Institute and Faculty of Actuaries

Practical Techniques for Dealing with Long Tail Reserving Challenges

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Quote

“ Progress comes to those who train and train; reliance on secret techniques will get you nowhere...”

Morihei Ueshiba – Founder of Aikido

Agenda

1) Introduction and purpose
2) Long tail complications and universe of techniques
3) Paid and incurred projection differences
4) Step changes in case estimation approaches
5) Frequent changes in claims legislation
6) Frequent changes in claims legislation – Ogden rate
7) Changes in business mix
8) Questions and comments

Introduction and purpose

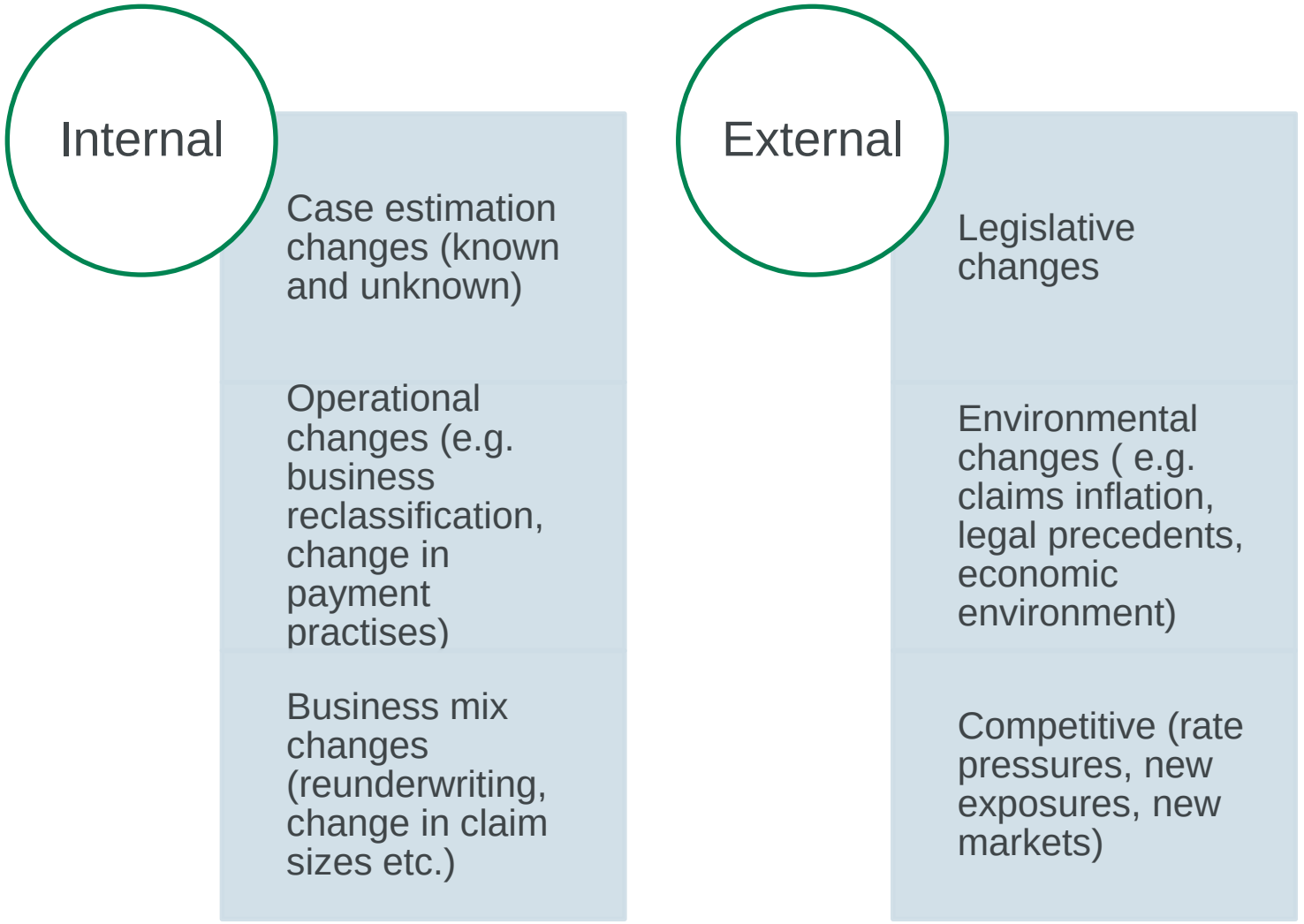
- Long tail reserving is one of the most complicated parts of an actuary's job because the data is often sparse, the claims are varied, the delays are long and the reserves are usually large.
  - Magnifying these difficulties is that long tail reserves are usually a large component of the balance sheet and a change in reserves can determine the fortunes of the company.
  - Short tail reserving can also be complicated (e.g. accidental and third property damage in the current market) but the reserving outcomes are known quicker and management can respond sooner.

- Reserving actuaries need a tool kit. Some it will come from knowledge and coursework but the majority of it will come from practise and exposure to difficult reserving situations.

Introduction and purpose

- The main purposes of this presentation are to:
  - Highlight some of the common complications in long trail reserving
  - Outline techniques to handle paid and incurred projection differences
  - Provide techniques to manage changes in case estimation practises
  - Outline techniques to reserve in an environment of constant legislative changes
  - Review techniques to handle changes in business mix and their impact on reserving

Long tail complications



Universe of techniques

- At a high level the universe of techniques to solve long tail challenges can be categorised as:

Data adjustment (e.g. remove, smooth out, back fit)

Method adjustment (new methods)

Introduce new data (benchmark data, proxy portfolio)

Proxy modelling (e.g. finding historical claims that would meet a desired criteria)

Other (e.g. simulation, individual claims estimation, statistical case estimation)

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Paid and incurred differences

- Two of the most frequently used reserving techniques are the chain ladder on payments (PCL) and on incurred data (ICL).
- Consequently, one of the most frequent reserving complications is when the methods diverge in their estimates of ultimate costs. Some divergence is to be expected and arguably ‘good’ otherwise it would negate the usage of both techniques.
- What are some of the ways this complication comes about?
  - Changes in speed of settlement
  - Changes in case estimation strength
  - Changes in claims mix within a layer or business mix
- What is the impact of paid and incurred differences?
  - Uncertainty in reserve estimates
  - Loss of confidence in reserve estimates
  - Impact on profitability

Paid and incurred differences – change in payment speed

Historical Payments Triangle (Incremental)

AY/DY	1	2	3	4	5	6	7	8	9	10
2009	1,400,000	6,300,000	5,600,000	8,400,000	8,400,000	4,550,000	3,920,000	3,360,000	2,520,000	1,680,000
2010	1,600,000	7,200,000	6,400,000	9,600,000	9,600,000	5,200,000	4,480,000	3,840,000	2,880,000	
2011	1,550,000	6,975,000	6,200,000	9,300,000	9,300,000	5,037,500	4,340,000	3,720,000		
2012	1,500,000	6,750,000	6,000,000	9,000,000	9,000,000	4,875,000	4,200,000			
2013	1,600,000	7,200,000	6,400,000	9,600,000	9,600,000	5,200,000				
2014	1,700,000	7,650,000	6,800,000	10,200,000	10,200,000					
2015	1,650,000	7,425,000	6,600,000	9,900,000						
2016	1,850,000	8,325,000	7,400,000							
2017	1,900,000	8,550,000								
2018	2,000,000									

Incurred Triangle

AY/DY	1	2	3	4	5	6	7	8	9	10
2009	11,532,500	21,219,800	27,885,585	35,796,880	37,249,975	39,441,150	45,207,400	42,439,600	44,450,000	46,130,000
2010	13,048,200	24,251,200	32,211,920	40,910,720	42,123,280	43,177,680	50,611,200	52,720,000	51,138,400	
2011	12,768,125	24,004,075	30,873,326	37,589,360	42,109,276	45,505,598	46,986,700	51,072,500		
2012	11,244,188	24,712,500	31,804,988	37,563,000	40,750,913	42,703,200	44,976,750			
2013	11,993,800	26,360,000	31,526,560	41,332,480	43,915,760	46,973,520				
2014	13,163,525	25,766,900	34,953,360	43,915,760	43,803,730					
2015	12,504,525	26,640,075	34,632,098	40,449,420						
2016	14,477,406	28,650,025	38,433,704							
2017	15,338,225	30,363,425								
2018	15,816,000									

Scenario 1: Consider a portfolio that is long tailed where the claims are paid via large one off settlements.

Paid and incurred differences – change in payment speed

- The current projection of ultimates for the paid and incurred chain ladder give the following results.
- In this scenario between 2012-2015 there was a management decision to settle dormant claims.
- The claims are settled with no marked shift in the incurred costs i.e. the incurred triangle doesn't change but the payments triangle shows a speed up in payments in the latest diagonal for 2012-2015.

Initial Ultimate Projections (Pre-Speeding up)

AY	Ultimate (ICL)	Ultimate (PCL)	Diff (PCL-ICL)
2009	46,130,000	46,130,000	-
2010	51,138,400	52,720,000	1,581,600
2011	51,072,500	51,072,500	-
2012	46,326,053	49,425,000	3,098,948
2013	50,801,862	52,720,000	1,918,138
2014	51,163,633	56,015,000	4,851,367
2015	51,497,847	54,367,500	2,869,653
2016	58,717,866	60,957,500	2,239,634
2017	60,304,835	62,605,000	2,300,165
2018	62,824,353	65,900,000	3,075,647
Total	529,977,349	551,912,500	21,935,151

Paid and incurred differences – change in payment speed

- The new payments triangle is shown below and the revised ultimate projection is shown to the right.
- As can be seen, the speed up in payments has significantly led to a divergence in the two sets of ultimates.

Historical Payments Triangle (Incremental)

AY/DY	1	2	3	4	5	6	7	8	9	10
2009	1,400,000	6,300,000	5,600,000	8,400,000	8,400,000	4,550,000	3,920,000	3,360,000	2,520,000	1,680,000
2010	1,600,000	7,200,000	6,400,000	9,600,000	9,600,000	5,200,000	4,480,000	3,840,000	2,880,000	
2011	1,550,000	6,975,000	6,200,000	9,300,000	9,300,000	5,037,500	4,340,000	3,720,000		
2012	1,500,000	6,750,000	6,000,000	9,000,000	9,000,000	4,875,000	8,400,000			
2013	1,600,000	7,200,000	6,400,000	9,600,000	9,600,000	10,400,000				
2014	1,700,000	7,650,000	6,800,000	10,200,000	16,320,000					
2015	1,650,000	7,425,000	6,600,000	18,480,000						
2016	1,850,000	8,325,000	7,400,000							
2017	1,900,000	8,550,000								
2018	2,000,000									

Ultimate Projections (Post-Speeding up)

PCL (New)-PCL (Old)

PCL (New)-ICL

AY	Ultimate Claims Cost (PCL)	Base PCL Ult	Diff - PCL	Base ICL	Diff - ICL
2009	46,130,000	46,130,000	-	46,130,000	-
2010	52,720,000	52,720,000	-	51,138,400	1,581,600
2011	51,072,500	51,072,500	-	51,072,500	-
2012	*52,953,221*	*49,425,000*	*3,528,221*	*46,326,053*	*6,627,169*
2013	*59,642,828*	*52,720,000*	*6,922,828*	*50,801,862*	*8,840,966*
2014	*65,394,256*	*56,015,000*	*9,379,256*	*51,163,633*	*14,230,623*
2015	*72,606,919*	*54,367,500*	*18,239,419*	*51,497,847*	*21,109,072*
2016	60,957,500	60,957,500	-	58,717,866	2,239,634
2017	62,605,000	62,605,000	-	60,304,835	2,300,165
2018	65,900,000	65,900,000	-	62,824,353	3,075,647
Total	589,982,225	551,912,500	38,069,725	529,977,349	60,004,876

Paid and incurred differences – change in payment speed

Finalisation Rate Operational Time

AY/DY	1	2	3	4	5	6	7	8	9	10
2009	9.7%	39.6%	60.0%	74.3%	80.8%	85.5%	93.1%	93.1%	94.1%	100.0%
2010	9.7%	39.6%	60.0%	71.3%	83.3%	86.4%	94.0%	97.0%	99.0%	
2011	10.0%	40.0%	57.0%	73.5%	82.5%	87.3%	91.2%	97.0%		
2012	9.9%	39.6%	57.6%	73.5%	81.6%	90.0%	98.0%			
2013	10.0%	38.4%	57.0%	73.5%	82.5%	95.0%				
2014	9.9%	38.0%	57.0%	74.3%	91.0%					
2015	9.7%	38.8%	59.4%	88.0%						
2016	9.8%	39.2%	60.0%							
2017	9.5%	40.0%								
2018	10.0%									

Paid to Incurred Ratio

AY/DY	1	2	3	4	5	6	7	8	9	10
2009	12.1%	36.3%	47.7%	60.6%	80.8%	87.9%	85.3%	98.8%	104.7%	106.4%
2010	12.3%	36.3%	47.2%	60.6%	81.7%	91.7%	87.1%	90.9%	99.3%	
2011	12.1%	35.5%	47.7%	63.9%	79.1%	84.3%	90.9%	90.9%		
2012	13.3%	33.4%	44.8%	61.9%	79.1%	86.9%	98.4%			
2013	13.3%	33.4%	48.2%	60.0%	78.3%	95.4%				
2014	12.9%	36.3%	46.2%	60.0%	97.4%					
2015	13.2%	34.1%	45.3%	84.4%						
2016	12.8%	35.5%	45.7%							
2017	12.4%	34.4%								
2018	12.6%									

- Each of the diagnostics to the left are examining payment speed.
- Operational time is defined as claims finalised / Ultimate claims numbers

Paid and incurred differences – change in payment speed

- Practical techniques to cope with change in payment speed:
  - If these payments are truly for dormant and/or laggard claims then the payments can be spread over the preceding development periods (implicitly we are assuming this is a once off effect)
    - This approach can only be used if there is no step shift in the development patterns.
  - If the ordering of the claims has stayed the same we can use an operational time based reserving method.
    - This involves replacing development quarters with operational time bands. Claim payments are mapped to operational time bands using linear regression. We can then use an ACPC based on finalised claim numbers.

Paid and incurred differences – change in case estimates

- Changes in case estimates will also affect the relationship between paid and incurred projections.

- Some common ways in which changes manifest are:
  - One off step changes with reversion to normal strength/case estimation practices thereafter
  - One off step changes followed by a change in case estimation practices
  - Frequent changes in strength/case estimation practices

- The next section will review scenarios and potential solutions to the above common problems.

- In the meantime lets look at the effect a change in case estimate strength on the 2012-2015 AY's can have on the ultimate costs.

Paid and incurred differences – change in case estimates

- In this slide the case estimates are reduced in the latest calendar period which then widens the difference between the paid and incurred projections. This is intended to be a scenario of a one-off change without reversion to normal practices.

New Incurred

AY/DY	1	2	3	4	5	6	7	8	9	10
2009	11,532,500	21,219,800	27,885,585	35,796,880	37,249,975	39,441,150	45,207,400	42,439,600	44,765,000	46,130,000
2010	13,048,200	24,251,200	32,211,920	40,910,720	42,123,280	43,177,680	50,611,200	52,720,000	51,138,400	
2011	12,768,125	24,004,075	30,873,326	37,589,360	42,109,276	45,505,598	46,986,700	51,072,500		
2012	11,244,188	24,712,500	31,804,988	37,563,000	40,750,913	42,703,200	44,475,000			
2013	11,993,800	26,360,000	31,526,560	41,332,480	43,915,760	45,680,000				
2014	13,163,525	25,766,900	34,953,360	43,915,760	42,500,000					
2015	12,504,525	26,640,075	34,632,098	36,960,000						
2016	14,477,406	28,650,025	38,433,704							
2017	15,338,225	30,363,425								
2018	15,816,000									

Comparison of Ultimate Projections

AY	Base PCL	New ICL	New Diff
2009	46,130,000	46,130,000	-
2010	52,720,000	51,138,400	1,581,600
2011	51,072,500	51,072,500	-
2012	49,425,000	45,809,250	3,615,750
2013	52,720,000	49,402,920	3,317,080
2014	56,015,000	49,640,850	6,374,150
2015	54,367,500	47,055,321	7,312,179
2016	60,957,500	58,717,866	2,239,634
2017	62,605,000	60,304,835	2,300,165
2018	65,900,000	62,824,353	3,075,647
Total	551,912,500	522,096,295	29,816,205

Paid and incurred differences – change in case estimates

Case Estimate Development Factors

AY/DY	1	2	3	4	5	6	7	8	9	10
2009		1.96	1.49	1.54	1.10	1.31	2.20	0.58	5.56	5.33
2010		1.98	1.52	1.51	1.08	1.14	3.08	1.32	0.67	
2011		2.00	1.44	1.42	1.33	1.39	1.21	1.95		
2012		2.38	1.43	1.33	1.22	1.23	1.32			
2013		2.38	1.29	1.60	1.16	1.19				
2014		2.10	1.56	1.48	0.92					
2015		2.30	1.45	1.12						
2016		2.12	1.53							
2017		2.12								
2018										-

The CED change is less pronounced in 2013 and 2012 but are still evident.

The CED factors in 2014 and 2015 have changed markedly.

Paid and incurred differences – change in claims mix

- A typical long tail reserving segmentation is to split claims by layers
  - E.g. <20, 20-50, 50-100…
- Inflationary pressures can increase the claim sizes on the smaller layers thus changing the distribution of claim sizes from past historical experience.
- Natural payment delay can cause the paid projection to stay static with the incurred cost increasing from the higher average reported claim size.
  - This results in divergence in paid and incurred projections.
- Diagnostics:
  - Os:Inc ratios
  - Average finalised claim sizes vs average outstanding case estimates
- Potential Solutions:
  - Split the layer into further segmentations e.g. 20-40, 40-50, 50-100
  - Combine the layers e.g. 0-50, 50-100
  - Use frequency/severity modelling to standardise for claim size changes

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Step changes in case estimation

- Step changes in case estimation usually follow two main approaches:
  - An increase or decrease in the case estimates arising from a change in the expected cost of claims. This usually affects the latest diagonal.
  - A change in case estimation practises which can result in an immediate change to case estimates and/or changes in how case estimates subsequently develop.

- Avoidance of changes is the ideal approach but preparation is a close second.

- Changes in case estimation complicates reserving by leading to:
  - Divergences in projection methodologies
  - Inability to rely on historical experience
  - Uncertainty in reserve estimates
  - Placing limits on model usage

Step changes in case estimation – scenario 1

- **Scenario 1**: Consider the earlier example where the case estimates had experienced a one off decrease in the 2012-2015 accident years.
- In this scenario, if the case estimates are a reflection of a temporary view of the claims cost but the management and processing will remain unchanged then one technique for setting the pattern is to select a pattern excluding the latest diagonal.

Set pattern using historical data(excluding leading diagonal) and project off the previous diagonal for affected periods.

New Incurred

AY/DY	1	2	3	4	5	6	7	8		
2009	11,532,500	21,219,800	27,885,585	35,796,880	37,249,975	39,441,150	45,207,400	42,439,600	[illegible]	[illegible]
2010	13,048,200	24,251,200	32,211,920	40,910,720	42,123,280	43,177,680	50,611,200	[illegible]	[illegible]	
2011	12,768,125	24,004,075	30,873,326	37,589,360	42,109,276	45,505,598	[illegible]	[illegible]		
2012	11,244,188	24,712,500	31,804,988	37,563,000	[illegible]	[illegible]	[illegible]			
2013	11,993,800	26,360,000	31,526,560	[illegible]	43,915,760	[illegible]				
2014	13,163,525	25,766,900	34,953,360	43,915,760	[illegible]					
2015	12,504,525	26,640,075	34,632,098	[illegible]						
2016	14,477,406	28,650,025	[illegible]							
2017	15,338,225	[illegible]								
2018	[illegible]									

Step changes in case estimation – scenario 2

- **Scenario 2**: In this scenario the case estimates have experienced a one off increase and subsequent case estimates will be of similar strength but will follow the same claims management pattern.
  - In this situation, it would be reasonable to adopt the same approach as in scenario 1 except the projection would be from the leading diagonal.

- **Scenario 2a**: In this scenario the claims management approach will change and no longer follow past practises:
  - Approach 1: Project off the leading diagonal but use a benchmark development pattern e.g. LMA patterns, similar class. Although the pattern may imply a different approach to claims management, this could result in a reasonable projection which can be finessed over time.
  - Approach 2: Use Berquist-Sherman approach. This highly judgemental approach should be used with caution and one approach could be to adopt an average ultimate from different versions of the method.

Step changes in case estimation – scenario 3

- **Scenario 3:** Consider the scenario where the claims management approach has consistently changed both in strength and approach.

- Approaches:
  - Investigate whether the data could be segmented into the claim sizes most effected to make the case estimates more homogenously consistent in their strength and development pattern.
  - Avoid using incurred or case estimate methodologies. In this instance the actuary should be clear that the data is too inconsistent to model and either avoid using incurred methodologies or project using a benchmark pattern.
  - Use BS method.

Step changes in case estimation – planned changes in case estimation

- **Scenario 4**: In this scenario , there is a planned (and known) change to introduce more ‘prudence’ in case estimates. In this situation we consider the steps/considerations that should be taken to ensure that this change occurs with minimal disturbance to actuarial estimates.

Actuarial	Claims	Other
• Influence/understand whether it is a one off change and/or a change in claims management processes. • Take a cut of the claims data before any changes. • Provide claims with diagnostics to validate updated case estimates. • Validate settlements against new case estimates to calibrate reserving.	• Provide a list of claims that will be affected with their pre-change case estimates. • As above except with their new case estimates. • Make all the changes in one month and at least two months before the half –year end. • Monitor compliance against new procedures.	• Management are bought into the process and understand increased reserve uncertainty. • Be clear what is in/out of scope of any changes. • Ensure other operational changes do not occur at the same time. • Adopt consistent case estimation philosophy across all lines.

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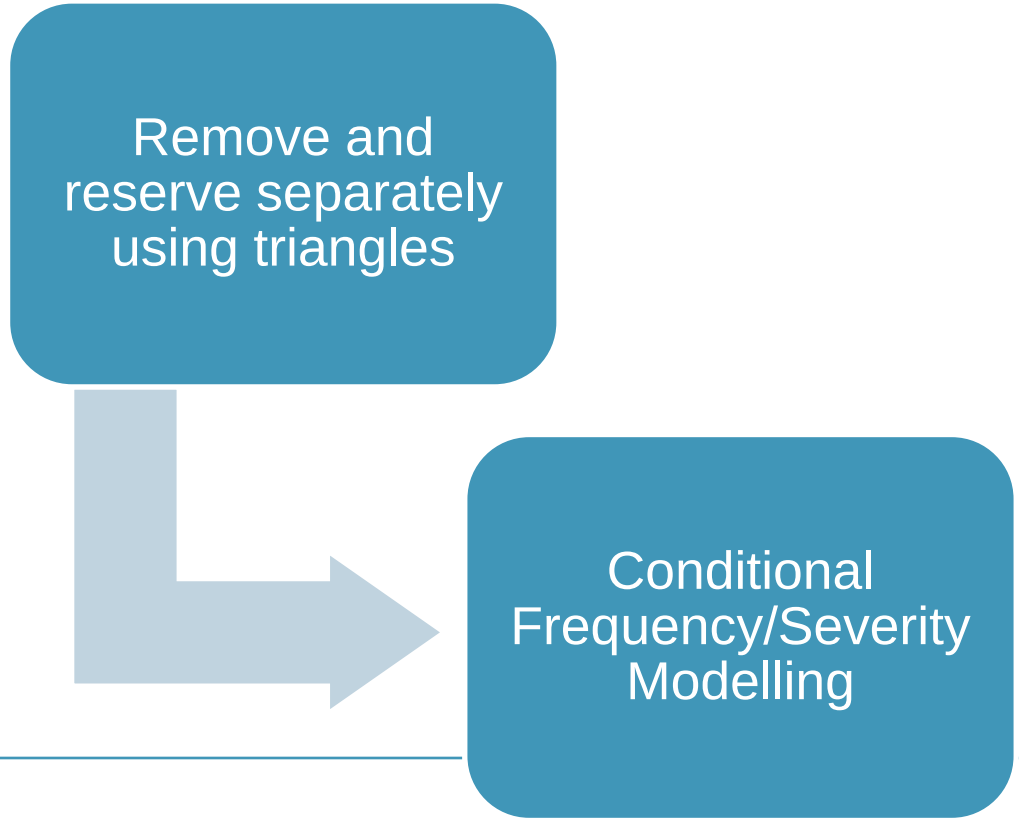
Frequent changes in claims legislation

- Long tail classes are highly exposed to changes in legislation. In particular, third party classes where the insured and the claimant are different, are particularly exposed.
  - This category includes major court outcomes that change case law.
- E.g. Motor insurance is the classic example. A look at motor will show frequent changes in claims legislation/significant court outcomes: Thompstone Vs. Tameside, LASPO, Coles Vs. Heathrington, MoJ portal, Civil Liability Reforms 2018, Ogden rate changes
- Impact on reserving and pricing
  - Inconsistent historical data
  - Lack of comparability of product performance
  - Uncertainty about claims cost leads to uncertainty about pricing
  - Lack of data to estimate impact of changes
  - Caution in reserving

Frequent changes in claims legislation – changes affecting only one Head of Damage

- **Scenario 1**: Consider the scenario of a change in only one Head of Damage. E.g. removal of access to general damages for claims less than 100k
- Potential solutions:



Frequent changes in claims legislation – change to amount of benefits payable

- **Scenario 2**: Consider an upcoming change in motor insurance: Under the Civil Liability Act 2018, whiplash claims for pain, suffering and loss of amenity will be subject to a fixed tariff structure where the quantum of benefits payable will be based on the duration of injury.

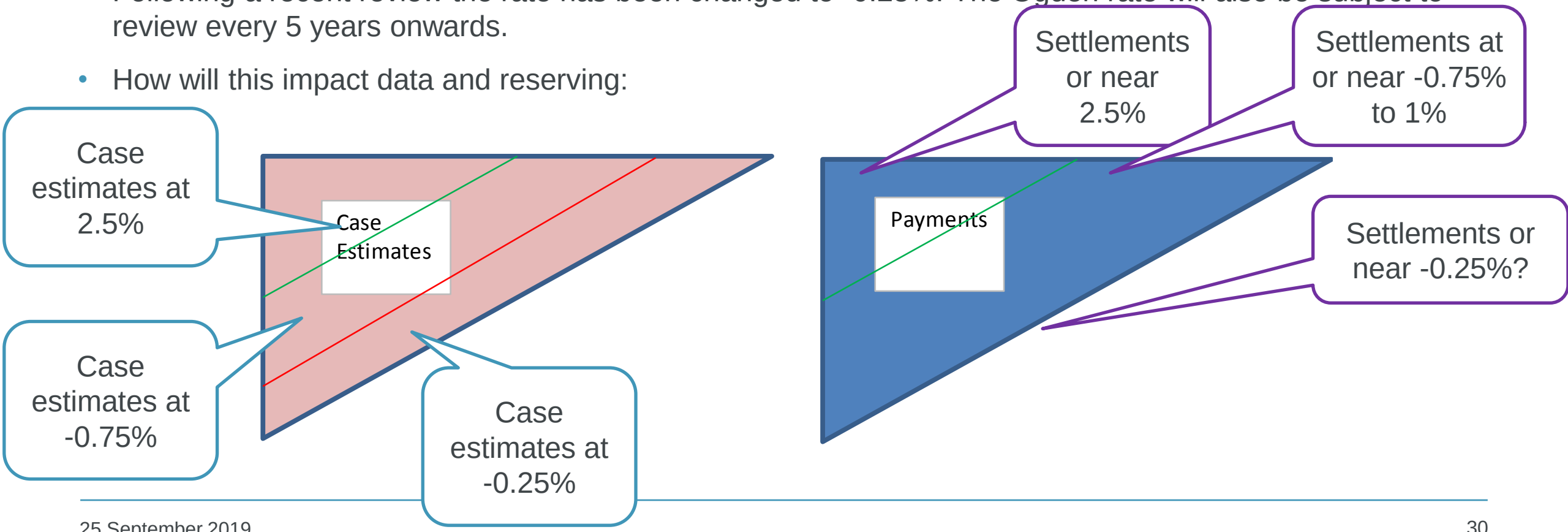
- Impact on reserving:
  - Increased certainty or increased uncertainty?
  - Formulaic reserving approach
  - Changes to segmentation
  - Benefit substitution to other Heads of Damage
  - Data improvement/challenge

Frequent changes in claims legislation – change to amount of benefits payable

- Each of the possible approaches requires a sensible amount of data availability E.g. individual claims data.
  - Underpinning each of the below approaches is the ability to segment data according to size and/or claim type.
  - It is useful to segment the data by claim type to analyse whiplash claims separately or if that is not possible to separate out according to the maximum size of the benefit payable which could be around £4000 (TBC)
- Approach 1:
  - Use a frequency severity approach (e.g. ACPC) with two separate assumption vectors. One for pre reform and one post reform experience. The advantage of this approach is its simplicity as only one triangle needs projecting but it can be based on two separate sets of assumptions.
- Approach 2:
  - Use a PPCF (payment per claim finalised). Under this approach claims finalisation numbers are projected based on finalisation rates and payments per claim finalised are then calculated (PPCF). Future claim settlements are then projected according to the prevailing average finalised claim size for each finalisation period and the number of finalisations expected per finalisation period

Frequent changes in claims legislation – Ogden Rate

- Background: The Ogden rate had been 2.5% from 2001 until March 2017 when it changed to -0.75%. Following a recent review the rate has been changed to -0.25%. The Ogden rate will also be subject to review every 5 years onwards.
- How will this impact data and reserving:

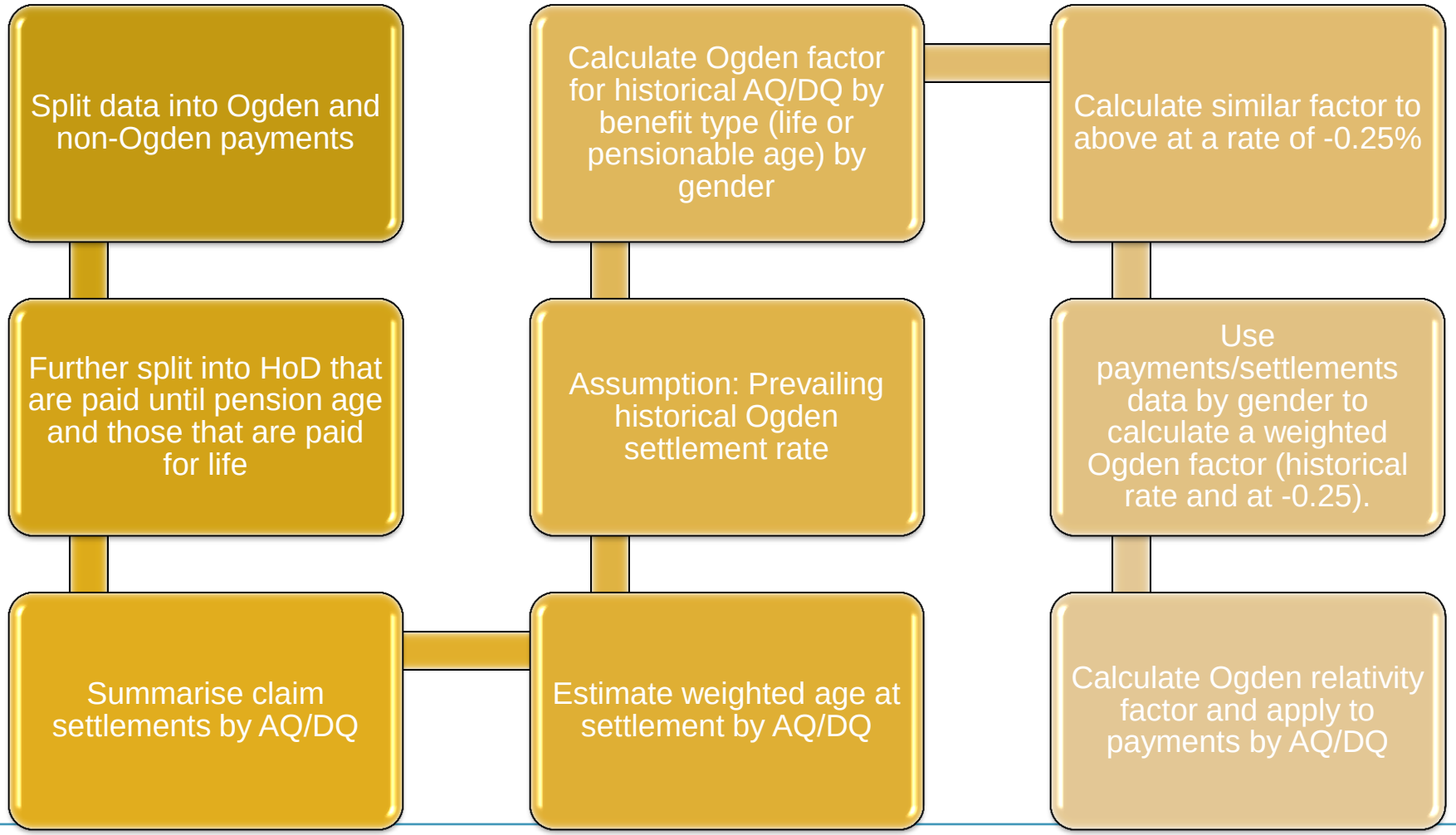


Frequent changes in claims legislation – Ogden Rate
Key Considerations

- How well is the historical settlement experience understood?
  - It is important to understand this to understand how it may be possible restate the data.
- How good is the data and how granular is it?
  - Is it possible to identify Ogden-able Heads of Damage? Was the Ogden settlement rate captured? Is the data on system or held off system?
- What reserving MI do stakeholders need?
- How much reinsurance is in place?
  - A low retention could limit the materiality of the business impact of the Ogden Change.

Frequent changes in claims legislation – Ogden Rate

One practical approach



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Changes in business mix

- Changes in business mix can take numerous forms and they can take time to present challenges to long tail claim reserving.

- Some common changes and their drivers are:
  - New risks: e.g. new types of business being accepted or new coverages added to existing business
  - New binders/books: for some portfolios (e.g. PI) new binders may be written within the same portfolio or class of business
  - Changes in layers: the business might be the same but the business/claims mix might be changing without the company being aware. E.g. the average claim size in the small layer increasing significantly compared to historical experience

- The last point above is challenging to detect but can be a key driver of changes in paid and incurred projections and late stage development in long tail reserves.

Changes in business mix – are reserving changes needed?

- The typical responses to changes in business mix can be changes in the reserving approach and review of reserving assumptions.
  - Another typical response is to do nothing which is often borne from reserving fatigue.

- However, there is merit in challenging the conventional wisdom that changes in business mix have created more uncertainty and/or a change in reserving approach/assumptions is needed.

- Some questions/assumptions that require challenge are:
  - Is the change in business mix material?
  - Is the binder being added or removed substantially different to the rest of the portfolio?
  - What is the impact on the reserving assumptions by taking the risk out of the data?

Changes in business mix – reserving adjustments

- **Scenario 1**: Consider the scenario of a London Market D&O portfolio which has traditionally written big ticket policies but recently taken on some binders offering cover to small to medium sized businesses. Some key changes to claims could be:
  - Smaller average claim sizes
  - Slower reporting
  - Lower legal expenses
  - More settlement opportunities
- Possible reserving approaches:
  - Remove the claims data from the portfolio and uplift any claims with the IBNR uplift in the rest of the portfolio. Possibly adjust the ultimate using a pricing loss ratio relativity factor
  - Reserve in the existing class but validate ultimate loss ratio using a weighted pricing loss ratio
  - Group the claims into a different class of business e.g. general liability for small ticket risks

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Questions

Comments