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An Enhanced On-Level Approach to Calculating Expected Loss Costs

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Background

- Our paper deals with Initial Expected Loss Costs (IELCs) as used in a typical B-F Method.
- One way to select an IELC is to use historical loss costs, and bring them “on level” using the following:
  - Frequency trend F
  - Severity trend S
  - Loss cost trend=F x S
  - Benefit Level Changes
  - Changes in Limits/Deductibles
- These are all appropriate. Usually, we do not see an explicit adjustment for historical changes in the mix of business.

Additional Background

- The idea for this paper arose in the following context:
  - Insurance company writing a number of significantly-sized accounts
  - Reserve reviews conducted on a policy year basis
  - The company often non-renews an account based on loss experience or other considerations causing a shift in the loss cost trend.
  - The larger the account non-renewed, the bigger the effect.
  - To account for this and the addition of new business in the on-leveling procedure, we calculate a “mix of business adjustment factor” for each year.
- We’ll walk through an example of the calculation, using exhibits from the paper.

Example

Below is a fairly conventional IELC calculation

Policy Year	(1) Exposure	(2) Ultimate Loss	(3) Loss Cost	(4) Trend	(5) On-Level Loss Cost	(6) B-F IELC
2005	14,000	56,000	4.00	1.23	4.92	2.85
2006	14,000	57,680	4.12	1.19	4.92	2.93
2007	14,000	59,410	4.24	1.16	4.92	3.02
2008	10,000	48,080	4.81	1.13	5.41	3.11
2009	14,000	54,502	3.89	1.09	4.25	3.20
2010	14,000	56,137	4.01	1.06	4.25	3.30
2011	14,000	38,603	2.76	1.03	2.84	3.40
2012	14,000	39,761	2.84	1.00	2.84	3.50
				Selected	3.50	

Example (continued)

But suppose the account-level data looks like this…

	Account A			Account B			Account C		
Policy		Ultimate			Ultimate			Ultimate	
Year	Exposure	Loss	Loss Cost	Exposure	Loss	Loss Cost	Exposure	Loss	Loss Cost
2005	2,000	4,000	2.00	4,000	12,000	3.00			
2006	2,000	4,120	2.06	4,000	12,360	3.09			
2007	2,000	4,244	2.12	4,000	12,731	3.18			
2008	2,000	4,371	2.19						
2009	2,000	4,502	2.25				4,000	30,000	7.50
2010	2,000	4,637	2.32				4,000	30,900	7.73
2011	2,000	4,776	2.39				4,000	31,827	7.96
2012	2,000	4,919	2.46				4,000	32,782	8.20

	Account D			Account E			Account F			Total Company XYZ		
Policy		Ultimate			Ultimate			Ultimate			Ultimate	
Year	Exposure	Loss	Loss Cost	Exposure	Loss	Loss Cost	Exposure	Loss	Loss Cost	Exposure	Loss	Loss Cost
2005	8,000	40,000	5.00							14,000	56,000	4.00
2006	8,000	41,200	5.15							14,000	57,680	4.12
2007	8,000	42,436	5.30							14,000	59,410	4.24
2008	8,000	43,709	5.46							10,000	48,080	4.81
2009				8,000	20,000	2.50				14,000	54,502	3.89
2010				8,000	20,600	2.58				14,000	56,137	4.01
2011							8,000	2,000	0.25	14,000	38,603	2.76
2012							8,000	2,060	0.26	14,000	39,761	2.84

Example (continued)

What do we observe?

- The book consists of individual accounts, each with a very stable loss cost. Loss trend=3%, Exposure trend=0%.
- The mix of business has changed over the years, as accounts have been non-renewed and new business is written.
- In policy year 2013, the company writes accounts A, C and F.
- For 2013, an appropriate IELC would be 2.84*1.03=2.93.
- Can we get to this number by adjusting the data?

Example (continued)

Total Company XYZ

Policy Year	Exposure	Ultimate Loss	Loss Cost	Loss Cost Trend	Mix of Business Factor	Mix of Business Factor (Cum.)	On-Level Loss Cost	B-F IELC
2005	14,000	56,000	4.00	1.23	1.000	0.577	2.84	4.00
2006	14,000	57,680	4.12	1.19	1.000	0.577	2.84	4.12
2007	14,000	59,410	4.24	1.16	1.100	0.577	2.84	4.24
2008	10,000	48,080	4.81	1.13	0.786	0.525	2.84	4.81
2009	14,000	54,502	3.89	1.09	1.000	0.668	2.84	3.89
2010	14,000	56,137	4.01	1.06	0.668	0.668	2.84	4.01
2011	14,000	38,603	2.76	1.03	1.000	1.000	2.84	2.76
2012	14,000	39,761	2.84	1.00	1.000	1.000	2.84	2.84
						Selection	2.84	

- By using a mix of business adjustment factor in each non-renewal year, we can remove the distortions caused by the change in mix.
- The following example illustrates how these adjustment factors are developed.

Example (continued)

	Total Company XYZ					Total Company XYZ excluding B					Total XYZ		
Policy Year	Exposure	Ultimate Loss	Loss Cost	Trend	On-Level Loss Cost	Exposure	Ultimate Loss	Loss Cost	Trend	On-Level Loss Cost	Mix of Bus. Factor	Mix of Bus. Factor (cum.)	B-F IELC
2005	14,000	56,000	4.00	1.093	4.37	10,000	44,000	4.40	1.093	4.81	1.000	1.100	4.00
2006	14,000	57,680	4.12	1.061	4.37	10,000	45,320	4.53	1.061	4.81	1.000	1.100	4.12
2007	14,000	59,410	4.24	1.030	4.37	10,000	46,680	4.67	1.030	4.81	1.100	1.100	4.24

	(A) Selected Loss Cost	4.37	(B) Selected Loss Cost	4.81
	Mix of Business Adjustment	1.100		
(A)/(B)	Final Projected 2008 Loss Cost	4.81		

- In 2008, when we learn that Account B has been non-renewed, we conduct an analysis similar to the above to derive the Mix of Business adjustment.
- The approach is always the same: the Mix of Business adjustment is equal to the loss cost relativity before and after the non-renewal.

Example (continued)

Policy Year	Total Company XYZ excluding B: Exposure	Ultimate Loss	Loss Cost	Trend	On-Level Loss Cost	Ongoing Business: Accounts A, C & E: Exposure	Ultimate Loss	Loss Cost	Trend	On-Level Loss Cost	Total XYZ: Mix of Bus. Factor	Mix of Bus. Factor (cum.)	B-F IELC
2005	10,000	44,000	4.40	1.126	4.95	14,000	48,424	3.46	1.126	3.89	1.000	0.865	4.00
2006	10,000	45,320	4.53	1.093	4.95	14,000	49,877	3.56	1.093	3.89	1.000	0.865	4.12
2007	10,000	46,680	4.67	1.061	4.95	14,000	51,373	3.67	1.061	3.89	1.100	0.865	4.24
2008	10,000	48,080	4.81	1.030	4.95	14,000	52,915	3.78	1.030	3.89	0.786	0.786	4.81

(A)	Selected Loss Cost	4.95
	Mix of Business Adjustment	0.786
(A)/(B)	Final Projected 2009 Loss Cost	3.89

(B) Selected Loss Cost 3.89

- In 2009, the company informs us that they are cancelling all existing accounts except A, and adding two new accounts C and E.
- The calculation is similar: compare the book of business before and after the change in mix.
- Requires some kind of historical data for new accounts C and E.
- In practice this data is often available or can be reasonably estimated.

Example (continued)

Policy Year	Ongoing Business: Accounts A, C & E Exposure	Ultimate Loss	Loss Cost	Trend	On-Level Loss Cost	Ongoing Business: Accounts A, C & F Exposure	Ultimate Loss	Loss Cost	Trend	On-Level Loss Cost	Total XYZ Mix of Bus. Factor	Mix of Bus. Factor (cum.)	B-F IELC
2005	14,000	48,424	3.46	1.194	4.13	14,000	32,330	2.31	1.194	2.76	1.000	0.577	4.00
2006	14,000	49,877	3.56	1.159	4.13	14,000	33,299	2.38	1.159	2.76	1.000	0.577	4.12
2007	14,000	51,373	3.67	1.126	4.13	14,000	34,298	2.45	1.126	2.76	1.100	0.577	4.24
2008	14,000	52,915	3.78	1.093	4.13	14,000	35,327	2.52	1.093	2.76	0.786	0.525	4.81
2009	14,000	54,502	3.89	1.061	4.13	14,000	36,387	2.60	1.061	2.76	1.000	0.668	3.89
2010	14,000	56,137	4.01	1.030	4.13	14,000	37,479	2.68	1.030	2.76	0.668	0.668	4.01

(A)	Selected Loss Cost	4.13	(B) Selected Loss Cost 2.76
	Mix of Business Adjustment	0.668	
(A)/(B)	Final Projected 2011 Loss Cost	2.76	

- The calculation for the 2010 Mix of Business adjustment (reflecting changes to the book that took place between 2010 and 2011) follows exactly the same logic.

Summing Up

Total Company XYZ

Policy Year	Exposure	Ultimate Loss	Loss Cost	Loss Cost Trend	Mix of Business Factor	Mix of Business Factor (Cum.)	On-Level Loss Cost	B-F IELC
2005	14,000	56,000	4.00	1.23	1.000	0.577	2.84	4.00
2006	14,000	57,680	4.12	1.19	1.000	0.577	2.84	4.12
2007	14,000	59,410	4.24	1.16	1.100	0.577	2.84	4.24
2008	10,000	48,080	4.81	1.13	0.786	0.525	2.84	4.81
2009	14,000	54,502	3.89	1.09	1.000	0.668	2.84	3.89
2010	14,000	56,137	4.01	1.06	0.668	0.668	2.84	4.01
2011	14,000	38,603	2.76	1.03	1.000	1.000	2.84	2.76
2012	14,000	39,761	2.84	1.00	1.000	1.000	2.84	2.84
						Selection	2.84	

- Consolidating the Mix of Business factors, and accumulating up the column, we arrive back at the exhibit displayed earlier.

Additional Considerations

- Data availability
- Ultimate losses at account level
- Policy Year vs. Accident Year
- Recalculate the mix of business factor, or lock it in?

Q & A

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