Work Comp Tail Reserving Using Mortality

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Based on:

Enhancements to the Shane-Morelli Method to Provide Technical Guidance in Implementation and Proposed Solutions for Challenges Encountered in the Application to a Workers Compensation Tail

CAS E-Forum, Winter 2019

Part 2 of 2

Agenda

- Intro – Dawn
- Background on Shane Morelli approach - Dawn
- **Updates to the model - Shon**
- Business and updating model considerations – Dolph
- Walkthrough of tool - Shon
- Q & A - All

Enhancement 1: Curve Fit

Shane-Fowle method fits LDF-1 (ν) using inverse power curve

$$\hat{v}(d) = ad^b$$

Why use inverse power?

- good fit to WC LDF's (Sherman, 1984)

But …

- Fit is not always ideal
- Good fit to observed data does not mean good fit to future data

Maybe the choice of curve fit is not important since mortality is the dominant effect?

Mortality is not dominant until very late. In many cases, there are more than 10 years of projected development driven mainly by the curve fit.

Conclusion: It is worthwhile to understand what it means to use the inverse power (or any other) curve.

Key Question: What does the inverse power imply about the nature of future loss development?

Constant Decay Loss Model

Hypothetical loss development scenario:
Incremental losses decrease at some fixed rate β (decay rate).

Example for β = 0.1

Dev age (d)	Increm Loss	Cumul Loss
1	1,000	1,000
2	900	1,900
3	810	2,710
4	729	3,439
5	656	4,095

Example for β = 0

Dev age (d)	Increm Loss	Cumul Loss
1	1,000	1,000
2	1,000	2,000
3	1,000	3,000
4	1,000	4,000
5	1,000	5,000

- Don't worry for now about restriction that d>= 10
- We will consider 0 <= β < 1
- McClenahan (1975) used constant decay model for formulation of reserves.

Constant Decay Loss Model

With constant β assumption, we get this solution:

$$v(d) = \frac{\beta(1-\beta)^d}{1-(1-\beta)^d}$$

Recall:
$v(d)$ is LDF-1 at age d
β is decay rate of incremental loss

What happens when β = 0?

$v(d) = 0/0$

But L'Hôpital says:

$$\lim_{\beta\to 0} v(d) = \lim_{\beta\to 0}\left\{\frac{\frac{d}{d\beta}(\text{numerator})}{\frac{d}{d\beta}(\text{denominator})}\right\}$$

$$\lim_{\beta\to 0} v(d) = d^{-1}$$

This is the **inverse power**

What happens when β -> 1 ?

In the denominator, 1 dominates over $(1-\beta)^d$

$$\lim_{\beta\to 1} v(d) = \beta(1-\beta)^d$$

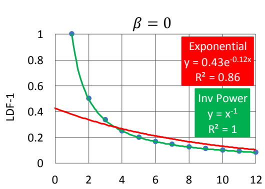
This has the geometric distribution form, which is the discrete analogue of the **exponential**.

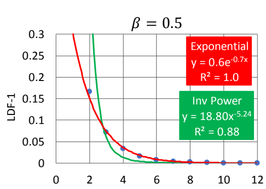
Decay Factor Effect

No Decay
Inverse Power

$\beta = 0$ — Blend of Inv Power and Exponential — $\beta = 1$

Full Decay
Exponential





Loss Decay Rate in Work Comp Development

- Low decay rate is often found in paid data with:
  - Steady claimant pool (10+ years)
  - Low mortality (young cohort)
  - Paid Indemnity
  - Paid Medical: routine payments (office visits, prescriptions)
  - Paid ALAE: expenses at steady state
- High decay rate is often found in incurred data where:
  - Initial case reserving followed by smaller adjustments
  - Mature AY's develop in shrinking amounts as information improves over time

As a general rule of thumb, paid development should follow *inverse power* and incurred development should follow *exponential*

BUT… remember reality is not always so predictable!
- Paid development can have high decay if cohort is aged
- Incurred development can have low decay (stair-stepping)

Combined Inverse Power and Exponential Curve

We don't want to always have to choose between inverse power and exponential
- Requires judgement and more modeling effort
- A single curve would be desirable

Why not this one? $v(d) = \dfrac{\beta(1-\beta)^d}{1-(1-\beta)^d}$

- This formula assumes a constant decay rate, which is rarely true
- Single parameter curve – in practice, need more dof's to fit to real life data

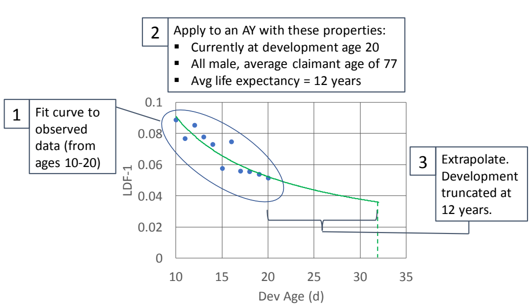
A better alternative (gamma form) : $v(d) = Ad^b e^{rd}$

Pros
- Can fit pure inverse power (r=0) or pure exponential (b=0) as well as spectrum in between
- Three parameters provides more fitting flexibility

Cons
- Not an option in Excel
- Not industry standard

Enhancement 2: Mortality Application

Original method uses a *truncation* approach for applying mortality.



Motivation for Enhancement 2

Areas for improvement in the truncation approach:

- More accurate estimate of group life expectancy
    - Using average life expectancy of the cohort underestimates the actual group life expectancy
    - Group ages more slowly than individual because oldest members have higher mortality rates
- Curve extrapolates observed mortality, but future mortality may be very different from the past
- Mortality is applied only at one point (at ultimate), but in reality the group experiences mortality continuously

Proposed: a *gradual application* of mortality

Gradual Mortality Application Example

Projection is done for one AY at a time

Male proportion for life table weighting

Diagonal

Loss Year	Dev Age (Yrs)	Prop Male	Open Claims	Avg Age	Life Exp	Cumul Loss
2005	13	0.76	191	55.76	30.64	3,504,668

y = Ax^(-b)exp(-rx)		
A	1.358624	From
b	1.539219	ScatterFit
r	0.023330	

Life Exp Offset	Adj Life Exp
0	31

Curve fit has been done using data from all AY's

Avg Age and Life Exp are used for original truncation method

Loss Year	Dev Age (Yrs)	Prop Male	Open Claims	Avg Age	Life Exp	Cumul Loss
2005	13	0.76	191	55.76	30.64	3,504,668

y = Ax^(-b)exp(-rx)		
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Life Exp Offset	Adj Life Exp
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Projection Yr	Avg Age	Dev Age	Fitted LDF	Cumul Loss	Incr Loss	Loss Decay	qx
1	55.8	13	1.019354	3,504,668	67,831		0.00342
2	56.7	14	1.016870	3,572,499	60,267	0.1115	0.00373
3	57.7	15	1.014820	3,632,766	53,839	0.1067	0.00409
4	58.6	16	1.013109	3,686,604	48,329	0.1023	0.00451
5	59.5	17	1.011666	3,734,933	43,572	0.0984	0.00498
6	60.5	18	1.010437	3,778,505	39,437	0.0949	0.00551

Step 1: Calculate average age of the AY for every year of projection

$$\text{group avg age}(t) = \frac{\sum_{k=1}^{N} \text{age}_k(t) S_k(t)}{\sum_{k=1}^{N} S_k(t)}$$

$\text{age}_k(t)$: claimant k's future age at projection year t
$S_k(t)$: probability that claimant k is still alive at year t

Step 2: Projected group mortality rate

- Look up from life table using the group average age
- Weighted average between male & female tables
- Varies for each future year
- Best estimate of future mortality

Loss Year	Dev Age (Yrs)	Prop Male	Open Claims	Avg Age	Life Exp	Cumul Loss
2005	13	0.76	191	55.76	30.64	3,504,668

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Step 3: Project future incremental losses
- Curve fit -> Fitted LDF -> Cumulative loss -> Incremental loss
- Remember these projected losses reflect observed mortality, not future mortality

Step 4: Calculate incremental loss decay rate.
Example:

$$0.0949 = \frac{43{,}572 - 39{,}437}{43{,}572}$$

Loss Year	Dev Age (Yrs)	Prop Male	From Summary Open Claims	Avg Age	Life Exp	Cumul Loss	Proj Years	EOT	Ultimate
2005	13	0.76	191	55.76	30.64	3,504,668	20	4,112,549	4,228,156

y = Ax^(-b)exp(-rx)		
A	1.358624	From
b	1.539219	ScatterFit
r	0.023330	

Life Exp Offset	Adj Life Exp	Trunc EOT	Trunc Ult
0	31	4,125,030	4,222,551

Projection Yr	Avg Age	Dev Age	Fitted LDF	Cumul Loss	Incr Loss	Loss Decay	qx	Adj Decay	Adj Incr Loss	Adj Cumul
1	55.8	13	1.019354	3,504,668	67,831		0.00342		67,831	3,504,668
2	56.7	14	1.016870	3,572,499	60,267	0.1115	0.00373	0.111817	60,246	3,572,499
3	57.7	15	1.014820	3,632,766	53,839	0.1067	0.00409	0.107338	53,779	3,632,745
4	58.6	16	1.013109	3,686,604	48,329	0.1023	0.00451	0.103425	48,217	3,686,524
5	59.5	17	1.011666	3,734,933	43,572	0.0984	0.00498	0.099997	43,396	3,734,742
6	60.5	18	1.010437	3,778,505	39,437	0.0949	0.00551	0.096995	39,187	3,778,137

Step 5: Calculate adjusted incremental loss decay rate
- First remove observed mortality rate
- Then add projected mortality rate (qx)
- i.e., Adjusted Decay = Loss Decay – 0.00342 + qx

Example:

$$0.096995 = 0.0949 - 0.00342 + 0.00551$$

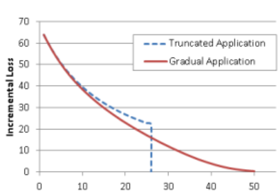
Simplifying assumption: current mortality rate is a sufficient proxy for observed mortality
- Not a bad assumption especially for younger claimants and current mortality << loss decay

Step 6: Calculate adjusted incremental loss.
Example:

$$39{,}187 = 43{,}396(1 - 0.096995)$$

Step 7: Sum Adj Incr Loss column to get ultimate unpaid (or IBNR)

Truncation vs. Gradual



Observations
- Gradual losses decrease at a faster rate due to continuous application of mortality
- Total unpaid for gradual is typically higher because gradual method predicts a longer group life expectancy
- Gradual method produces more realistic cash flow
- Truncation method appropriate for incurred with adequate case reserve

Enhanced vs. Original

Acc Year	Cumul. Paid ($M)	Enhanced Shane-Fowle		Shane-Fowle		Traditional	
		CDF	Unpaid ($M)	CDF	Unpaid ($M)	CDF	Unpaid ($M)
1985	984	1.031	31	1.031	30	1.030	30
1986	1,133	1.035	40	1.034	38	1.033	37
1987	1,326	1.039	51	1.037	49	1.037	49
1988	1,530	1.041	63	1.041	62	1.040	61
1989	1,784	1.045	80	1.045	79	1.044	78
1990	2,029	1.048	98	1.047	96	1.048	97
1991	2,180	1.053	115	1.053	116	1.051	112
1992	1,741	1.058	101	1.057	99	1.055	97
1993	1,491	1.062	93	1.062	93	1.060	89
1994	1,449	1.068	99	1.068	98	1.065	95
1995	1,591	1.077	122	1.074	118	1.072	115
1996	1,681	1.081	136	1.077	130	1.081	136
1997	1,975	1.091	180	1.087	171	1.091	179
1998	2,585	1.100	258	1.094	243	1.101	261
1999	2,963	1.110	325	1.106	313	1.113	334
2000	3,486	1.121	422	1.114	396	1.127	442
2001	5,225	1.132	691	1.125	652	1.142	741
2002	5,342	1.149	798	1.141	756	1.158	842
2003	4,900	1.166	815	1.159	778	1.175	856
2004	3,915	1.184	720	1.177	695	1.194	760
2005	3,505	1.207	727	1.204	715	1.217	762
Total			5,967		5,727		6,171

Traditional:
No curve-fitting and using a tail factor based on incurred/paid ratio

Notes:
- Enhancement 1 (gamma curve) tends to decrease unpaid estimate
- Enhancement 2 (gradual mortality) tends to increase unpaid estimate

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- **Business and updating model considerations** - Dolph
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Business Considerations - Updating

So we have reasonable indications now, are we done?

- What does it mean to "update" the model?
- When do we "update"?

- "Refreshing" the model: uses prior parameters, but updates underlying data
  Updating data with fixed prior parameters
- "Updating" the model: includes refitting the curves to updated data – generating new parameters *A, b,* and *r*
  *Update data **and** update model parameters*
- We can continue to use (or "refresh") the model on updated data (a new diagonal), but may only want to "update" the model when certain conditions are true.

Business Considerations - Updating

Proposal – model parameters "locked in" for 3-5 years

- When do we "unlock"?

During annual/semi-annual review we go through both exercises:

- Refreshing the model - use "locked in" prior parameters, but update underlying data
  - *Using latest claim info (financials and characteristics) generate a new indication*
- Updating the model - go through entire process again, includes updating the data and refitting the curves to updated data (generating new parameters *A*, *b*, and *r*)
  - *We then test to see if the newly created parameters have changed materially from the prior; in practice this may translate to testing indications rather than parameters*

Business Considerations - Updating

Have the prior parameters changed materially?

Often a judgement call – benchmarks are helpful

Need to separate change in indication due to updated data vs. change in indication due to new parameters.

- Optimally, the change in indication due to new parameters hovers around "zero" cycle to cycle
- If change due to new parameters is increasing/decreasing your indications every cycle, likely something changing in your data
- Suggested thresholds to measure change in indications due to parameter update:
  - Percentage change off of initial indications
  - Percentage of overall reserves
  - Percentage of surplus

So when are we updating the parameters?

Business Considerations - Updating

Summary – When do we change model parameters?

Again, sometimes a judgement call…but general guidance identifies three scenarios:

1. The end of the predetermined "locked in" period has arrived. E.g. 3 years after original implementation.
2. The change in indication due to updating parameters has crossed some predetermined threshold. E.g. 10% of total reserves.
3. The change in indication over several cycles is moving in the same direction. E.g. +2% of reserves, then +3%, then +2%.

Remember, when parameters are updated…must re-lock

Business Considerations - Updating

Other items to consider when updating model parameters:

- How well has model performed against expectations, are we using the right data cuts?
- Is there a change to data aggregation that we should make?
  - More/less granular, more/less aggregated
  - Additional data attributes to use in creating homogenous groups
- Are we using the most appropriate, and most up to date, mortality table?
- Should we consider using more (or less) accident years in our data/fits?

Any changes to your model structure may drive changes in indications that must be explained

Business Considerations – Discussing Results

How does this model help the Actuary discuss results?

- When the model is "refreshed": parameters are locked, but data is updated - drivers of change in indications should be fairly clear:
  - Changing distribution of claimant ages or genders
  - Relatively higher/lower level of payment/reserve activity on open claims

  Ideally, an "actual vs. expected" framework is established and monitored regularly. This should help the results discussion and minimize "surprises".

- When the model is "updated": parameters are refit, **and** data is updated - drivers of change in indications can be messy:
  - Critical to bifurcate change due to data vs. change due to refit.
    - Certainly there will be overlap between the two
  - How much of the change is due to a distributional shift in data?
  - How did this distributional shift drive the new parameters?
  - What are the other internal and external forces in play?

Business Considerations – Discussing Results

Other Considerations – Internal/External Forces

- Internal factors driving change in indications:
  - Claim operational changes – change in personnel, case reserving strategy, settlement strategy, etc.
  - Underwriting operational changes – even if focusing on older cohort of claims, there may be growth/contraction in certain segments/jurisdictions, etc.
  - Cost containment strategy – change in nurse case management, change in pharmacy strategy, changing medical vendor usage, etc.
- External factors driving change in indications:
  - Medical inflation and or utilization
  - State specific reforms (fee schedules, benefit levels, etc.)
  - Change in legal environment
  - Changes in mortality expectations

Not an exhaustive list – many more considerations!

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Excel Tool: Life Tables Tab

	Male		Female	
Age	qx	ex	qx	ex
0	0.001115	82.88575	0.001126	85.9555
1	0.000376	81.97716	0.000369	85.05128
2	0.00028	81.00762	0.000243	84.08226
3	0.000224	80.03003	0.000176	83.10246
4	0.00019	79.0477	0.000146	82.11687
5	0.000185	78.06249	0.000135	81.12867
6	0.000181	77.07675	0.000126	80.13945
7	0.000168	76.09048	0.000114	79.14943
8	0.000151	75.1031	0.000102	78.1583
9	0.000135	74.11429	9.6E-05	77.16613
10	0.000125	73.12413	9.5E-05	76.17344
11	0.000135	72.13311	0.0001	75.18058
12	0.000167	71.14271	0.000112	74.18804
13	0.000212	70.15446	0.000133	73.19627
14	0.000259	69.16913	0.00016	72.20588
15	0.000303	68.18679	0.000186	71.21727
16	0.000344	67.20718	0.000209	70.23037

Note:
2012 IAM from Age 0 to 100
Merged with 2000 Annuity Base table for 100+
Using correction for ALB (Age Last Birthday)

Disclaimer | Instructions | LifeTables | OpenClaims

- Period table, no mortality improvement
- Healthy vs. disabled life tables is up to the user

Excel Tool: Open Claims Tab

CLAIM ID	CLAIMANT GENDER	LOSS YEAR	AGE	Weighting
Ex000001	M	1988	74.2	1.0
Ex000002	M	1988	65.9	1.0
Ex000003	M	1988	71.5	1.0
Ex000004	M	1989	81.7	1.0
Ex000005	M	1990	65.4	1.0
Ex000006	M	1985	88.0	1.0
Ex000007	M	1985	78.6	1.0
Ex000008	M	1985	73.5	1.0
Ex000009	M	1985	82.9	1.0
Ex000010	M	1985	74.6	1.0
Ex000011	F	1986	52.3	1.0
Ex000012	M	1986	70.3	1.0
Ex000013	M	1987	63.3	1.0
Ex000014	M	1990	73.8	1.0
Ex000015	M	1991	60.7	1.0

Instructions | LifeTables | OpenClaims | AgingTable

- Age as of evaluation date
- Weights can be individual's annual *run rate* (loss per year)

Excel Tool: Aging Table Tab

	A	B	C	D	E	F	G	H	I	J	K	
1												
2				Build Aging Table								
3												
4		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	
5	1	73.43379	71.05656	70.06405	69.36253	68.39435	67.0986	65.98698	65.91035	64.53726	63.6969	61.
6	2	74.04058	71.59711	70.73119	69.91093	69.15565	67.96039	66.8343	66.77975	65.45528	64.62949	62.
7	3	74.66318	72.17972	71.39126	70.52996	69.91133	68.80906	67.67122	67.63794	66.36463	65.55528	6
8	4	75.2946	72.7953	72.04411	71.1938	70.66133	69.64416	68.49742	68.48392	67.26459	66.47353	64.
9	5	75.92966	73.43541	72.68991	71.88171	71.40573	70.46537	69.31274	69.31658	68.15454	67.3834	64.
10	6	76.56475	74.08817	73.32941	72.57902	72.14457	71.27271	70.11775	70.13506	69.03386	68.28397	65.
11	7	77.19706	74.74865	73.96313	73.27566	72.87713	72.06655	70.91267	70.93908	69.90199	69.17433	66.
12	8	77.8246	75.41468	74.5911	73.96585	73.60219	72.84737	71.69706	71.72859	70.75844	70.05356	67.
13	9	78.44566	76.08307	75.21442	74.64747	74.31832	73.61606	72.47086	72.50346	71.60278	70.92086	68.
14	10	79.05989	76.75267	75.8345	75.32092	75.02477	74.37327	73.23395	73.26387	72.43476	71.77545	69.
15	11	79.66693	77.42218	76.45138	75.98721	75.72134	75.11963	73.98658	74.00994	73.25432	72.61671	69.
16	12	80.26633	78.08841	77.06551	76.64721	76.40739	75.85624	74.72957	74.7424	74.06184	73.44418	70.
17	13	80.85828	78.74911	77.67739	77.30333	77.08258	76.58402	75.46393	75.4621	74.85777	74.25766	71.
18	14	81.44276	79.40331	78.28757	77.95741	77.74661	77.30358	76.19067	76.16937	75.64233	75.0569	72.
19	15	82.01948	80.04942	78.89607	78.61081	78.39975	78.01528	76.91092	76.86445	76.41581	75.84171	72.

LifeTables | OpenClaims | AgingTable | LossTriang

- Macro will compute projected average age for each AY (no manual input necessary)
- Done only once for a claimant pool

AY 1993

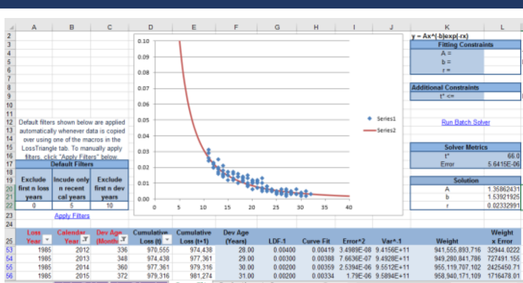
Excel Tool: Loss Triangle Tab

	A	M	N	O	P	Q	R	S	T	U	V
4											
5											
6	**Loss yr**	**144**	**156**	**168**	**180**	**192**	**204**	**216**	**228**	**240**	**252**
13	1991	0	0	0	0	0	2,066,028	2,082,556	2,097,134	2,109,716	2,120,265
14	1992	0	0	0	0	1,623,777	1,651,381	1,666,243	1,679,573	1,682,932	1,693,030
15	1993	0	0	0	1,345,600	1,363,092	1,379,450	1,394,624	1,411,359	1,425,473	1,439,727
16	1994	0	0	1,296,090	1,316,828	1,333,947	1,351,288	1,368,855	1,382,543	1,396,369	1,411,729
17	1995	0	1,368,158	1,398,257	1,424,824	1,450,471	1,472,228	1,492,839	1,513,739	1,536,445	1,554,883
18	1996	1,445,847	1,480,547	1,513,119	1,543,381	1,566,532	1,588,463	1,610,702	1,631,641	1,652,852	1,669,381
19	1997	1,732,279	1,773,854	1,811,105	1,841,893	1,871,364	1,893,820	1,920,333	1,947,218	1,962,796	1,974,573
20	1998	2,267,610	2,322,033	2,368,473	2,411,106	2,452,095	2,491,328	2,531,189	2,561,564	2,584,618	
21	1999	2,630,935	2,701,970	2,750,606	2,794,616	2,842,124	2,890,440	2,930,906	2,963,146		
22	2000	3,159,796	3,229,311	3,290,668	3,359,772	3,410,169	3,451,091	3,485,602			
23	2001	4,764,887	4,869,715	4,991,458	5,081,304	5,157,523	5,224,571				
24	2002	5,003,926	5,104,004	5,206,085	5,278,970	5,342,317					
25	2003	4,640,357	4,747,085	4,827,786	4,900,203						
26	2004	3,778,092	3,853,654	3,915,312							
27	2005	3,435,949	3,504,668								
28											

OpenClaims | AgingTable | LossTriangle | CurveFit

- Manually input for each loss triangle (paid, incurred, ALAE)
- Macros to assist copying link ratios to next tab

Excel Tool: Curve Fit Tab



- Solver add-in is <u>required</u>
- Batch Solver macro tries several different initial configurations
- Fitting by weighted minimum MSE (weights = inverse variance)
- Link ratios < 1 are ok

Excel Tool: Projection Tab

	Loss Year	Dev Age (Yrs)	Prop Male	Open Claims	Avg Age	Life Exp	Cumul Loss	Proj Years	EOT	Ultimate
From Summary	2005	13	0.76	191	55.76	30.64	3,504,668	20	4,112,549	4,228,156

y = Ax^(-b)exp(-rx)		
A	1.358624	From
b	1.539219	ScatterFit
r	0.023330	

Life Exp Offset	Adj Life Exp	Trunc EOT	Trunc Ult
0	31	4,125,030	4,222,551

Projection Yr	Avg Age	Dev Age	Fitted LDF	Cumul Loss	Incr Loss	Loss Decay	qx	Adj Decay	Adj Incr Loss	Adj Cumul
1	55.8	13	1.019354	3,504,668	67,831		0.00342		67,831	3,504,668
2	56.7	14	1.016870	3,572,499	60,267	0.1115	0.00373	0.111817	60,246	3,572,499
3	57.7	15	1.014820	3,632,766	53,839	0.1067	0.00409	0.107338	53,779	3,632,745
4	58.6	16	1.013109	3,686,604	48,329	0.1023	0.00451	0.103425	48,217	3,686,524
5	59.5	17	1.011666	3,734,933	43,572	0.0984	0.00498	0.099997	43,396	3,734,742
6	60.5	18	1.010437	3,778,505	39,437	0.0949	0.00551	0.096995	39,187	3,778,137
7	61.4	19	1.009382	3,817,942	35,821	0.0917	0.00609	0.094363	35,489	3,817,324
8	62.3	20	1.008470	3,853,763	32,642	0.0888	0.00671	0.092048	32,222	3,852,812
9	63.2	21	1.007676	3,886,405	29,832	0.0861	0.00738	0.090023	29,321	3,885,034
10	64.1	22	1.006981	3,916,237	27,339	0.0836	0.00811	0.088277	26,733	3,914,356
11	65.0	23	1.006369	3,943,576	25,116	0.0813	0.00811	0.085989	24,434	3,941,089
12	65.9	24	1.005828	3,968,693	23,128	0.0792	0.00873	0.084494	22,370	3,965,523
13	66.7	25	1.005346	3,991,820	21,342	0.0772	0.00926	0.083054	20,512	3,987,893

AgingTable | LossTriangle | CurveFit | Projection | Summary

- No required input or macros, but can dig deeper into projection of a particular AY (cash flow, projected group age, …)

Excel Tool: Summary Tab

y = Ax^(-b)exp(-rx)	
A	1.358624
b	1.539219
r	0.023330

Project All Accident Years

Age At EOT (End Of Triangle): 33.00

Projection Using Gradual Application of Mortality

Loss Year	Dev Age (Yrs)	Proportion Male	Open Claims	Average Age	Average Life Exp	Cumulative Loss	Years To EOT	Loss at EOT	Ultimate Loss	EOT-Ult Tail Factor
1985	33	0.83	462	73.4	15.5	984,218	0	984,218	1,019,587	1.036
1986	32	0.74	54	71.1	17.2	1,133,046	1	1,136,564	1,178,381	1.037
1987	31	0.73	75	70.1	18.0	1,325,594	2	1,334,149	1,383,607	1.037
1988	30	0.81	77	69.4	18.7	1,529,676	3	1,545,075	1,600,435	1.036
1989	29	0.74	109	68.4	19.6	1,784,169	4	1,809,080	1,873,147	1.035
1990	28	0.77	105	67.1	20.4	2,028,738	5	2,065,665	2,136,510	1.034
1991	27	0.75	134	66.0	22.0	2,180,319	6	2,229,953	2,305,775	1.034
1992	26	0.73	102	65.9	22.1	1,740,964	7	1,789,258	1,849,451	1.034
1993	25	0.74	106	64.5	22.9	1,490,763	8	1,540,215	1,589,959	1.032
1994	24	0.69	130	63.7	23.8	1,448,746	9	1,505,363	1,553,571	1.032
1995	23	0.82	97	61.5	25.2	1,590,847	10	1,663,437	1,719,847	1.034
1996	22	0.90	100	64.1	22.6	1,681,067	11	1,769,835	1,822,587	1.030
1997	21	0.80	133	61.6	25.3	1,974,573	12	2,094,433	2,161,662	1.032
1998	20	0.86	176	61.2	25.2	2,584,618	13	2,764,229	2,850,047	1.031
1999	19	0.83	222	59.5	26.9	2,963,146	14	3,197,914	3,294,743	1.030
2000	18	0.79	229	60.7	26.2	3,485,602	15	3,800,134	3,914,021	1.030

AgingTable | LossTriangle | CurveFit | Projection | Summary

- “Project All Accident Years” macro will run through every AY projection and summarize results on this page
- There is also a section (not shown) with the truncation method

Agenda

- Intro – Dawn
- Background on Shane Morelli approach - Dawn
- Updates to the model - Shon
- Business and updating model considerations – Dolph
- Walkthrough of tool - Shon
- **Q & A - All**