis and validation.
- For some assumptions (e.g. average claim size), the trend analysis can be performed in one cohort but applied to a projection based on a different cohort.

Practical Approaches – Trend Measurement

• A key difficulty in measuring trends is differentiating between signals and noise.



- In the case of triangulations, trends can be measured across calendar, development and accident/underwriting years. The measurement cohort used is influenced by the trend being analysed.
- Accident year and underwriting year cohorts are better for distinguishing between signal and noise.
 - The source of a trend is easier to pinpoint as claim and policy inception dates can be grouped in a more tractable way.
- Changing the time cohort: Often with long tail classes, the trends will not be as evident when the time cohorts are shorter e.g. quarterly. One useful analysis is to compress the time cohort into longer periods. This means that longer term trends are more easily distinguishable by suppressing noise effects.

Practical Approaches – Trend Measurement Adjustments

- Removing event/clash claims: Event claims (e.g. Hurricanes) can distort the measurement of trends and are best removed from the analysis.
- Inflation adjusting historical data using an appropriate index is highly beneficial in trend measurement as it segments one potential source of trend and thus can unmask other trends.
 - This adjustment works for payments but what about case estimates, claim numbers?
- In these cases, other adjustments can be used to 'standardise' the data better e.g. exposure adjusted claim numbers/frequency, case estimates per outstanding claim.

Practical Approaches – Visual Inspection

Paid Chain Ladde	Paid Chain Ladder Factors (LDFs)										
AY/DY	2/1	3/2	4/3	5/4	6/5						
2012	1.079	1.021	1.009	1.005	1.002						
2013	1.086	1.019	1.010	1.004							
2014	1.103	1.021	1.009								
2015	1.126	1.019									
2016	1.152										
2017											
Simple Avg (5) -											
No Trend	1.11	1.02	1.01	1.00	1.00						
Trended											
selection	1.17	1.02	1.01	1.00	1.00						

Some of the commonly used (but less sophisticated) LDF trending approaches are visual inspection, linear regression, exponential growth. In the previous example, visual inspection was used to select a trended LDF.



Practical Approaches – Curve Fitting

- Simplified linear regression and exponential fitting can lead to an initial view of the trended LDF assumption
- In practice, it is best to rely on more than curve fitting
- A multi-factor curve would have more predictive power but would be time consuming and potentially spurious in accuracy depending on data availability
- Qualitative validation is of more importance here
- Curve fitting can provide an initial view of a trend assumption which can help industrialise the process.



Dev Period 2/1 Paid Chain Ladder Factor -

Practical Approaches – Incorporating Industry Trends

- For some classes of business internal company data is sparse and/or there isn't sufficient historical data.
 - This can lead to difficulty in analysing and projecting trends. E.g. distinguishing signal from noise.
- A practical way to incorporate trending in reserving analysis is to perform trend analysis on industry data and then incorporate these trends into the company's own reserving analysis.
- There are several practical adjustments that can be considered to improve this analysis:
 - Adjust the industry/company experience for differences in exposure, policy limits and specific underwriting criteria before the analysis or application of trends
 - It is important to consider the layers the insurer is focused on. This is also applicable in subscription markets where a company
 has a history of taking certain shares of policies as trends may affect different claim cost layers.
- For classes with more historical data available (e.g. workers compensation), international benchmarks can be used if the legal cost element of industry data can be segmented. Therefore, other claim types can be analysed separately to understand industry trends.
 - E.g. workers compensation industry data is usually available at this level of granularity.

Practical Approaches – Trend Validation



Selecting Material Assumptions to Trend

- Trending is a time consuming exercise as it involves the granular analysis of already granular modelling assumptions.
 - Given resource constraints and the volumes of classes that are being reserved for, it isn't practical to trend all assumptions
 - Even if some reserving assumptions are trended they are not likely to have a material bearing on reserving analysis.
- Furthermore, trending in one reserving segment (or actuarial function) and not another can lead to an inconsistency in how a company approaches assumptions trending.
 - Although, trending is heavily influenced by an actuary's reserving philosophy, there should still be some consistency in selecting which assumptions are most material to trend
 - Example: Reserving vs. Pricing vs. Business Plan loss ratios can materially vary for companies where the trending philosophy is different amongst actuaries.
- Consequently, it is useful to have a framework when considering the materiality of assumptions to trend.



Selecting Material Assumptions to Trend



Trending and the Reserving Cycle

- In the paper 'The Cycle Survival Kit. An investigation into the reserving cycle and other issues'¹ the reserving cycle was defined as the 'tendency for insurers to over-reserve when underlying loss ratios are low and to under-reserve when underlying loss ratios are high.'
- The paper also concludes the following:

"It does appear that a "mechanical" approach to reserving using traditional actuarial methods may result in a reserving cycle. Any judgmental intervention to a mechanical approach may dampen the effects of a reserving cycle. It does not follow that actuarial methods are unhelpful; in fact it underlines the importance of using actuarial judgment in conjunction with the methods."

This commentary could be extended to measuring, capturing and forecasting key reserving trends can
reduce the propensity for surprise reserve deteriorations and also further dampen the effects of the
reserving cycle.

^{1:} The Cycle Survival Kit. An investigation into the reserving cycle and other issues, 2003, General Insurance Convention 2003, Philip Archer-Lock; Steven Fisher; Ian Hilder; Nick Line; Shreyas Shah; Kevin Wenzel; Martin White

Trending and the Reserving Cycle - Example

 The following example shows how the lack of trending can contribute to a reserving cycle: 2017 Paid LDF

AY/DY	2/1	3/2	4/3	5/4	6/5	7/6
2010	1.121	1.081	1.050	1.024	1.000	1.012
2011	1.048	1.009	1.009	1.009	1.018	1.000
2012	1.055	1.052	1.000	1.089	1.155	
2013	1.083	0.983	1.087	1.008	1.008	
2014	1.107 🗖	1.008	1.120		(2/1 sh	ows
2015	1.130	1.038			trend o	f
2016	1.154			inor		
2017					easing	LDFS

Weighted	1.104	1.022	1.063	1.036	1.086	1.005
Simple	1.100	1.029	1.053	1.032	1.057	1.006

AY/DY	1	2	3	4	5	6	7
2010	33,000	37,000	40,000	42,000	43,000	43,000	43,500
2011	52,000	54,500	55,000	55,500	56,000	57,000	57,000
2012	91,000	96,000	101,000	101,000	110,000	127,000	127,635
2013	108,000	117,000	115,000	125,000	126,000	136,852	
2014	112,000	124,000	125,000	140,000	144,977		
2015	115,000	130,000	135,000	143,515			
2016	117,000	135,000	138,021				
2017	120,000	132,516		•			

Weighted average		e					
slowly re	esponds	to					
tr	rend		2018 Pa	id LDF			
AY/DY		2/1	3/2	4/3	5/4	6/5	7/6
2010		1.121	1.081	1.050	1.024	1.000	1.012
2011		1.048	1.009	1.009	1.009	1.018	1.000
2012		1.055	1.052	1.000	1.089	1.155	1.000
2013		1.083	0.983	1.087	1.008	1.016	
2014		1.107	1.008	1.120	1.007		
2015		1.130	1.038	1.007			
2016	<u>۱</u>	1.154	1.004				
2017		1.167					
2018		N					
		<u> </u>					
Weighted		1.114	1.019	1.050	1.027	1.060	1.002
Simple		1.108	1.025	1.046	1.027	1.047	1.004
AY/DY	1	2	3	4	5	6	7
2010	33000	37000	40000	42000	43000	43000	43500
2011	52,000	54,500	55,000	55,500	56,000	57,000	57,000
2012	91,000	96,000	101,000	101,000	110,000	127,000	127,000
2013	108,000	117,000	115,000	125,000	126,000	128,000	128,282
2014	112,000	124,000	125,000	140,000	141,000	149,418	
2015	115,000	130,000	135,000	136,000	139,668		
2016	117,000	135,000	135,500	142,263			
2017	120,000	140,000	142,624				
2018	125,000	139,288					

Trending and the Reserving Cycle - Example

We	ighted ave	erage	2/1	3/2	4/3	5/4	6/5	7/6
still	not adequ	ately	1.121	1.081	1.050	1.024	1.000	1.012
са	pturing tre	nds	1.048	1.009	1.009	1.009	1.018	1.000
	2012		1.055	1.052	1.000	1.089	1.155	1.000
	2013		1.083	0.983	1.087	1.008	1.016	1.000
	2014		1.107	1.008	1.120	1.007	1.007	
	2015	\mathbf{X}	1.130	1.038	1.007	1.015		
	2016		1.154	1.004	1.011			
	2017		1.167	1.014				
	2018		1.176					
	2019							
Γ	Weighted		1.123	1.018	1.042	1.024	1.044	1.001
[Simple		1.116	1.024	1.041	1.025	1.039	1.003
	AY/DY	1	2	3	4	5	6	7
	2010	33,000	37,000	40,000	42,000	43,000	43,000	43,500
	2011	52,000	54,500	55,000	55,500	56,000	57,000	57,000
	2012	91,000	96,000	101,000	101,000	110,000	127,000	127,000
	2013	108,000	117,000	115,000	125,000	126,000	128,000	128,000
	2014	112,000	124,000	125,000	140,000	141,000	142,000	142,200
	2015	115,000	130,000	135,000	136,000	138,000	144,088	
	2016	117,000	135,000	135,500	137,000	140,314		-
	2017	120,000	140,000	142,000	148,030			
	2018	125,000	147,000	149,645				
	2019	128,000	143,762					

	2018 AvE Analysis					2019 AvE A	nalysis	
		Expected A	Actual				Expected	Actual
	2012	127,635	127,000			2013	128,282	128,000
	2013	136,852	128,000			2014	149,418	142,000
	2014	144,977	141,000			2015	139,668	138,000
	2015	143,515	136,000			2016	142,263	137,000
	2016	138,021	135,500			2017	142,624	142,000
<	2017	132,516	140,000	>	V	2018	139,288	147,000

- In this example, taking weighted averages leads to a slow response to a deteriorating trend
- It also leads to AvE results which show the most recent year is under-projected
- Trending the DY 2/1 LDF would have dampened this effect
- This cycle of slowly responding to trends, adverse AvE experience and resultant assumption strengthening leads to a negative feedback loop in the reserving process.

Trending and the Reserving Cycle - Issues

- Trending in the midst of a reserving cycle can be challenging.
 - An actuary might note the presence of a deteriorating trend but the recent experience might still be positive
 - Also, as is typical towards the top of the cycle, past underwriting year profitability may be masking recent underwriting year losses
 - This can make trending a courageous proposition given its subjective nature.
- Monitoring processes
- Leading indicators
- Communication and consistency
- Validation
- Role of industry bodies, regulators and auditors
- The role of pricing.



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