

CLRS Presentation
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**Workers Compensation Settlements and their Effect on Paid
Loss Development Factor Methods**

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Agenda

- Discussion of paid methods and settlements
- Bias Caused by Settlements
- Adjustment to remove bias caused by past settlements
- Accounting for expected future settlements
- Methods for modeling future payments on settled claims
- Settlement effect on Tail Factors
- Settlement effect on Reserve Ranges
- Comparison of Industry Paid Triangles and Carried Reserves



Paid Method Philosophy

- The partial payment system in workers compensation makes the paid development factor methodology ideal for predicting ultimate losses.
- However, there have been significant distortions to the paid methodology over the past decade.
- This was caused by a change in claims handling practices over the past decade around the settlement of workers compensation claims.
- Adjusting the paid triangle leads to a more theoretically accurate paid method, but the estimation of these adjustments leads to significant parameter risk.
- This coupled with the process risk inherent in Lost Time Work Comp claims makes the estimation of ultimate loss difficult on an absolute basis.



Overview of Settlements

- Claims can settle when the injured worker and the insurance company agree to exchange a one-time lump-sum payment for the unknown future benefits of the Workers' Compensation claim.
- The injured worker gets closure on his WC claim and in some cases, the injured worker can make different life decisions if he does not have to consider the effects decisions would have on his future WC benefits.
 - Part time work possibilities
 - Marriage/Divorce
- The insurance company gets closure on the claim and no longer needs to estimate the future cash flows associated with that claim.
 - Lower variance of ultimate losses
 - Surplus / Equity releases on lower loss reserves
 - Loses opportunity for investment income.



Interactive Question #1

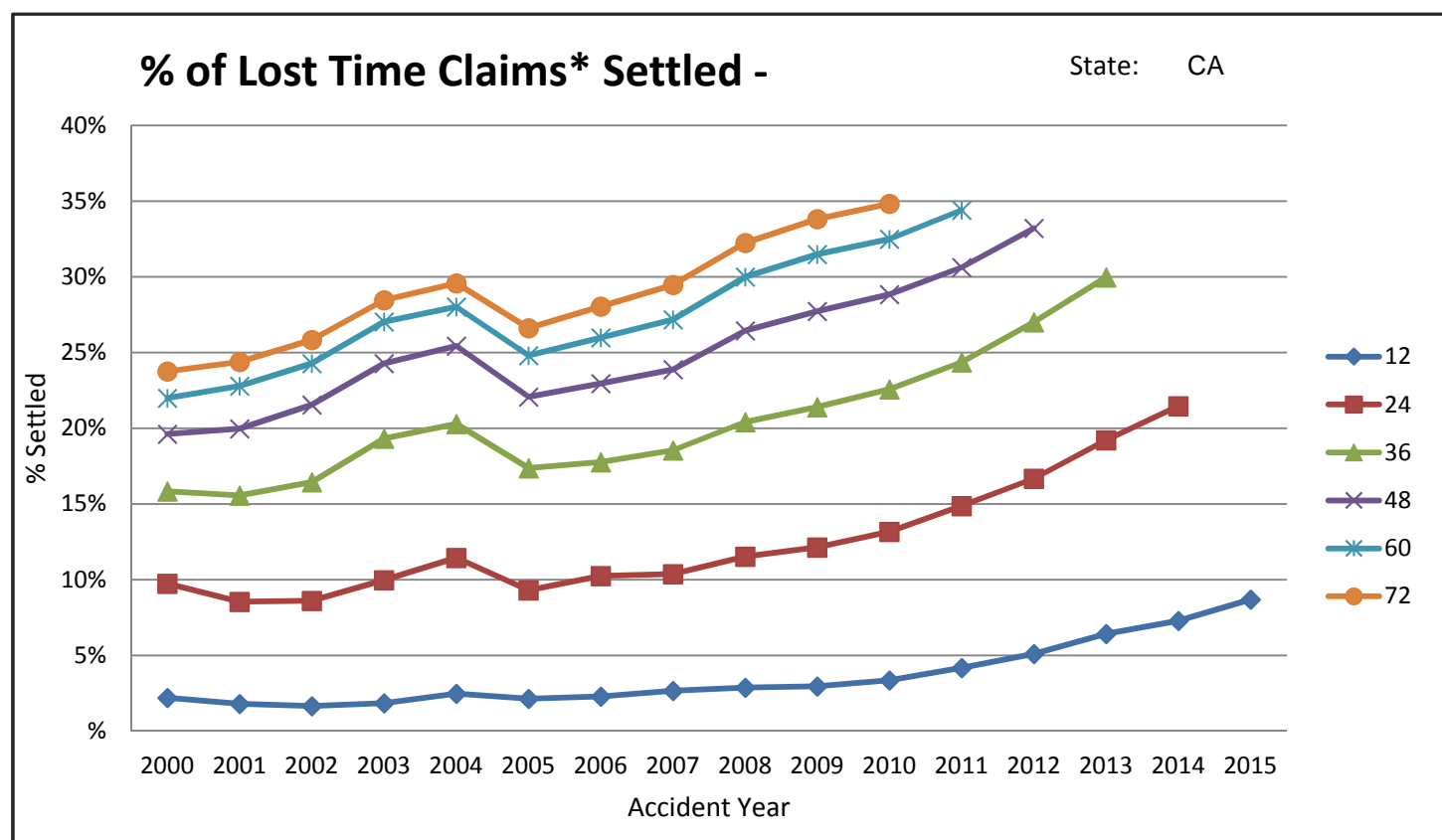
Have you worked with a Workers Compensation dataset that has been influenced by the increase in lump-sum settlements?

- A. Yes
- B. No



Increased Settlement Rates in California

- WCRI methodology uses company data to calculate settlement metrics
- Lump-Sum Settlements in CA have been increasing recently and are expected to continue
- Data in other WCRI states show similar increases, but some states show signs of flattening



* claims with greater than 7 days of lost time

Understanding the Bias Caused by Lump-Sum Settlements





Explanation of the Bias To Ultimate Losses Caused by Settlements

- 5 claims pay 20 per year for 5 years.

Cumulative Paid

AY	Dev								
	12	24	36	48	60	72	84	96	
1	100	200	300	400	500	500	500	500	500
2	100	200	300	400	500	500	500	500	500
3	100	200	300	400	500	500	500		
4	100	200	300	400	500	500			
5	100	200	300	400	500				
6	100	200	300	400					
7	100	200	300						
8	100	200							
9	100								

- Paid LDF Method yields 500 of ultimate loss each year.

Ultimate Losses

AY	Last Diag	CDF	Ultimate
1	500	1.00	500
2	500	1.00	500
3	500	1.00	500
4	500	1.00	500
5	500	1.00	500
6	400	1.25	500
7	300	1.67	500
8	200	2.50	500
9	100	5.00	500



Interactive Question #2

What happens to the ultimate loss of an unadjusted paid method when a claim is settled?

- A. Ultimate loss goes up
- B. Ultimate loss goes down
- C. Ultimate loss is unchanged

Explanation of Bias Cont.

- In AY 8, one claim with 60 of future payments settles in CY 10 with a 50 lump-sum payment (the present value of the future cash flows).

Incremental Development

AY	Dev							
	12	24	36	48	60	72	84	96
2	100	100	100	100	100	0	0	0
3	100	100	100	100	100	0	0	0
4	100	100	100	100	100	0	0	
5	100	100	100	100	100	0		
6	100	100	100	100	100			
7	100	100	100	100				
8	100	100	130					
9	100	100						
10	100							

Cumulative Development

AY	Dev							
	12	24	36	48	60	72	84	96
2	100	200	300	400	500	500	500	500
3	100	200	300	400	500	500	500	500
4	100	200	300	400	500	500	500	
5	100	200	300	400	500	500		
6	100	200	300	400	500			
7	100	200	300	400				
8	100	200	330					
9	100	200						
10	100							



Explanation of Bias Cont.

Paid Loss Development Factors

AY	Dev							
	12-24	24-36	36-48	48-60	60-72	72-84	84-96	96-
2	2.00	1.50	1.33	1.25	1.00	1.00	1.00	
3	2.00	1.50	1.33	1.25	1.00	1.00	1.00	
4	2.00	1.50	1.33	1.25	1.00	1.00		
5	2.00	1.50	1.33	1.25	1.00			
6	2.00	1.50	1.33	1.25				
7	2.00	1.50	1.33					
8	2.00	1.65						
9	2.00							
10								

5 Year Average	2.00	1.53	1.33	1.25	1.00	1.00	1.00
CDF	5.10	2.55	1.67	1.25	1.00	1.00	1.00

- The PLDF method overprojects AY 8 due to the additional payments and overprojects AY9 and AY10 due to the higher 24-36 link ratio.

Ultimate Losses

AY	Last Diag	CDF	Ultimate
2	500	1.00	500
3	500	1.00	500
4	500	1.00	500
5	500	1.00	500
6	500	1.00	500
7	400	1.25	500
8	330	1.67	550
9	200	2.55	510
10	100	5.10	510



Explanation of Bias Cont.

- The following year, another claim settles for 50, this time for AY 9. AY 8 has only 80 in payments because of the previous settlement.

Incremental Paid

AY	Development Age							
	12	24	36	48	60	72	84	96
3	100	100	100	100	100	0	0	0
4	100	100	100	100	100	0	0	0
5	100	100	100	100	100	0	0	
6	100	100	100	100	100	0		
7	100	100	100	100	100			
8	100	100	130	80				
9	100	100	130					
10	100	100						
11	100							

Cumulative Paid

AY	Development Age							
	12	24	36	48	60	72	84	96
3	100	200	300	400	500	500	500	500
4	100	200	300	400	500	500	500	500
5	100	200	300	400	500	500	500	
6	100	200	300	400	500	500		
7	100	200	300	400	500			
8	100	200	330	410				
9	100	200	330					
10	100	200						
11	100							



Explanation of Bias Cont.

Paid Loss Development Factors

AY	Development Age							
	12-24	24-36	36-48	48-60	60-72	72-84	84-96	96-
3	2.00	1.50	1.33	1.25	1.00	1.00	1.00	
4	2.00	1.50	1.33	1.25	1.00	1.00	1.00	
5	2.00	1.50	1.33	1.25	1.00	1.00		
6	2.00	1.50	1.33	1.25	1.00			
7	2.00	1.50	1.33	1.25				
8	2.00	1.65	1.24					
9	2.00	1.65						
10	2.00							
11								

	Development Age							Tail
	12-24	24-36	36-48	48-60	60-72	72-84	84-96	
5 Year Average	2.00	1.56	1.32	1.25	1.00	1.00	1.00	1.00
CDF	5.13	2.56	1.64	1.25	1.00	1.00	1.00	1.00

- The PLDF method still overprojects AY 8 due to the additional payments, however the subsequent AY's will have LDFs that are both biased high and biased low.

Ultimate Losses

AY	Last Diag	CDF	Ultimate
3	500	1.00	500
4	500	1.00	500
5	500	1.00	500
6	500	1.00	500
7	500	1.00	500
8	410	1.25	513
9	330	1.64	543
10	200	2.56	513
11	100	5.13	513

Explanation of Bias Cont.

- Over time, the bias caused by the increase in settlements decreases as the accident year gets more mature.

AY	Calendar Year Ultimate Loss							
	9	10	11	12	13	14	15	16
1	500	500	500	500	500	500	500	500
2	500	500	500	500	500	500	500	500
3	500	500	500	500	500	500	500	500
4	500	500	500	500	500	500	500	500
5	500	500	500	500	500	500	500	500
6	500	500	500	500	500	500	500	500
7	500	500	500	500	500	500	500	500
8	500	550	513	490	490	490	490	490
9	500	510	543	508	490	490	490	490
10		510	513	530	504	490	490	490
11			513	511	518	499	490	490
12				511	509	506	495	490
13					509	506	495	490
14						506	495	490
15							495	490
16								490

Accident Year

Calendar Year

- In a real example, the bias caused by the increase in settlements can take decades to flow through the paid methodology.

Adjusting Paid Triangle for Known Settlements





Interactive Question #3

What should happen to ultimate losses when there is an increase in lump-sum settlements beyond what has settled in the past?

- A. Ultimate loss goes up
- B. Ultimate loss goes down
- C. Ultimate loss is unchanged

Adjusting the Paid Method

- Same example, one settlement for 50 in AY 8
- Settlement has to be identified and accounted for separately.

Incremental Paid

AY	Dev							
	12	24	36	48	60	72	84	96
2	100	100	100	100	100	0	0	0
3	100	100	100	100	100	0	0	0
4	100	100	100	100	100	0	0	
5	100	100	100	100	100	0		
6	100	100	100	100	100			
7	100	100	100	100				
8	100	100	130					
9	100	100						
10	100							

Incremental Settlements

AY	Dev							
	12	24	36	48	60	72	84	96
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	
5	0	0	0	0	0	0		
6	0	0	0	0	0			
7	0	0	0	0				
8	0	0	50					
9	0	0						
10	0							

Adjusting the Paid Method – Cont.

- The actuary needs to estimate the amount that a claim would have paid had it not settled.
- In this example, it is known that the claim would have paid 20 per year for the next 3 years.
- Methods of estimating the future payments are discussed later in the presentation.

What the settled claim would have paid had it not settled

AY	Dev							
	12	24	36	48	60	72	84	96
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	
5	0	0	0	0	0	0		
6	0	0	0	0	0			
7	0	0	0	0				
8	0	0	20	20	20			
9	0	0						
10	0							



Settlement Neutral Triangle

- Unadjusted Paid Triangle – Triangle of Lump-Sum Settlements + Triangle of Modeled Payments

Settlement Neutral Incremental Paid

AY	Dev							
	12	24	36	48	60	72	84	96
2	100	100	100	100	100	0	0	0
3	100	100	100	100	100	0	0	0
4	100	100	100	100	100	0	0	
5	100	100	100	100	100	0		
6	100	100	100	100	100			
7	100	100	100	100				
8	100	100	100					
9	100	100						
10	100							

- Ultimate losses on a Settlement Neutral basis are back to 500 for every accident year.
- However, we know that the ultimate loss for AY 8 is lower because of the effect of settling the claim.

Ultimate Losses

AY	Last Diag	CDF	Settlement Neutral Ultimate
2	500	1.00	500
3	500	1.00	500
4	500	1.00	500
5	500	1.00	500
6	500	1.00	500
7	400	1.25	500
8	300	1.67	500
9	200	2.50	500
10	100	5.00	500



Ultimate Reduction Adjustment (URA)

- On average, settlements reduce the ultimate loss that an insurance company pays to handle a workers compensation claim.
- The ultimate loss should be reduced by the difference between the actual settlement amount and the theoretical stream of cash flows.
- $URA = \text{Amount claim would have paid} - \text{settlement}$
- AY8: $URA = 60 - 50 = 10$
- URA is not savings. To understand the benefit to the insurance company, careful consideration has to be paid to the foregone investment income as well as any surplus/equity considerations.

Ultimate Losses

AY	Last Diag	CDF	Settlement Neutral Ultimate	Savings/ URA	Settlement Adjusted Ultimate
2	500	1.00	500	0	500
3	500	1.00	500	0	500
4	500	1.00	500	0	500
5	500	1.00	500	0	500
6	500	1.00	500	0	500
7	400	1.25	500	0	500
8	300	1.67	500	10	490
9	200	2.50	500	0	500
10	100	5.00	500	0	500

Adjusting Ultimate Losses for Future Settlements





Expectation for Future Settlements

- Without accounting for future settlements, accident years would be priced to have higher expected loss ratios. Over time, after the claims have had the opportunity to settle, the loss ratios would come down.
- In the case of consistently high settlement rates, traditional methods would account for expected settlements within the loss development factors.
 - Loss development factors would be higher at the early development points when the claims are settling, but lower as the claims no longer make payments.

Settlement Adjusted Ultimate Loss without URA Reserve

AY	Calendar Year							
	9	10	11	12	13	14	15	16
1	500	500	500	500	500	500	500	500
2	500	500	500	500	500	500	500	500
3	500	500	500	500	500	500	500	500
4	500	500	500	500	500	500	500	500
5	500	500	500	500	500	500	500	500
6	500	500	500	500	500	500	500	500
7	500	500	500	500	500	500	500	500
8	500	490	490	490	490	490	490	490
9	500	500	490	490	490	490	490	490
10		500	500	490	490	490	490	490
11			500	500	490	490	490	490
12				500	500	490	490	490
13					500	500	490	490
14						500	500	490
15							500	500
16								500



Expectation for Future Settlements

Cumulative Paid

AY	Development Age							
	12	24	36	48	60	72	84	96
2	100	200	300	400	500	500	500	500
3	100	200	300	400	500	500	500	500
4	100	200	300	400	500	500	500	
5	100	200	300	400	500	500		
6	100	200	300	400	500			
7	100	200	300	415				
8	100	200	330					
9	100	240						
10	100							

In this example, there are 3 claims resolved with a Lump-Sum settlement in CY 10.

- AY7 claim settles for 35 (would have paid 40)
- AY8 claim settles for 40 (would have paid 60, same as before)
- AY9 claim settles for 60 (would have paid 80)

- Unadjusted paid method significantly overstates ultimate loss
- New ultimate loss should be lower than previous estimate
- AY 10 needs an estimate of future settlement
 Otherwise pricing for AY 11 will be uncompetitive

Ultimate Losses

AY	Last Diag	CDF	Unadj Ultimate	Sett Adj Ultimate
2	500	1.00	500	500
3	500	1.00	500	500
4	500	1.00	500	500
5	500	1.00	500	500
6	500	1.00	500	500
7	415	1.25	519	495
8	330	1.68	554	490
9	240	2.57	617	480
10	100	5.34	534	500



Expectation for Future Settlements - cont.

Unadjusted Incremental Paid

AY	Dev							
	12	24	36	48	60	72	84	96
2	100	100	100	100	100	0	0	0
3	100	100	100	100	100	0	0	0
4	100	100	100	100	100	0	0	
5	100	100	100	100	100	0		
6	100	100	100	100	100			
7	100	100	100	115				
8	100	100	130					
9	100	140						
10	100							

Latest diagonal of unadjusted paid triangle is overstated due to settlements

Incremental Settlements

AY	Dev							
	12	24	36	48	60	72	84	96
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	
5	0	0	0	0	0	0		
6	0	0	0	0	0			
7	0	0	0	35				
8	0	0	50					
9	0	60						
10	0							

Triangle of identified settlements is created



Expectation for Future Settlements - cont.

What the settled claim would have paid had it not settled

AY	Dev								
	12	24	36	48	60	72	84	96	
2	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0
7	0	0	0	20	20	0	0	0	0
8	0	0	20	20	20	0	0	0	0
9	0	20	20	20	20	0	0	0	0
10	0	0	0	0	0	0	0	0	0

Triangle of modeled payments is derived using the individual claim characteristics

Settlement Neutral Cumulative Paid

AY	Dev								
	12	24	36	48	60	72	84	96	
2	100	200	300	400	500	500	500	500	500
3	100	200	300	400	500	500	500	500	500
4	100	200	300	400	500	500	500	500	500
5	100	200	300	400	500	500	500	500	500
6	100	200	300	400	500	500	500	500	500
7	100	200	300	400	500	500	500	500	500
8	100	200	300	400	500	500	500	500	500
9	100	200	300	400	500	500	500	500	500
10	100	200	300	400	500	500	500	500	500

Settlement neutral triangle is calculated by taking the unadjusted paid triangle – settlements + modeled payments

Expectation for Future Settlements - cont.

URA on Settled Claims

AY	Dev								Total
	12	24	36	48	60	72	84	96	
2	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0
7	0	0	0	5	0	0	0	0	5
8	0	0	10	0	0	0	0	0	10
9	0	20	0	0	0	0	0	0	20
10	0	0	0	0	0	0	0	0	0

URA is the sum of modeled payments – actual settlement value; done for each settlement

Ultimate Losses

AY	Last Diag	CDF	Settlement Neutral Ultimate	URA	Settlement Adjusted Ultimate
2	500	1.00	500	0	500
3	500	1.00	500	0	500
4	500	1.00	500	0	500
5	500	1.00	500	0	500
6	500	1.00	500	0	500
7	400	1.25	500	5	495
8	300	1.67	500	10	490
9	200	2.50	500	20	480
10	100	5.00	500	0	500

The settlement adjusted ultimate loss accurately reflects actual settlements and URA to date but leaves the most recent years overstated because AY 10 claims have not reached the point where lump-sum settlements are a viable option



Expectation for Future Settlements – Method 1 – URA / SNU

- In this method, the URA (to date) is divided by the SNU for the years that have significant settlement activity.
 - AYs 7-9 are averaged to get a selected URA/SNU ratio of 2.3%
 - That is applied to the SNU for AY 10 to get a URA Reserve of 11.7
 - Ultimate loss for AY10 is 488.3

Ultimate Losses

AY	Last Diag	CDF	Settlement Neutral Ultimate	URA	Settlement Adjusted Ultimate	URA / SNU	Selection	URA Reserve	Selected Ultimate Loss
2	500	1.00	500	0	500	0.0%			500
3	500	1.00	500	0	500	0.0%			500
4	500	1.00	500	0	500	0.0%			500
5	500	1.00	500	0	500	0.0%			500
6	500	1.00	500	0	500	0.0%			500
7	400	1.25	500	5	495	1.0%			495
8	300	1.67	500	10	490	2.0%			490
9	200	2.50	500	20	480	4.0%			480
10	100	5.00	500	0	500	0.0%	2.3%	11.7	488.3

2.3%

- In times of increased settlement activity, this method will overproject ultimate loss, but not nearly as much as an ultimate loss without a URA reserve, and especially an unadjusted paid method.



Expectation for Future Settlements – Method 2 – Incremental URA

URA / SNU

AY	Dev									Total
	12	24	36	48	60	72	84	96		
2	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
7	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
8	0%	0%	2%	0%	0%	0%	0%	0%	0%	2%
9	0%	4%	0%	0%	0%	0%	0%	0%	0%	4%
10	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1-Yr-Ave	0.0%	4.0%	2.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2-Yr-Ave	0.0%	2.0%	1.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

URA (to date) is divided by the SNU and then put into triangle form to “develop” the URA to ultimate.

Future URA / SNU

AY	Dev									Total
	12	24	36	48	60	72	84	96		
2										0%
3										0%
4								0%		0%
5							0%	0%		0%
6						0%	0%	0%		0%
7					0%	0%	0%	0%		0%
8				1%	0%	0%	0%	0%		1%
9			2%	1%	0%	0%	0%	0%		3%
10		4%	2%	1%	0%	0%	0%	0%		7%

Incremental URA method assumes that there is always an “infinite” amount of claims available to settle and that claims settle randomly throughout the life of the accident year.



Expectation for Future Settlements – Incremental URA

- The future incremental URA/SNU ratios are applied to the SNU to get a URA reserve.

Ultimate Losses

AY	Last Diag	CDF	Settlement Neutral Ultimate	URA to date	Settlement Adjusted Ultimate	Incr URA/SNU	URA Reserve	Selected Ultimate Loss
2	500	1.00	500	0	500	0.0%	0	500
3	500	1.00	500	0	500	0.0%	0	500
4	500	1.00	500	0	500	0.0%	0	500
5	500	1.00	500	0	500	0.0%	0	500
6	500	1.00	500	0	500	0.0%	0	500
7	400	1.25	500	5	495	0.0%	0	495
8	300	1.67	500	10	490	1.0%	5	485
9	200	2.50	500	20	480	3.0%	15	465
10	100	5.00	500	0	500	7.0%	35	465

- Increasing settlement activity => overprojection of URA; Inadequate Ultimate Loss
 - If settlement rates increase in the following year, ultimate losses will decrease, making inadequacy worse.
 - Solution: End incremental URA earlier than data would suggest.



Expectation for Future Settlements – Weighting Method 1 and 2

- In a time of increasing settlements, the aggressiveness of the ultimate loss is a function of the actuary's expectation for future settlements.
 - The conservative actuary could give more weight to method 1, but highlight the opportunity for future reserve releases if the company continues to settle claims at the increased rate.
 - The actuary can also see where the current reserve fits within this range and track the weighting over time.
 - Methods 1 and 2 should converge over time as the new, higher level of settlements is reached and is then consistent.

Ultimate Losses

AY	Last Diag	CDF	Settlement Neutral Ultimate	URA	Settlement Adjusted Ultimate	URA/SNU Method 1	Incr. URA/SNU Method 2	Selected URA Reserve (50-50)	Selected Ultimate Loss
2	500	1.00	500	0	500			0.0	500.0
3	500	1.00	500	0	500			0.0	500.0
4	500	1.00	500	0	500			0.0	500.0
5	500	1.00	500	0	500			0.0	500.0
6	500	1.00	500	0	500			0.0	500.0
7	400	1.25	500	5	495			0.0	495.0
8	300	1.67	500	10	490	0.0	5.0	2.5	487.5
9	200	2.50	500	20	480	0.0	15.0	7.5	472.5
10	100	5.00	500	0	500	11.7	35.0	23.3	476.7



Expectation for Future Settlements – Other Methods

- Incremental URA / Open Claim Count
 - Years with more open claim counts get higher URA reserves.
 - Doesn't consider that most willing claimants settle first
 - Future settlements more difficult to procure
- Incremental URA/ Case Reserve Outstanding
 - Years with higher case reserves get higher URA reserves.
 - Doesn't consider that most willing claimants settle first
 - Decreasing case reserve levels will reduce URA reserve over time
- Incremental URA / Settlement Neutral Unpaid Loss
 - Most complete way of calculating URA reserve
 - Must be done recursively
 - Significant parameter risk results in higher dislocations



Conclusion

- The Settlement Adjustment Method is a sophisticated actuarial method
 - Could / should be done separately by Medical and Lost Wages, by state
 - Predicts ultimate losses with reasonable accuracy
 - Can be used to understand dislocations from one analysis to the next

 - Drawbacks include the overall complexity compared to an unadjusted LDF method
 - Calculating the modeled cash flows is an inexact science with parameters that can move the method ultimate loss a material amount.

- This method can be used in conjunction with other actuarial methods to give management an overall picture of the Work Comp reserves for the company
 - Over time, methods should converge towards the “true ultimate” of the accident year

Appendix 1:

How Much Would A Claim Have Paid Had It Not Settled?





Modeled Future Payments on Settled Claims - Method 1

- When a claim is ready to be settled, the claim handler must have a modeled set of cash flows in order to calculate the settlement amount.
- On an individual claim basis, those assumptions and cash flows can be used directly.

Yearly Payments	1000
Inflation Rate	2.0%
Interest Rate	3.5%
Duration	5 Years

Payment	Nominal Amount	Discounted Amount
0	1,000	1,000
1	1,020	986
2	1,040	971
3	1,061	957
4	1,082	943

Total	5,204	4,857
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URA	347
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- The difference between the nominal amount of the future payments and the actual settlement amount is the URA.
- If this claim actually settled for \$4,800, the URA on this claim would be \$404.



Modeled Future Payments on Settled Claims - Method 2

- On a large book of business, it is not practical to look at the claim notes for every claim that settled, especially smaller (<\$100k) settlements.
- Given what is known, how much would the claim have paid out had it not settled?
 - Settlement amount – Known
 - Average amount paid before settlement – Known
 - Future Medical and Indemnity inflation – Estimate
 - Discount rate for future cash flows – Estimate
- With these variables, the actuary can back into a stream of future cash flows for a claim.



Modeled Future Payments on Settled Claims - Method 2 - Cont.

Claim	Calendar Year						
	0	1	2	3	4	5	6
1	X	X	990	1,000	1,010	8,000	

There was a settlement of 8,000 on the claim during year 5.

The average inflation rate during the previous 3 years was 1%.

The average payment during the evaluation period was 1000.

The average payment date was year 3.

Trending the 1,000 average payment from year 3 to year 5 is 1,020 in year 5.

Settlements have an average discount rate of 3.5%.

The settlement multiplier is $8,000 / 1020 = 7.8$

- The settlement multiplier can be used to back into the duration by using a table.
- The 7.8 multiplier is in between duration 8 and 9.
- Interpolating results in an duration of 8.5.

Payment	Incremental Nominal Payment	Cumulative Nominal Payment	Incremental Discounted Payment	Cumulative Discounted Payment	Duration
0	1.00	1.00	1.00	1.00	1
1	1.01	2.01	0.98	1.98	2
2	1.02	3.03	0.95	2.93	3
3	1.03	4.06	0.93	3.86	4
4	1.04	5.10	0.91	4.76	5
5	1.05	6.15	0.88	5.65	6
6	1.06	7.21	0.86	6.51	7
7	1.07	8.29	0.84	7.36	8
8	1.08	9.37	0.82	8.18	9
9	1.09	10.46	0.80	8.98	10
10	1.10	11.57	0.78	9.76	11
11	1.12	12.68	0.76	10.53	12
12	1.13	13.81	0.75	11.27	13



Modeled Future Payments on Settled Claims - Method 2 - Cont.

- The incremental nominal payments are placed into the future calendar years

	<u>Calendar Year</u>									
<u>Claim</u>	5	6	7	8	9	10	11	12	13	
1	1,020	1,030	1,041	1,051	1,062	1,072	1,083	1,094	1,105	

- The final calendar year is adjusted to reflect that only .5 of the yearly payments are made

	<u>Calendar Year</u>									
<u>Claim</u>	5	6	7	8	9	10	11	12	13	
1	1,020	1,030	1,041	1,051	1,062	1,072	1,083	1,094	552	

- Alternatively, modeled cash flows can be extended out indefinitely, but multiplied by a decrement model that considers the chance that the injured worker would have returned to work or was lost to mortality.

Appendix 2:

Tail Factors in a Post-Settlement World?





Sherman Diss Tail Factor Methodology

1. Square a triangle of open claim count up to the tail
 2. Square a paid triangle up to the tail
 3. Calculate a triangle of Paid per Prior Open Claim
 4. Take open claims at the tail and decrement them to zero using mortality tables
 5. Estimate the paid per prior open at the tail and use escalation factors to estimate the paid per prior open after the tail.
 6. Multiply paid per prior open and the number of open claims in the tail at each point in time to estimate the amount paid in the tail
 7. Divide the amount paid in the tail by the amount paid before the tail
- In a time of increasing settlements, the tail factors calculated using this methodology will increase.
 - Claim settlements increase the amount paid before the tail and decrease the amount paid in the tail.



Sherman Diss Tail Factors with Increasing Settlements

- A new claim closure triangle must be calculated where the closure from claim settlement is removed from the triangle, and the claim closure is put back into the triangle at the time that the claim would have closed, had it not settled.
- This can be used in conjunction with the settlement neutral paid triangle to create tail factors as if no claim ever settled with a lump-sum.
- Note: tail factors are still extremely difficult to calculate and must produce diagnostics such as paid per open claim and IBNR per open claim as reasonability checks.

Appendix 3:

Settlement Affect on Reserve Ranges





Interactive Question #4

What should happen to the Workers Compensation volatility of ultimate loss as carriers increase their settlement activity?

- A. Volatility increases
- B. Volatility decreases
- C. Volatility is unchanged

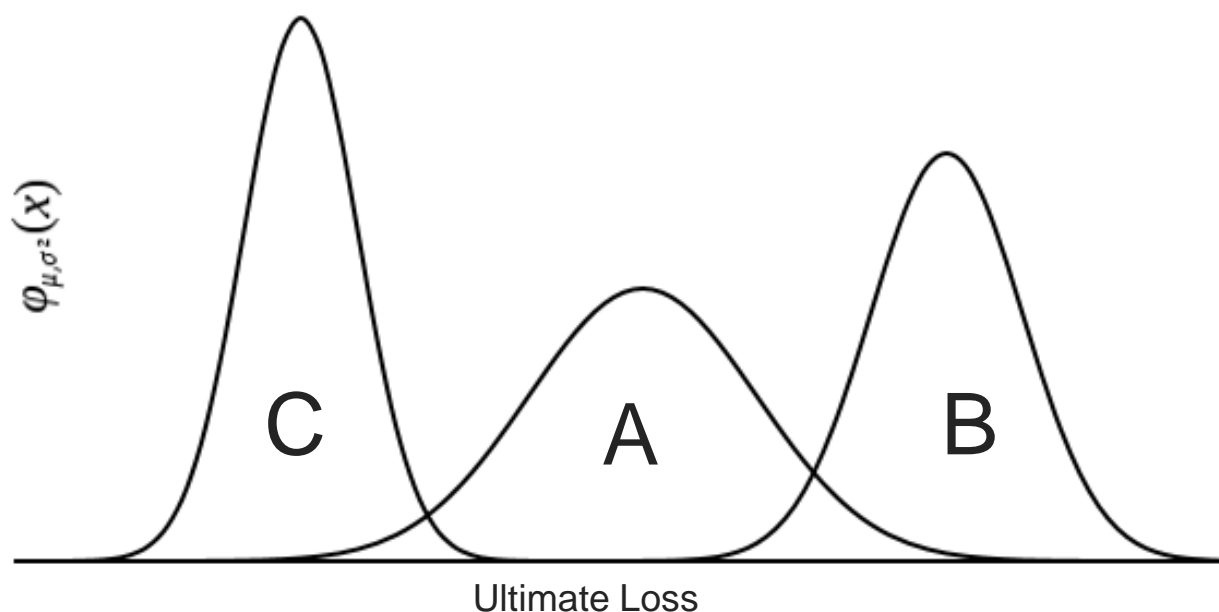


Reserve Range Methodology

- Over Dispersed Poisson Method (ODP)
 - Residuals are calculated to measure variance between your actual versus expected incremental losses.
 - Residuals are then used to resample incremental losses resulting in new simulated reserves.
 - The standard deviation is based on the variability among these 25,000 simulated reserves.

- ODP Method with settlements
 - Unadjusted ODP method will show a higher confidence interval as claim settlements increase.
 - ODP method on the Settlement Neutral triangle will have a smaller confidence interval
 - Confidence interval is reduced further after considering that a percentage of the settlement neutral claim counts are closed.

Settlement Affect on Reserve Ranges



- A Confidence interval of unadjusted paid method contains volatility caused by large settlement payments
- B Confidence interval of settlement neutral triangle has a higher mean, but lower standard deviation because many of the largest payments are removed
- C Confidence interval after settlement adjustment has the lowest mean and the lowest confidence interval due to the settling of claims and the URA

Appendix 4:

Settlement Affects to Industry WC Schedule P





Analysts Use Paid LDF Methods to Comment on the Adequacy of Company Loss Reserves

ANNUAL STATEMENT FOR THE December 31, 2017 OF THE P&C Combined Industry

SCHEDULE P - PART 3 - Workers' Compensation

Years in Which Losses Were Incurred	1	2	3	4	5	6	7	8	9	10
	CUMULATIVE PAID NET LOSSES AND DEFENSE AND COST CONTAINMENT EXPENSES REPORTED AT YEAR END (\$000 OMITTED)									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1 Prior	0	16,756,523	26,137,649	33,742,127	40,250,918	46,698,133	51,367,855	55,704,200	59,564,925	63,375,031
2 2008	5,766,921	12,508,151	16,452,577	19,033,709	20,715,721	21,982,137	22,918,654	23,590,174	24,180,360	24,734,042
3 2009	XXX	5,242,463	11,366,743	14,964,062	17,201,172	18,874,195	20,034,037	20,798,831	21,456,667	22,085,183
4 2010	XXX	XXX	5,366,125	11,699,158	15,431,904	17,852,926	19,505,666	20,500,196	21,369,980	22,135,236
5 2011	XXX	XXX	XXX	5,556,845	11,945,192	15,767,843	18,165,671	19,747,174	20,945,793	21,945,250
6 2012	XXX	XXX	XXX	XXX	5,415,084	11,765,198	15,318,008	17,542,947	19,160,753	20,340,572
7 2013	XXX	XXX	XXX	XXX	XXX	5,261,205	11,505,673	15,093,223	17,473,392	19,067,201
8 2014	XXX	XXX	XXX	XXX	XXX	XXX	5,302,544	11,575,623	15,353,102	17,734,624
9 2015	XXX	XXX	XXX	XXX	XXX	XXX	XXX	5,148,107	11,672,615	15,487,977
10 2016	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	5,182,826	11,312,412
11 2017	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	5,146,394

- The Schedule P Part 3 paid triangle can be developed to ultimate using the Paid LDF method.
- 5-Year averages are derived using prior versions of the industry Schedule P



Industry LDFs are Trending Consistent with Settlement Practices

AY	12-24	24-36	36-48	48-60	60-72	72-84	84-96	96-108	108-120	120-Ult
2002	2.306	1.348	1.146	1.085	1.048	1.043	1.028	1.022	1.032	1.228
2003	2.237	1.326	1.149	1.088	1.060	1.038	1.031	1.025	1.020	1.218
2004	2.141	1.284	1.143	1.088	1.054	1.039	1.032	1.026	1.023	1.205
2005	2.057	1.295	1.147	1.085	1.055	1.040	1.030	1.028	1.017	1.212
2006	2.126	1.329	1.145	1.083	1.058	1.039	1.039	1.021	1.018	1.203
2007	2.196	1.308	1.146	1.090	1.057	1.046	1.030	1.032	1.011	1.195
2008	2.169	1.315	1.157	1.088	1.061	1.043	1.029	1.025	1.023	
2009	2.168	1.316	1.149	1.097	1.061	1.038	1.032	1.029		
2010	2.180	1.319	1.157	1.093	1.051	1.042	1.036			
2011	2.150	1.320	1.152	1.087	1.061	1.048				
2012	2.173	1.302	1.145	1.092	1.062					
2013	2.187	1.312	1.158	1.091						
2014	2.183	1.326	1.155							
2015	2.267	1.327								
2016	2.183									
2017										

- By 3 years of development (36 months), many claims have reached Maximum Medical Improvement (MMI) and are at the point where settlement becomes a more viable option.
- By the time a claim is 10 years years old (120 months) many of the claims available to settle have already settled. Most of what is left is the ongoing payments on open claims. Increased early settlements suggest that development after 10 years will continue to decrease.



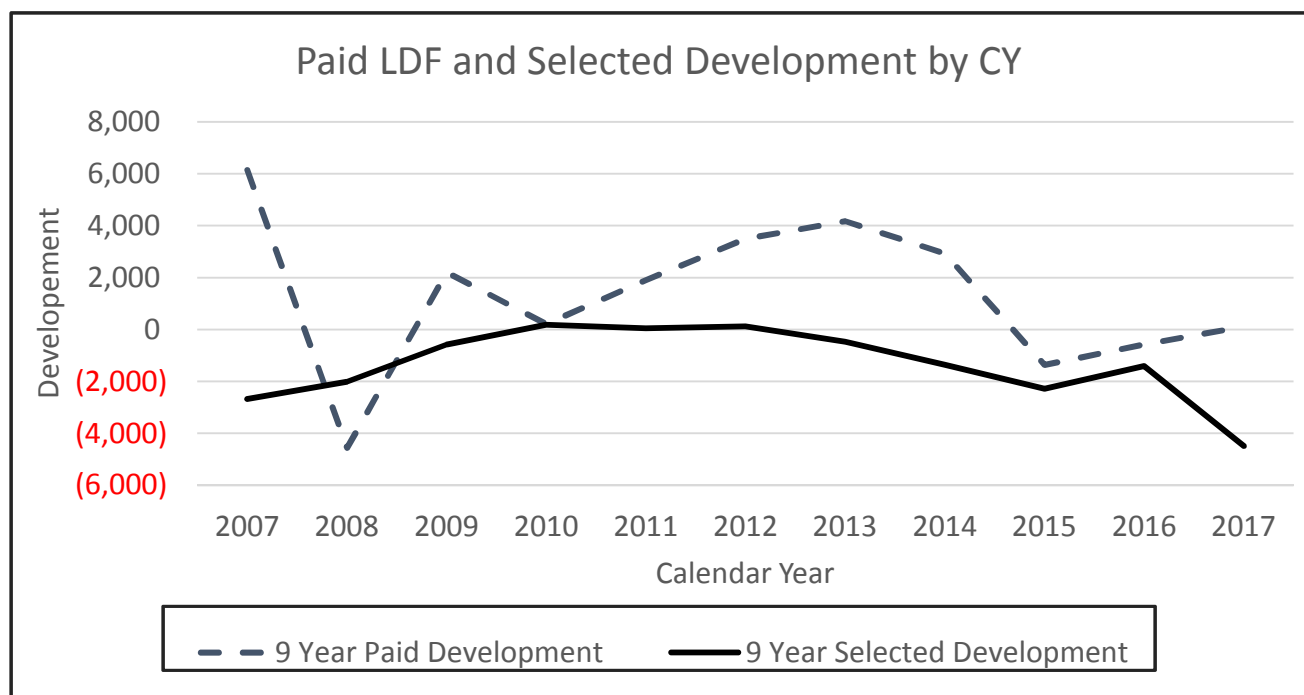
Industry Paid LDF Example

AY	1 Paid (M's)	2 CDF	3=1x2 Paid LDF Ultimate	4 Selected From Part 2	5=4-3 Redundancy % of Ultimate	6=5/4
2008	24,734	1.207	29,845	29,548	(297)	-1.0%
2009	22,085	1.229	27,141	26,667	(474)	-1.8%
2010	22,135	1.262	27,942	27,144	(798)	-2.9%
2011	21,945	1.304	28,622	27,793	(828)	-3.0%
2012	20,341	1.361	27,681	27,186	(495)	-1.8%
2013	19,067	1.441	27,484	27,256	(228)	-0.8%
2014	17,735	1.574	27,917	27,847	(69)	-0.2%
2015	15,488	1.816	28,120	28,514	394	1.4%
2016	11,312	2.392	27,058	29,060	2,002	6.9%
2017	5,146	5.259	27,063	29,675	2,612	8.8%
Total	179,989		278,872	280,690	1,818	0.6%

- Ultimate losses calculated using a Paid LDF method can be compared to the carried ultimate loss to estimate the redundancy of the industry reserves
- Expected trends in loss development factors suggest that redundancy could be higher.
- Other distortions caused by reforms and or lower than expected severity make the estimation of ultimate losses less reliable.



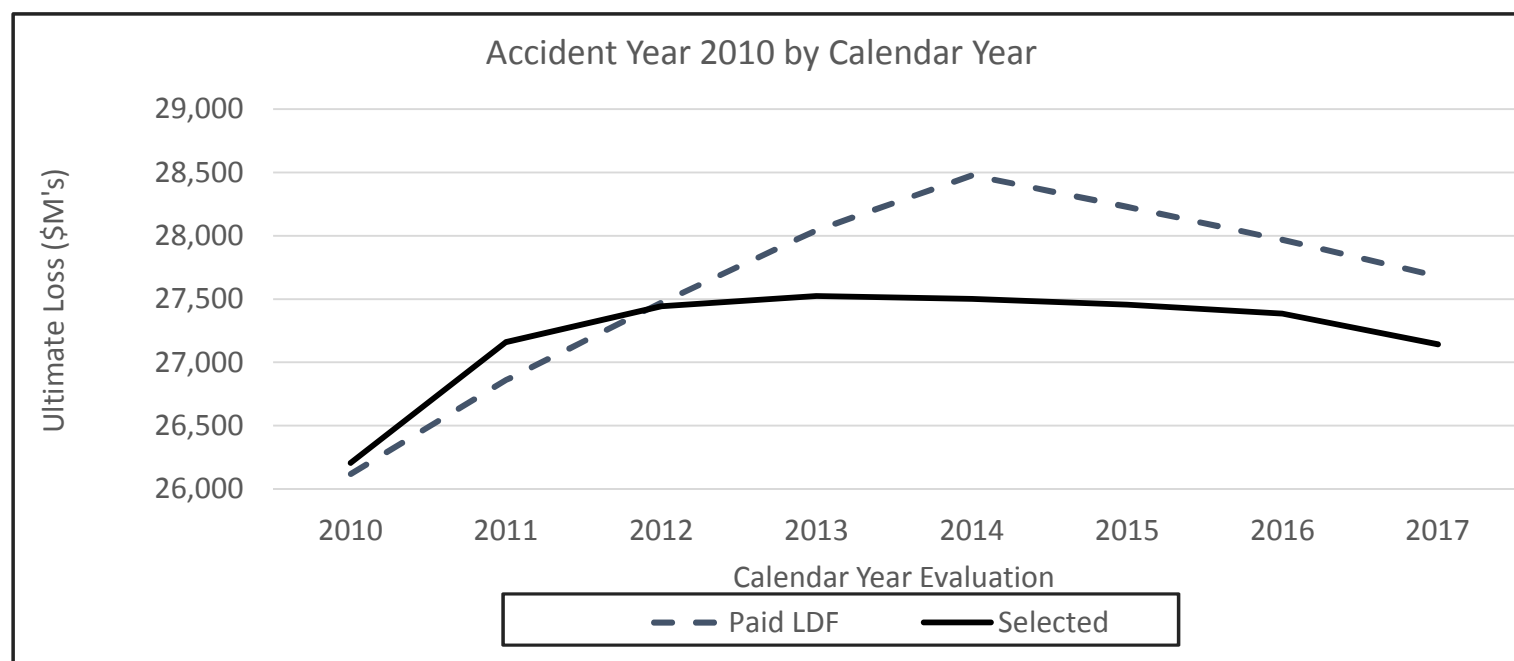
Development of Paid LDF Method Compared to Selected Ultimate Losses from Part 2 Suggests that Carriers Did Not Overreact to Settlements



- Settlements added to the volatility of the Paid LDF methodology
- Industry selected ultimate losses are more stable and did not overreact to the adverse development that settlements cause to the Paid LDF method.



Accident Year 2010 First Emerged Adversely Before Favorable Development Starting in 2015



- AY 2010 initially deteriorated due to the frequency of latent claims
- Settlements added to the volatility of the Paid LDF methodology
- Industry selected ultimate loss has been more stable and has been decreasing since 2014 as the claims that have settled no longer have payments



Interactive Question #5

If a state puts a law into place that eliminates lump-sum settlements, how would that affect ultimate losses?

- A. Ultimate loss goes up
- B. Ultimate loss goes down
- C. Ultimate loss is unchanged

Questions?

