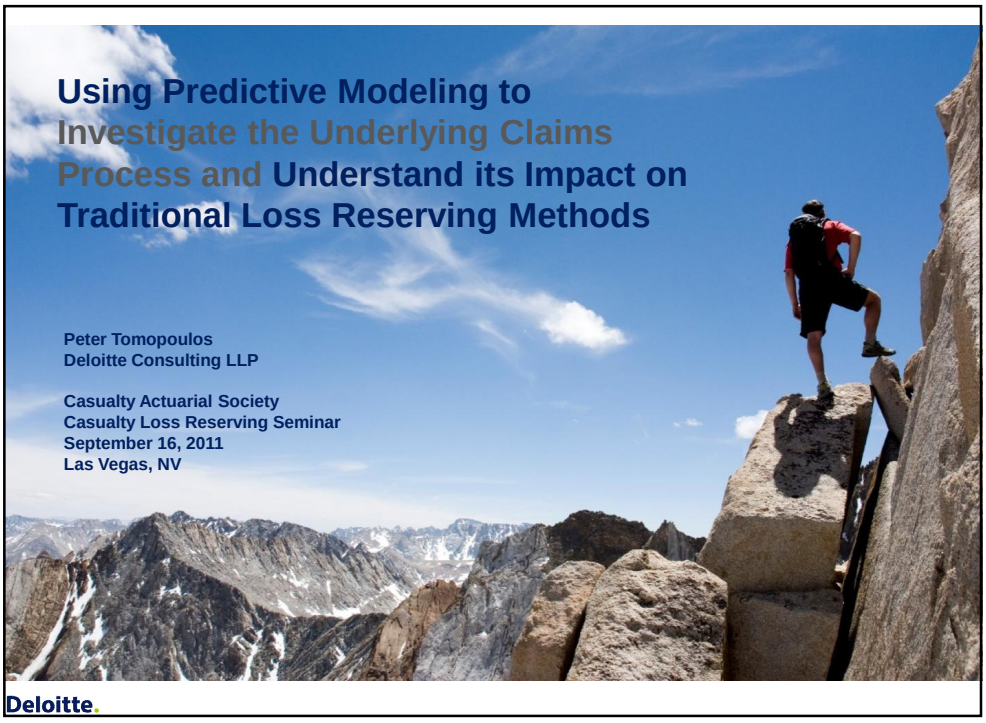

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Agenda

1. What are the types of advanced analytics (a/k/a predictive modeling) that the insurance industry is utilizing, and how, along with advancements in technology, are they impacting losses and claim counts?
2. How are advanced analytics impacting traditional loss reserving methods?
3. What are some key considerations for an actuary when reviewing loss and claim development information?
4. How can the various forms of advanced analytics offset each other and therefore mask the trends?
5. How will the role of the actuary need to change and evolve in the near future? How can the actuary adapt to these changes?

3

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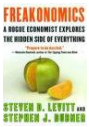
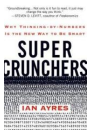
Advanced analytics: a trend in the insurance industry

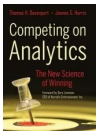
Advanced analytics and technological advances are enabling insurers to leverage data to increase efficiency, improve allocation of resources and reduce claim costs.

Analytics is gaining popularity everywhere, not just in the insurance industry

- To gain a competitive advantage and operational efficiencies, and to lower loss and expense ratios, insurers continue to look for more ways to apply advance analytics into their business models.
- Insurers have access to more data, and more detailed and refined claim and underwriting information







Commonly used analytics

4

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Recent trends in leveraging technology by the insurance industry

In recent years, insurers have made the necessary investments in technology to enable them to capture the amount of information needed and at the appropriate level of detail in order to effectively apply predictive modeling and advanced analytics into their operations

Recent Technological Advancements

- Improved core legacy claims systems
- Enhanced data storage capabilities to capture large amounts of risk and claim information at a very refined level of detail
- Data mining capabilities
- Predictive modeling scoring engines, including at real-time
- Business rules management systems
- Tools used to analyze results from predictive modeling / advanced analytics to assist underwriters, claims personnel and actuaries to make informed decisions using the most appropriate and current information

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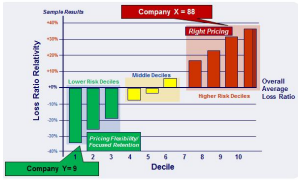
Shifting application of advanced analytics to claims

While insurers have effectively deployed underwriting predictive models over the past decade, developing these applications for claims is just beginning to gain traction in the industry.

Underwriting Predictive Modeling

- Advanced underwriting, pricing and segmentation of insurable risks
- Leveraging of internal and external data to better segment potential profitable and unprofitable risks for new business and renewal policies



Claims Predictive Modeling

- Claims are assigned optimally to claim adjustor by mapping advisory indicator to adjustor competency as early as first notice of loss (FNOL)
- Potentially high-severity claims are flagged and routed to specific SIU resources for proper handling of claims

Claims Analytics

- Advanced claims systems and improved data capture techniques (e.g., three party contact, adjuster notes, etc.) facilitate better estimates of the ultimate value of a claim
- Targets the core claim management process of reserving for claims

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Shifting application of advanced analytics to claims (Cont'd)

Fraud Analytics

- Application of advanced fraud detection tools along with traditional investigation activities by claim personnel. This provides them with a broader set of information early in the claim life.
- More accurately identify claims with the highest propensity for fraud as early as FNOL by utilizing in excess of 50 variables to predict the propensity for fraud of each claim or claimant.

Other Analytics

- **Safety Analytics** – science of studying the underlying causes of and contributing factors to workplace accidents. Provides the tools to assess, measure, monitor and direct employee health and safety across all aspects of an insured's operations.
- **Litigation Management Predictive Modeling** – use of advanced analytics to help identify the claims with the highest propensity for litigation in order to assign cases to the most appropriate claims and litigation resources.
- **Subrogation Predictive Modeling** – use of advanced analytics to help identify the claims with subrogation potential in order to improve the timeliness and quality of subrogation referrals
- **Customer Targeting Predictive Modeling** – to analyze purchasing patterns and behaviors of potential and current insureds.

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Analytics are changing our loss and claim count development triangles

Actuaries are beginning to observe the transformation of claim patterns into the loss development and claim count triangles as a result of the various forms of predictive/modeling analytics being applied

Technological Advancements

- Underwriting Predictive Modeling
- Claims Predictive Modeling
- Claim Analytics
- Fraud Analytics

Incurred Loss Triangle

Accident Year	Age 12	24	36	48	60	72
2005	16,000	20,000	22,000	22,523	22,523	22,523
2006	16,480	20,600	22,660	23,199	23,199	
2007	16,974	21,218	23,340	23,895		
2008	17,484	21,855	24,040			
2009	18,008	22,510				
2010	18,548					

Accident Year	Age 12-24	24-36	36-48	48-60	60-72	72-Ult
2005	1.250	1.100	1.024	1.000	1.000	
2006	1.250	1.100	1.024	1.000		
2007	1.250	1.100	1.024			
2008	1.250	1.100				
2009	1.250					
2010						
A-A	1.250	1.100	1.024	1.000	1.000	
A-U	1.408	1.126	1.024	1.000	1.000	1.000

As actuaries we need to understand the impact of the analytics on the loss and claim count triangles, but recognize that the true ultimate value of any claim will not be known until the claim is settled.

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Whiteboard - the changing world of a reserving actuary

How has your role as an actuary changed within your company?
How has the claim information you use to estimate reserves changed?

Changing Role

- Are you using more reserving methods or developing newer methods to better estimate reserves?
- Are you interacting with more business units more often within your companies or at your insurance company clients?
- Have you noticed any changes in the recent diagonals from your loss development triangles?

Changing Data

- Are you noticing that claims are taking a shorter time to settle? Longer?
- Is there more volatility in your reserve estimates?
- Are you seeing a shorter or longer tail?
- Are you noticing that claims are being reported faster? Is there a shorter lag from DOL to FNOL?
- Are claim expenses (ALAE / DCCE) as a percentage of losses decreasing?

Potential impact of analytics on loss and claim count triangles

The application of underwriting predictive modeling (which started over a decade ago) across most P&C lines has become the norm at P&C insurers, rather than the exception. Thus, its impact should already be evident in loss experience for several years now.

	Paid Losses	Incurred Losses	Closed Claims	Reported Claims
Underwriting Predictive Modeling	▪ May lower paid loss amounts across all evaluation periods ▪ May lead to fewer large losses	▪ May lower incurred loss amounts across all evaluation periods ▪ May lead to fewer large losses	▪ Claims may settle faster if fewer large losses come in.	▪ Frequency of claims may change

Depends on Insurer's Strategy

Key Highlights

- Target reduction of loss ratio – impact on initial expected loss ratio.
- More accurate pricing of risk
- Adverse selection
- Impacts triangles by PY only

	Evaluation Months								
PY	12	24	36	48	60	72	84	96	108
2002	8,306	24,918	49,835	74,753	97,178	106,896	109,034	111,215	113,439
2003	8,836	26,508	53,016	79,524	103,381	113,719	115,994	118,314	
2004	9,400	28,200	56,400	84,600	109,980	120,978	123,398		
2005	10,000	30,000	60,000	90,000	117,000	128,700			
2006	10,300	30,900	61,800	92,700	120,510				
2007	10,609	31,827	63,654	95,481					
2008	10,927	32,782	65,564						
2009	11,255	33,765							
2010	11,593								

Potential impact of analytics on loss and claim count triangles (Cont'd)

While underwriting predictive modeling has transformed the risks insurance companies have written on the front-end, claims analytics / predictive modeling transforms how claims are settled on the back-end. However, their impact may not be observed immediately in the loss and claim triangles.

	Paid Losses	Incurred Losses	Closed Claims	Reported Claims
Claim Predictive Modeling	▪ Lower claim severity as the potential for large claims lessens with more attention given to more severe claims ▪ May shorten tail	▪ Higher incurred loss amounts at earlier evaluation points as claims are assigned to the proper resources ▪ May shorten tail	▪ Claims may settle faster as resources are used more efficiently	▪ Likely no impact, but may lead to more reported claims without amount
Claims Analytics	▪ Likely no impact in early evaluation periods ▪ Shorter tail if claims are settled faster	▪ Higher incurred loss amounts at early evaluation points as systems predict ultimate value better ▪ May shorten tail	▪ Claims may settle faster ▪ Likely no impact on overall frequency	▪ Likely no impact, but may lead to more reported claims without amount

Key Highlights

- Claims are the single largest expense for a P&C insurer
- 20% of claims drive 80% of the costs
- Impacts triangles by PY and CY

	Evaluation Months								
PY	12	24	36	48	60	72	84	96	108
2002	8,306	24,918	49,835	74,753	97,178	106,896	109,034	111,215	113,439
2003	8,836	26,508	53,016	79,524	103,381	113,719	115,994	118,314	
2004	9,400	28,200	56,400	84,600	109,980	120,978	123,398		
2005	10,000	30,000	60,000	90,000	117,000	128,700			
2006	10,300	30,900	61,800	92,700	120,510				
2007	10,609	31,827	63,654	95,481					
2008	10,927	32,782	65,564						
2009	11,255	33,765							
2010	11,593								

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Potential impact of analytics on loss and claim count triangles (Cont'd)

While claims predictive modeling and analytics are putting strong downward pressure on claim severity, fraud analytics, along with some of the other forms of analytics (i.e. safety analytics and litigation management), could put downward pressure on claim frequency, as well as claim severity.

	Paid Losses	Incurred Losses	Closed Claims	Reported Claims
Fraud Analytics	▪ Lower paid loss amounts across all evaluation periods	▪ Lower incurred loss amounts across all evaluation periods	▪ Fewer claims as fraudulent claims are dismissed ▪ Higher claims closed without payment	▪ Likely no impact early on, but may lead to fewer reported claims in the future as a fraud deterrent evolves

Key Highlights

- Outright dismissal of claims, some of which may have started off small but became large
- Higher claims closed without pay as a percentage of closed, reported or ultimate claim counts
- Claims opened and investigated sooner
- Tempering of exaggerated claims leads to downward pressure on claim severity as well
- Impacts triangles by PY and perhaps by CY

	Evaluation Months								
PY	12	24	36	48	60	72	84	96	108
2002	8,306	24,918	49,835	74,753	97,178	106,896	110,103	111,755	113,431
2003	8,836	26,508	53,016	79,524	103,381	113,719	117,131	118,888	
2004	9,400	28,200	56,400	84,600	109,980	120,978	124,607		
2005	10,000	30,000	60,000	90,000	117,000	128,700			
2006	10,300	30,900	61,800	92,700	120,510				
2007	10,609	31,827	63,654	95,481					
2008	10,927	32,782	65,564						
2009	11,255	33,765							
2010	11,593								

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An example – impact of claims predictive modeling (Incurred Losses)

No Analytics Used

Incurred Loss

Accident Year	12	24	36	48	60	72
2005	51,948	77,922	101,299	121,558	133,714	140,400
2006	53,506	80,260	104,338	125,205	137,726	
2007	55,112	82,668	107,468	128,961		
2008	56,765	85,148	110,692			
2009	58,468	87,702				
2010	60,222					

Accident Year	12-24	24-36	36-48	48-60	60-72	72-Ult
2005	1.500	1.300	1.200	1.100	1.050	
2006	1.500	1.300	1.200	1.100		
2007	1.500	1.300	1.200			
2008	1.500	1.300				
2009	1.500					
A-A	1.500	1.300	1.200	1.100	1.050	
A-U	2.973	1.982	1.525	1.271	1.155	1.100

Claims predictive modeling & analytics

Analytics Used

Incurred Loss

Accident Year	12	24	36	48	60	72
2005	51,948	77,922	101,299	121,558	133,714	145,000
2006	53,506	80,260	104,338	125,205	140,000	
2007	55,112	82,668	107,468	133,000		
2008	56,765	86,000	115,000			
2009	75,000	125,000				
2010	80,000					

Accident Year	12-24	24-36	36-48	48-60	60-72	72-Ult
2005	1.500	1.300	1.200	1.100	1.084	
2006	1.500	1.300	1.200	1.118		
2007	1.500	1.300	1.238			
2008	1.515	1.337				
2009	1.667					
A-A	1.500	1.300	1.200	1.100	1.050	
A-U	2.973	1.982	1.525	1.271	1.155	1.100

Claims predictive modeling and analytics are implemented by the beginning of 2009

At first glance, what could be causing this?
- Predictive modeling / analytics?
- Case reserve strengthening?
- Increase in business?
- Bad year?

What do you do with your incurred LDF selections?

An example – impact of claims predictive modeling (Paid Losses)

No Analytics Used

Paid Loss

Accident Year	12	24	36	48	60	72
2005	10,000	30,000	60,000	90,000	117,000	128,700
2006	10,300	30,900	61,800	92,700	120,510	
2007	10,609	31,827	63,654	95,481		
2008	10,927	32,782	65,564			
2009	11,255	33,765				
2010	11,593					

Accident Year	12-24	24-36	36-48	48-60	60-72	72-Ult
2005	3.000	2.000	1.500	1.300	1.100	
2006	3.000	2.000	1.500	1.300		
2007	3.000	2.000	1.500			
2008	3.000	2.000				
2009	3.000					
A-A	3.000	2.000	1.500	1.300	1.100	
A-U	15.444	5.148	2.574	1.716	1.320	1.200

Claims predictive modeling & analytics

Analytics Used

Paid Loss

Accident Year	12	24	36	48	60	72
2005	10,000	30,000	60,000	90,000	117,000	130,000
2006	10,300	30,900	61,800	92,700	122,000	
2007	10,609	31,827	63,654	97,000		
2008	10,927	33,000	68,000			
2009	12,500	39,000				
2010	13,000					

Accident Year	12-24	24-36	36-48	48-60	60-72	72-Ult
2005	3.000	2.000	1.500	1.300	1.111	
2006	3.000	2.000	1.500	1.316		
2007	3.000	2.000	1.524			
2008	3.020	2.061				
2009	3.120					
A-A	3.000	2.000	1.500	1.300	1.100	
A-U	15.444	5.148	2.574	1.716	1.320	1.200

The paid losses in the latest diagonals are at higher levels or are increasing at a faster rate than prior diagonals, but not as much as incurred losses.

Higher paid losses resulting from faster settlement of claims

What do you do with your paid LDF selections?

An example – impact of claims predictive modeling (Reported Counts)

No Analytics Used

Reported Claim

Accident Year	Age 12	24	36	48	60	72
2005	175	263	328	377	408	420
2006	175	263	328	377	408	
2007	175	263	328	377		
2008	175	263	328			
2009	175	263				
2010	175					

Accident Year	Age 12-24	24-36	36-48	48-60	60-72	72-Ult
2005	1.500	1.250	1.150	1.080	1.030	
2006	1.500	1.250	1.150	1.080		
2007	1.500	1.250	1.150			
2008	1.500	1.250				
2009	1.500					
A-A	1.500	1.250	1.150	1.080	1.030	
A-U	2.550	1.700	1.360	1.183	1.095	1.063

Claims predictive modeling & analytics

Analytics Used

Reported Claim

Accident Year	Age 12	24	36	48	60	72
2005	175	263	328	377	408	420
2006	175	263	328	377	408	
2007	175	263	328	377		
2008	175	263	328			
2009	175	263				
2010	175					

Accident Year	Age 12-24	24-36	36-48	48-60	60-72	72-Ult
2005	1.500	1.250	1.150	1.080	1.030	
2006	1.500	1.250	1.150	1.080		
2007	1.500	1.250	1.150			
2008	1.500	1.250				
2009	1.500					
A-A	1.500	1.250	1.150	1.080	1.030	
A-U	2.550	1.700	1.360	1.183	1.095	1.063

No change in reported claim counts (this assumes that Fraud Analytics not used)

So the recent increase in incurred losses is not as a result of a higher claim frequency

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An example – impact of claims predictive modeling (Closed Counts)

No Analytics Used

Closed Claim

Accident Year	Age 12	24	36	48	60	72
2005	100	200	280	336	370	388
2006	100	200	280	336	370	
2007	100	200	280	336		
2008	100	200	280			
2009	100	200				
2010	100					

Accident Year	Age 12-24	24-36	36-48	48-60	60-72	72-Ult
2005	2.000	1.400	1.200	1.100	1.050	
2006	2.000	1.400	1.200	1.100		
2007	2.000	1.400	1.200			
2008	2.000	1.400				
2009	2.000					
A-A	2.000	1.400	1.200	1.100	1.050	
A-U	4.463	2.231	1.594	1.328	1.208	1.150

Claims predictive modeling & analytics

Analytics Used

Closed Claim

Accident Year	Age 12	24	36	48	60	72
2005	100	200	280	336	390	420
2006	100	200	280	350	400	
2007	100	200	280	350		
2008	100	200	300			
2009	105	220				
2010	110					

Accident Year	Age 12-24	24-36	36-48	48-60	60-72	72-Ult
2005	2.000	1.400	1.200	1.161	1.077	
2006	2.000	1.400	1.250	1.143		
2007	2.000	1.400	1.250			
2008	2.000	1.500				
2009	2.095					
A-A	2.000	1.400	1.200	1.100	1.050	
A-U	4.463	2.231	1.594	1.328	1.208	1.150

Claims are being settled slightly faster in the early evaluation points, and settling even faster in the later evaluation points

Claims predictive modeling could be having an impact by assigning claims to the appropriate personnel and optimizing resources

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Frequent use of diagnostic exhibits to understand changes to triangles

By understanding the relationship of the various forms of analytics to loss and claim count information, actuaries can use diagnostic exhibits and metrics to better understand how analytics are changing the loss and claim count development patterns they observe.

Paid loss to incurred loss triangles	Average case reserves triangles	Close claim counts to reported claim counts	Disposal rates - close claim counts to ultimate claim counts
Shifts in paid/incurred loss ratios may indicated changes in reserving procedures	Material change in average case reserves in latest diagonal may indicate changes in reserving procedures	Used as a supplement to paid/incurred loss ratios to indicate true slow down or speed up of payments	Shifts in disposal rates by evaluation period may indicate changes in settlement patterns
Paid or incurred loss over an exposure proxy	Percentage of claims closed without a loss amount	Number of claims above a certain amount/ threshold	Average duration of a claim to settlement
To ensure that shifts in loss amounts relative to prior PY/AY are not a result of a material change in exposure	Increase in the number of claims closed without a pay may indicate effective use of fraud investigation techniques	Fewer claims above a large threshold indicates fewer severe claims, and optimization of resources	Lower duration may indicate fewer large losses & resources being used more efficiently

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Impact on traditional loss development (chain ladder) method

Incurred Loss Development Method

Incurred Loss

Accident Year	Age 12	24	36	48	60	72
2005	51,948	77,922	101,299	121,558	133,714	145,000
2006	53,506	80,260	104,338	125,205	140,000	
2007	55,112	82,668	107,468	133,000		
2008	56,765	86,000	115,000			
2009	75,000	125,000				
2010	80,000					

Accident Year	Age 12-24	24-36	36-48	48-60	60-72	72-Ult
2005	1.500	1.300	1.200	1.100	1.084	
2006	1.500	1.300	1.200	1.118		
2007	1.500	1.300	1.238			
2008	1.515	1.337				
2009	1.667					
A-A	1.500	1.300	1.200	1.100	1.050	
A-U	2.973	1.982	1.525	1.271	1.155	1.100

What If?

- Ignore latest diagonal when selecting LDFs?
  - Overstate ultimate losses, especially for most recent policy periods
- Give weight to the latest diagonal and increase LDFs?
  - Even greater overstatement of ultimate losses for most recent policy periods, but may better project ultimates for earlier policy periods (if shorten tail)

Steps to Take

- Rely more on methods utilizing paid losses
  - Be aware of speed up of payments and faster settlements patterns
- Ignore chain ladder method entirely
  - Rely more on the frequency-severity and Bornhuetter-Ferguson methods, provided you select the appropriate CDFs, or adjust IELRs to reflect the expected overall impact on loss ratio
- Shorten paid loss development tail
  - However, tail factor selections are a great source of uncertainty when estimating reserves

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Impact on traditional loss development (chain ladder) method (Cont'd)

Paid Loss Development Method

Paid Loss

Accident Year	Age 12	24	36	48	60	72
2005	10,000	30,000	60,000	90,000	117,000	130,000
2006	10,300	30,900	61,800	92,700	122,000	
2007	10,609	31,827	63,654	97,000		
2008	10,927	33,000	68,000			
2009	12,500	39,000				
2010	13,000					

Accident Year	Age 12-24	24-36	36-48	48-60	60-72	72-Ult
2005	3.000	2.000	1.500	1.300	1.111	
2006	3.000	2.000	1.500	1.316		
2007	3.000	2.000	1.524			
2008	3.020	2.061				
2009	3.120					
A-A	3.000	2.000	1.500	1.300	1.100	
A-U	15.444	5.148	2.574	1.716	1.320	1.200

What If?

- Ignore latest diagonal when selecting LDFs?
  - Overstatement, but not as large as incurred LD method
- Give weight to the latest diagonal and increase LDFs?
  - Even greater overstatement of ultimate losses for most recent policy periods, but may better project ultimates for earlier policy periods (if shorten tail)

Steps to Take

- Ignore chain ladder method entirely
  - Rely more on the frequency-severity and B-F methods, provided you select the appropriate CDFs, or adjust IELRs to reflect the expected overall impact on loss ratio
- Consider utilizing Berquist Sherman method if claims are settling faster
  - Adjust closed claim counts using B-S paid claim development adjustment
- Shorten incurred and paid loss development tails
  - However, tail factors are a great source of uncertainty when estimating reserves

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Impact on Bornhuetter-Ferguson ("B-F") method

AY	WC Payroll	Test 1 Ultimate	Test 2 Ultimate	Selected Ultimate	PP Trend	Benefit Level Adj Factor	ILF	On-Level Pure Premium	Selected IELR
2004	340,185	155,403	154,452	154,928	1.126	1.044	1.040	0.557	0.458
2005	346,988	159,500	156,000	157,750	1.104	1.030	1.040	0.538	0.473
2006	353,928	161,700	161,040	161,370	1.082	1.011	1.000	0.499	0.512
2007	368,085	168,977	166,452	167,714	1.061	1.014	1.000	0.490	0.520
2008	371,766	182,125	175,032	178,579	1.040	1.012	1.000	0.506	0.532
2009	375,484	247,748	200,772	224,260	1.020	0.998	1.000	0.608	0.550
2010	386,748	237,838	229,545	233,691	1.000	1.000	1.000	0.604	0.560
							All Year Average	0.543	
							Avg. 2004-2008	0.518	
							Avg. 2009-2010	0.606	
							IELR Selection	**0.560**	

Unadjusted ultimate loss indications from loss development methods

Is experience worsening? What weight do you give to 2009 + 2010, if any?

What If?

- If you use results from the development methods where LDFs are unadjusted for initiatives, you will overstate the pure premium indications.
- Should you consider pure premium indications from 2009 and 2010 when selecting initial expected loss rates?
  - If claims predictive modeling / analytics are intended to improve loss experience, true IELR would actually be lower than historical averages before initiatives were implemented.

Steps to Take

- Utilize expected loss ratios as the a priori rather than expected loss rates (loss/exposure unit)
  - Initial expected loss ratios based on discussions with the UW or modellers who've projected the impact of various analytics initiatives (as opposed to using ultimate loss indications)
- Can utilize other a priori – prior ultimate loss, ultimate loss indications from frequency-severity method, etc.
- Still need to utilize paid and incurred loss development patterns for % unpaid and unreported
  - Will need to reflect initiatives in your LDF selections

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Impact of frequency-severity method

Reported Claim

Accident Year	12	24	36	48	60	72
2005	175	263	328	377	408	420
2006	175	263	328	377	408	
2007	175	263	328	377		
2008	175	263	328			
2009	175	263				
2010	175					

No change

Accident Year	12-24	24-36	36-48	48-60	60-72	72-Ult
2005	1.500	1.250	1.150	1.080	1.030	
2006	1.500	1.250	1.150	1.080		
2007	1.500	1.250	1.150			
2008	1.500	1.250				
2009	1.500					

Incurred Sevirity

Accident Year	12	24	36	48	60	72
2005	297	297	309	322	328	345
2006	306	306	318	332	344	
2007	315	315	328	352		
2008	324	328	350			
2009	429	476				
2010	457					

Accident Year	12-24	24-36	36-48	48-60	60-72	72-Ult
2005	1.000	1.040	1.043	1.019	1.053	
2006	1.000	1.040	1.043	1.035		
2007	1.000	1.040	1.076			
2008	1.010	1.070				
2009	1.111					

What If?

- What if you reflect the observed increase in claims severity at early evaluation points?
  - Overstatement of ultimate severity when there is downward pressure instead
- What if used closed claim counts to project ultimate counts?
  - Claim settlement pattern to speed up if claims predictive modeling is implemented effectively, could lead to overstatement of ultimate claims

Steps to Take

- If claims predictive modeling / analytics do not have a material impact on reported claim counts, focus is more on ultimate severity
  - Fraud analytics and underwriting predictive modeling would have an impact on reported counts
  - In those instances, use of developed metrics to estimate impact on reported or closed counts
- Use of developed metrics to understand impact of claims severity and reduction in claims leakage
  - All forms of analytics place downward pressure on severity

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Impact from the various forms of analytics initiatives may offset

What if various forms of analytics were implemented simultaneously where one initiative would place upward pressure on incurred losses at early evaluation points, and the other initiative would place downward pressure?

Original Triangle

Incurred Loss

Accident Year	12	24	36	48	60	72
2005	51,948	77,922	101,299	121,558	133,714	140,400
2006	53,506	80,260	104,338	125,205	137,726	
2007	55,112	82,668	107,468	128,961		
2008	56,765	85,148	110,692			
2009	58,468	87,702				
2010	60,222					

Fraud analytics, if implemented effectively, would lead to a decrease in incurred losses throughout

Claims predictive modeling

Fraud analytics

Incurred Loss

Accident Year	12	24	36	48	60	72
2005	51,948	77,922	101,299	121,558	133,714	145,000
2006	53,506	80,260	104,338	125,205	140,000	
2007	55,112	82,668	107,468	133,000		
2008	56,765	86,000	115,000			
2009	75,000	125,000				
2010	80,000					

Incurred Loss

Accident Year	12	24	36	48	60	72
2005	51,948	77,922	101,299	121,558	133,714	140,400
2006	53,506	80,260	104,338	125,205	137,726	
2007	55,112	82,668	107,468	128,000		
2008	56,765	85,148	108,000			
2009	52,000	74,000				
2010	48,000					

Post-implementation Triangle

Incurred Loss

Accident Year	12	24	36	48	60	72
2005	60,546	90,818	118,064	141,677	155,844	163,636
2006	62,362	93,543	121,606	145,927	199,800	
2007	64,233	96,349	125,254	150,305		
2008	66,160	99,240	130,000			
2009	70,555	109,360				
2010	72,672					

The true impact of each analytics initiative taken is hidden when their impacts are merged, making the task more difficult for an actuary

As a result, it is important to review claim count triangles and diagnostic exhibits. Since claims predictive modeling does not impact reported counts, a decrease in reported counts could imply effective use of fraud analytics

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Impact from the various forms of analytics initiatives may offset (Cont'd)

Similarly, underwriting predictive modeling would put downward pressure on the incurred and paid losses coming in, and, if implemented properly, would remain at lower levels compared to earlier PY throughout the triangle.

Original Triangle

Incurred Loss

Accident Year	12	24	36	48	60	72
2005	51,948	77,922	101,299	121,558	133,714	140,400
2006	53,506	80,260	104,338	125,205	137,726	
2007	55,112	82,668	107,468	128,961		
2008	56,765	85,148	110,692			
2009	58,468	87,702				
2010	60,222					

Underwriting predictive modeling would put downward pressure on the incurred losses coming in.

Claims predictive modeling

Underwriting predictive modeling

Incurred Loss

Accident Year	12	24	36	48	60	72
2005	51,948	77,922	101,299	121,558	133,714	145,000
2006	53,506	80,260	104,338	125,205	140,000	
2007	55,112	82,668	107,468	133,000		
2008	56,765	86,000	115,000			
2009	75,000	125,000				
2010	80,000					

Incurred Loss

Accident Year	12	24	36	48	60	72
2005	51,948	77,922	101,299	121,558	133,714	140,400
2006	53,506	80,260	104,338	125,205	137,726	
2007	55,112	82,668	107,468	128,000		
2008	49,000	72,000	93,250			
2009	50,100	73,000				
2010	50,678					

Post-implementation Triangle

Incurred Loss

Accident Year	12	24	36	48	60	72
2005	60,546	90,818	118,064	141,677	155,844	163,636
2006	62,362	93,543	121,606	145,927	199,800	
2007	64,233	96,349	125,254	150,305		
2008	63,000	92,925	119,873			
2009	66,000	104,280				
2010	67,500					

If there was a lag period between when underwriting and claims predictive modeling initiatives were implemented, it would be more evident in the triangle

Paid to incurred loss ratios would be good indicators of the impact of these initiatives. Whereas UW predictive modeling may lead to no change in paid/incurred losses, claims predictive modeling may lead to lower paid/incurred loss ratios in early evaluation points (as long as there isn't a speed up in claim closures)

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Contemplating changes in an actuary's approach

Yes, analytics are changing the loss and claim count development triangles that an actuary uses to determine reserves. But that is nothing new – actuaries have had to consider the impact on triangles as a result of changes in the underlying risk, inflationary pressures, changes in WC benefits, case reserve strengthening, etc.

Data

- Use current, real time data as much as possible
  - Use of external data sources
  - Switch to quarterly or semi-annual evaluation periods for development triangles
- **Development of new metrics**
- Keep in mind changes to data as a result of multiple forms of analytics
- Keep in mind other changes to data such as:
  - changes in underlying risk
  - inflation
  - changes to WC benefits
  - case reserve strengthening/ weakening

Assumptions

- Overall, less reliance on long-term history for a priori selections, trends, on-leveling adjustments, etc.
- Use of shorter term averages for LDFs
- For selection of initial expected loss rates/loss ratios,
  - use of shorter term experience, and/or
  - apply adjustments judgmentally to loss history as needed to "on-level" data

Method

- Think outside the box – don't just use your standard four or five methods
- Develop new reserving methods or adjust existing ones, as needed
- Incorporate results from metrics into your trends and assumptions to reflect savings on IBNR
- Use diagnostics to support what you observe in loss and claim count triangles and the relationship between incurred/paid losses and/or reported/closed counts

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How to adapt to the changing world of an actuary

- Actuaries will need to develop/maintain key business skills beyond the technical skill sets we possess
  - Gain a better understanding of the business/operations of an insurance company
  - Communications – written and verbal – to effectively document and discuss at the C-suite level what changes are driving results
- Actuaries will be asked to be more analytical in our day-to-day work, since advanced tools and software will do the bulk of the number crunching for us.
  - Think outside the box – we'll be asked to be more critical thinkers
  - Be more creative with your analysis – new data sources, new methods, new techniques
- Embrace predictive modeling and analytics – it is where the industry and profession is headed, as it is evolving from a specialty to common responsibility or task in a job description.
  - We don't have to be proficient with the details of predictive modeling, but we should be able to understand how it works and most importantly, how it impacts reserves, payments and claim counts.
- Regardless of the methods or tools used by actuaries or insurance companies, remember that the ultimate value of a claim will not be known until it is settled (claim reopening notwithstanding)
  - But we should utilize whatever tools and information are available to us

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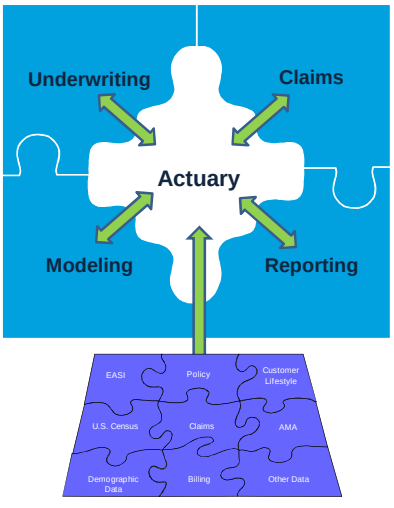
Stay on top of changes

The reserving actuary should proactively communicate with other departments to stay on top of changes in underwriting techniques and claim handling procedures and to be able to have access to the most critical, up-to-date information to best estimate reserves.



- Discuss with underwriters to understand changes to types of risks written, changes in the way that business is being priced, and any new information that underwriters are using to better understand the risk being insured.
- Discuss with the claims department to understand changes in claim handling procedures, increasing use of analytics, changes in staffing levels, changes in the definition of a claim and impact of any changes to claims systems.
- Discuss with modelers to understand changes to how a policy is priced or how the ultimate value of a claim is estimated, the expected timing of these changes, and the expected magnitude of their impact.
- Work with the reporting department (financial, statistical, accounting) to customize reports and provide the appropriate and detailed information needed.

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Actuarial Odyssey, Year 2020

Imagine the growing power of technology and data mining capabilities over the next ten years, where analytics and advanced claims systems could lead to a much better prediction of the ultimate value of a claim at first notice of loss.

- Given the appropriate characteristics of a claim (claimant age, injury type, region, salary, etc.) that predictive modeling can identify as being ideal predictors, advanced analytics and claims systems would be able to very closely estimate the ultimate value of a claim.
  - Would shorten the tail of an incurred loss development triangle considerably
  - It would move the actuary's focus to mainly estimating the true IBNR

Total Reserves =
Case Reserves + "True" IBNR

A reserving actuary would just need to estimate the reserves from claims that have not yet been reported

An actuary's estimates of ultimate losses and reserves always have uncertainty in them. The one thing that is certain is that our estimates of ultimates and reserves will not come in exactly as we project them to.

So if a tool can be developed to very closely estimate the ultimate value of a claim, at a minimum, this tool could be used as another data point for an actuary to use in his/her estimate of the reserves. The actuary's role would move from estimating total reserves (case + IBNR) to estimating true IBNR on claims that have not yet been reported.

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Concluding remarks

- It is incumbent on the actuary to review all the information available to him or her, and think everything through before reaching a conclusion
  - Whether you are consulting actuary or an insurance company actuary, you need to marry all this insight together to bring value to your client or your company
- Reflect potential savings from analytics into your IBNR estimates
  - Can phase in IBNR savings as you receive actual data
- As part of actuarial standards, always support and document your assumptions, methodologies used, and selections in your actuarial work papers and/or statements of actuarial opinion

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Q&A

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