C-24: Size of Loss Trend Matters Using New Experience and Credibility

CARe Seminar, June 5-6, 2017

Washington DC

John W. Buchanan, FCAS, MAAA, Managing Principal, Verisk / ISO
Paul D. Gates, FIA, Chief Reinsurance Actuary, Allied World Reinsurance
Vagif Amstislavskiy, FCAS, MAAA, VP & Actuary, Zurich North America

Antitrust Notice

- The Casualty Actuarial Society is committed to adhering strictly to the letter and spirit of the antitrust laws. Seminars conducted under the auspices of the CAS are designed solely to provide a forum for the expression of various points of view on topics described in the programs or agendas for such meetings.
- Under no circumstances shall CAS seminars be used as a means for competing companies or firms to reach any understanding – expressed or implied – that restricts competition or in any way impairs the ability of members to exercise independent business judgment regarding matters affecting competition.
- It is the responsibility of all seminar participants to be aware of antitrust regulations, to prevent any written or verbal discussions that appear to violate these laws, and to adhere in every respect to the CAS antitrust compliance policy.

Size of Loss Trend Matters - Using New Experience and Credibility

- This session will use new data and analytics to investigate the age-old question of whether trend varies by size of loss. Historically, a common trend assumption was that trend is independent of the size of a loss, but this assumption is being challenged. Evidence will be presented in this session to suggest that trend is size-dependent.
- This session will investigate the interconnection between layered and dispersed excess loss development factors, severity trends, frequency trends, and the resulting pressure on size of loss increased limits factors. This session will investigate these relationship from various U.S. casualty and International markets. The leveraged impact of varying trend and inflation assumptions on large claims associated with the U.K. and Ogden tables will be included.
- These topics will be some of the research areas in the potential new Joint IFoA / CAS International Pricing Research Working Party on Differentiating Global Casualty Markets and Companies.

C-24: Size of Loss Trend Matters
Agenda

- **Introduction / US Experiences**
  - John Buchanan 15 minutes
- **Global Reinsurance including Ogden UK**
  - Paul Gates 20 minutes
- **Trend in Excess Layers**
  - Vagif Amstislavskiy 35 minutes
- **Q&A** 5 minutes

Size of Loss Trend Matters Introduction / US Experiences

June 6, 2017

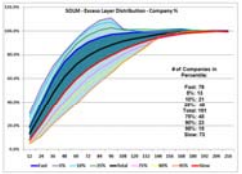
John Buchanan

ISO
Verisk Insurance Solutions

SERVE | ADD VALUE | INNOVATE

Size of Loss Trend Matters - Introduction

- **Estimating Trends by Size-of-Loss**
  - Main question: **Is Trend uniform for all Loss Sizes?**
  - Very difficult to answer due to significant data and analytic complexities
  - Possible methods:
    - Project individual claims to ultimate and directly measure layer trend
    - Various aggregated approaches
    - Percentile graphing approach
    - Various parametric approaches*
- **Sample Estimates and Impacts of Trend**
  - Commercial Auto pressure on Increased Limits Factors
  - Professional Liability Limited and Layered Average Severities
  - Primary vs. Umbrella Products
- **Potential joint 2017/18 IFoA / CAS Working Party**
  - Differentiating Global Casualty Markets and Companies
  - Size-of-Loss Trend Potential Chapter



** See Dave Clark, Large Loss Trend via Parametric Model, CARe 2012*

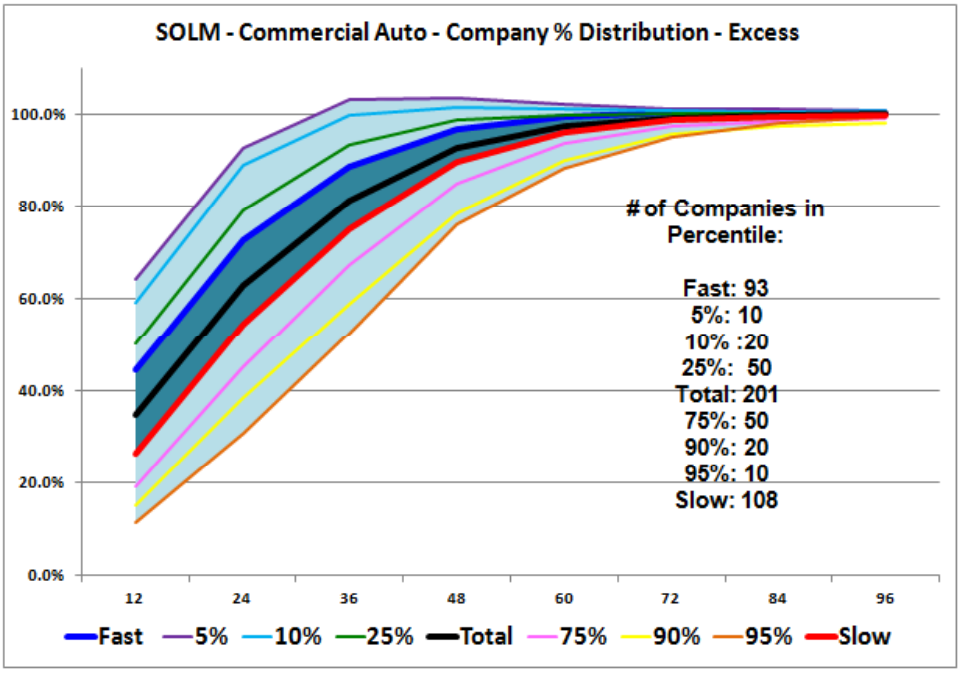
Size-of-Loss Trend Analysis Using Individual Claims Goal and Complexities

- **Goal: Produce a set of individual losses at an ultimate basis**
  - What development and other adjustment factors should be applied?
  - Assume information is from a variety of insureds or cedants
  - After trend estimation by SOL, can apply to individual claims for evaluating ILFs
- **Complexities in Projecting Claims to Ultimate**
  - Lack of credible large claims or don't have all claims (reinsurer threshold)
  - Vary individual LDFs by size of loss and company
    - do larger claims develop faster or slower?
    - should reflect different case reserving practices by company
    - potentially vary by soft/hard market and coverage differences
  - Evaluate dispersion of development factors
    - understate variability if apply the same LDF to all claims
  - Break apart claim components into e.g. medical vs. indemnity, and recombine
  - Could use closed claims to avoid development issues
    - but reduces data size and have IBNYR issues
  - Use Report Year if possible, with benefit that LDFs aren't as large as AY
  - Apply LDFs to open claims only, and look for off-balance
- **Other factors:**
  - Interaction of frequency and severity into excess layers
  - Evaluate impact of historical and/or changing policy limits or attachment points
  - Include randomization / simulation

SERVE | ADD VALUE | INNOVATE

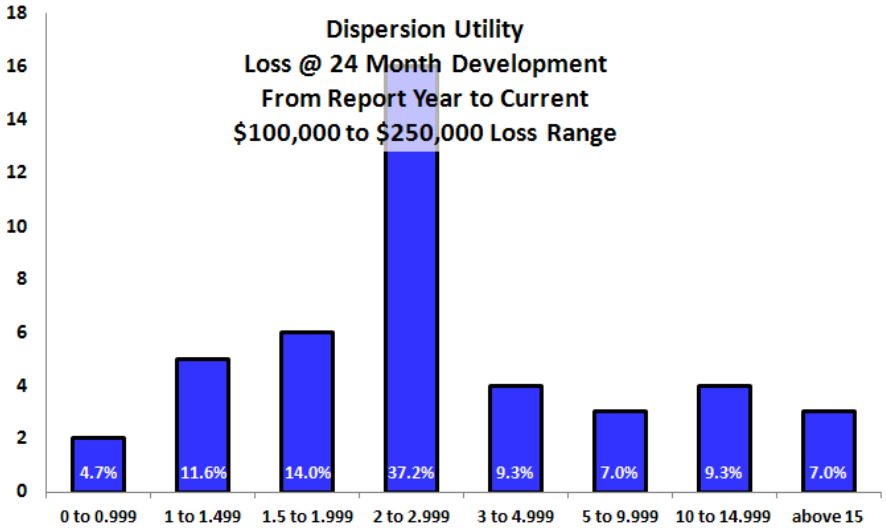
Loss Development Variations by Company

Illustrative



Excess Claim Dispersion

Illustrative



Sample Calculation of Individual Claims at Ultimate Including impact of Trend

Illustrative

Acc Date	Accident Year	Report Year	Incurred Loss+ALAE @12/31/2010	OS Loss	Excess LDF	Excess Trend	Other Factors	Random ization	Estimated Ultimate Loss
04/25/01	2001	2004	102,740	0	1.000	1.63	1.000	1.000	167,353
10/17/01	2001	2006	125,422	80,000	1.225	1.63	1.000	1.000	250,266
10/25/01	2001	2001	285,145	0	1.000	1.63	1.000	1.000	464,471
03/20/02	2002	2002	268,459	0	1.000	1.55	1.000	1.000	416,467
07/04/02	2002	2005	245,145	0	1.000	1.55	1.000	1.000	380,300
03/03/03	2003	2003	240,469	200,000	1.132	1.48	1.000	1.000	402,180
03/20/03	2003	2004	305,957	0	1.000	1.48	1.000	1.000	452,037
04/23/03	2003	2003	202,446	0	1.000	1.48	1.000	1.000	299,105
07/05/03	2003	2003	185,731	0	1.000	1.48	1.000	1.000	274,409
07/09/03	2003	2003	275,862	250,000	1.132	1.48	1.000	1.000	461,373
08/01/03	2003	2004	1,072,244	0	1.000	1.48	1.000	1.000	1,584,192
10/18/03	2003	2007	140,469	0	1.000	1.48	1.000	1.000	207,537
10/25/03	2003	2005	445,040	0	1.000	1.48	1.000	1.000	657,527
02/09/04	2004	2006	64,130	0	1.000	1.41	1.000	1.000	90,238
11/19/08	2008	2009	150,862	125,000	1.687	1.16	1.000	1.000	294,620
07/14/09	2009	2009	1,566,356	100,000	1.298	1.10	1.000	1.000	2,241,526
11/04/09	2009	2009	164,636	100,000	1.687	1.10	1.000	1.000	306,209
04/03/10	2010	2010	1,039,423	1,000,000	1.375	1.05	1.000	1.000	1,500,668
45			14,722,580	4,784,000					20,386,858

Measuring Impact due to Changing Policy Limits Distribution

Illustrative

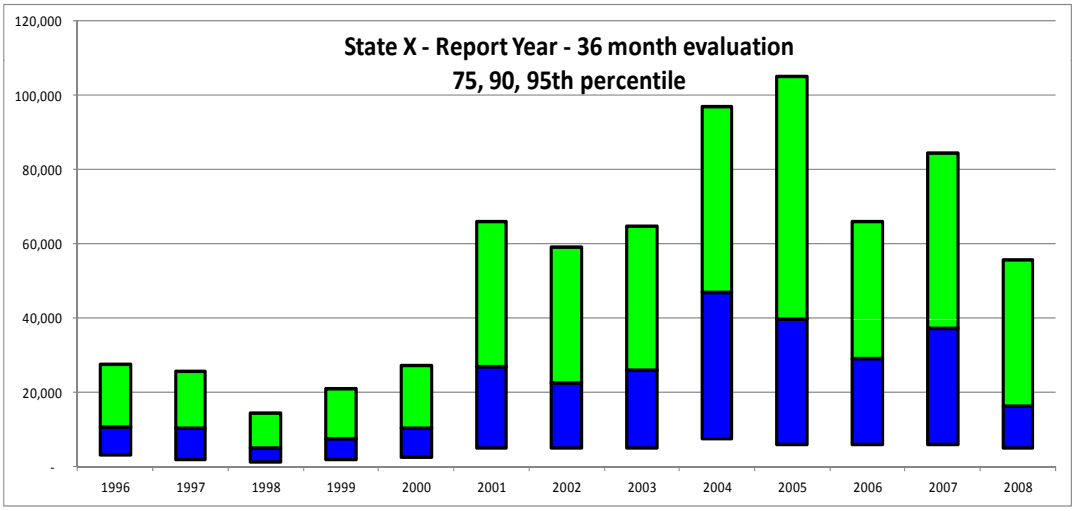
AY	Policy Limit Distribution 500,000	1,000,000	5,000,000	Exposure Rate 250,000 excess of 250,000	500,000 excess of 500,000
1998	75.00%	20.00%	5.00%	14.71%	3.09%
1999	75.00%	20.00%	5.00%	14.71%	3.09%
2000	75.00%	20.00%	5.00%	14.71%	3.09%
2001	75.00%	20.00%	5.00%	14.71%	3.09%
2002	75.00%	20.00%	5.00%	14.71%	3.09%
2003	50.00%	20.00%	30.00%	14.24%	6.18%
2004	25.00%	20.00%	55.00%	13.77%	9.27%
2005	10.00%	20.00%	70.00%	13.49%	11.13%
2006	10.00%	20.00%	70.00%	13.49%	11.13%
2007	10.00%	20.00%	70.00%	13.49%	11.13%
2008	10.00%	20.00%	70.00%	13.49%	11.13%

** See Dave Clark, Introduction to Experience Rating, CAS Reinsurance Pricing Seminar, 2007*

SERVE | ADD VALUE | INNOVATE

Size of Loss Trend Percentile Graphing Illustration

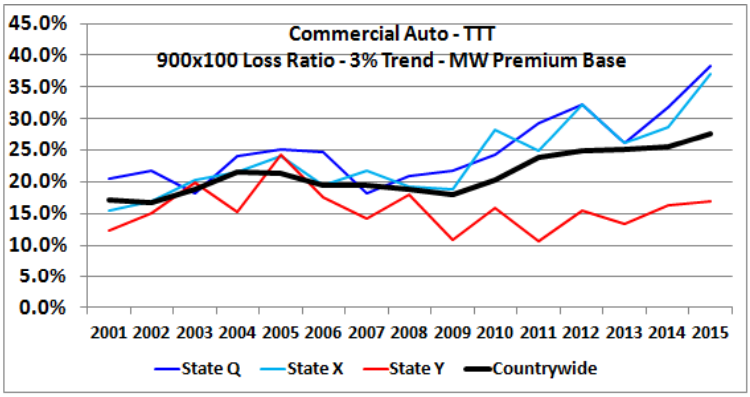
Illustrative



Commercial Auto – Excess vs. Ground-Up Trend

Illustrative

Excess Partial Loss Ratios 900x100k @12/2015
Using On-Level Premium and Assuming 3% Severity Trend



900x100 Loss Ratio - 3% Trend - MW Premium Base

	Countrywide	State Q	State X	State Y
2009	18.0%	21.8%	18.9%	10.9%
2010	20.4%	24.3%	28.3%	16.0%
2011	23.8%	29.3%	24.9%	10.6%
2012	25.0%	32.2%	32.2%	15.4%
2013	25.1%	26.2%	26.1%	13.3%
2014	25.5%	31.9%	28.6%	16.4%
2015	27.6%	38.3%	37.1%	16.9%
7 Year Trend	6.36%	7.58%	7.47%	5.69%
Total Indemnity	17,036,053,171	1,513,152,397	570,861,128	187,616,942
Excess vs GU trend	0.52%	0.52%	-0.55%	-0.07%

Size of Loss Trend - Aggregated Approach

Professional Line Illustration #1

Illustrative

Sample Professional Line	Ultimate Indemnity Layer Average Severity				
AY	100k	900x100	1M x1M	3M x 2M	Unl x 5M
2001	28,291	178,301	443,011	1,147,776	5,194,771
2002	30,199	184,139	461,993	1,397,644	5,138,950
2003	32,306	186,549	471,318	1,259,222	4,022,872
2004	33,658	192,677	450,308	1,404,271	4,290,698
2005	35,041	207,250	482,105	1,442,655	4,120,747
2006	36,313	211,981	495,030	1,596,200	3,952,509
2007	37,420	220,530	518,112	1,486,778	4,760,784
2008	37,429	216,304	581,851	1,627,814	6,220,841
2009	38,699	220,365	533,824	1,562,756	4,747,517
2010	41,349	230,991	557,724	1,618,902	3,728,193
2011	40,978	237,637	591,086	1,682,349	5,459,695
2012	41,966	239,938	626,227	1,673,620	4,863,424
2013	42,708	234,199	626,214	1,817,163	4,208,608
2014	45,959	258,297	720,497	2,044,922	3,585,025
2015	50,745	337,779	785,436	2,495,661	7,076,876
All Year	3.45%	3.25%	3.68%	3.86%	0.52%
Trend 09-15	3.81%	5.32%	6.17%	6.96%	3.07%

Source: ISO Size-of-Loss Matrix – 2016v4 using 3% detrend assumption and 5-year VWA; excludes claims <5k

Size of Loss Trend - Aggregated Approach
Professional Line Illustration #2

Illustrative

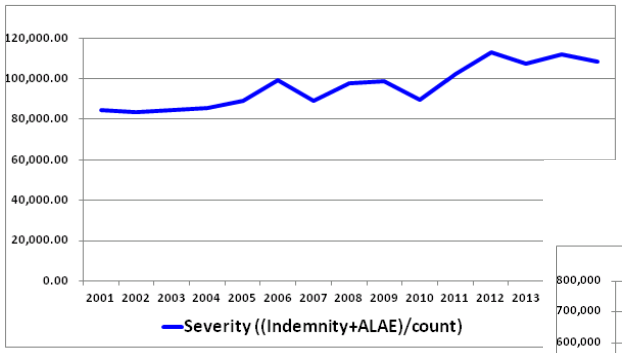
Sample Professional Line	Ultimate Indemnity Severity in the Layer				
AY	100k	900x100	1M x1M	3M x 2M	Unl x 5M
2001	28,291	46,484	13,345	16,991	27,307
2002	30,199	49,513	15,025	22,262	41,944
2003	32,306	52,461	14,716	19,257	23,893
2004	33,658	55,732	15,446	20,740	28,003
2005	35,041	61,644	17,594	25,108	35,968
2006	36,313	62,905	17,796	26,880	31,836
2007	37,420	64,720	18,918	25,894	35,050
2008	37,429	59,563	18,089	27,215	52,013
2009	38,699	62,365	16,635	22,965	28,507
2010	41,349	69,061	18,732	26,519	25,118
2011	40,978	66,472	19,401	27,434	36,460
2012	41,966	64,741	19,774	27,540	34,219
2013	42,708	63,383	18,064	27,628	30,677
2014	45,959	74,662	22,158	34,641	32,151
2015	50,745	86,126	26,755	41,633	54,799
All Year	3.45%	3.11%	3.39%	4.28%	1.68%
Trend 09-15	3.81%	3.85%	6.04%	8.31%	8.15%

Source: ISO Size-of-Loss Matrix – 2016v4 using 3% detrend assumption and 5-year VWA; excludes claims <5k

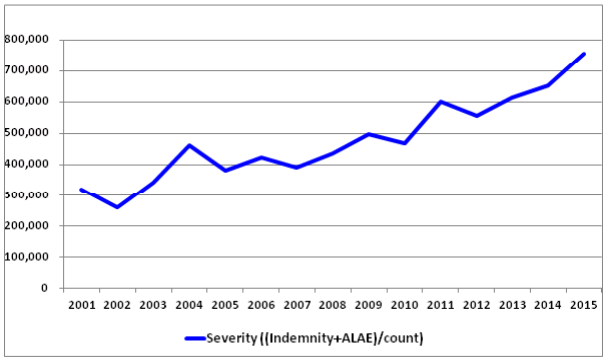
Size of Loss Trend – Primary vs. Umbrella Products

Illustrative

Products	
Severity ((Indemnity+ALAE)/count)	
Data Threshold Min	5,001
Data Threshold Max	1,000,000
7-year Trend	2.73%
All-year Trend	2.19%



Umbrella - Products	
Severity ((Indemnity+ALAE)/count)	
Data Threshold Min	5,001
Data Threshold Max	1,000,000
7-year Trend	6.91%
All-year Trend	6.07%



Source: ISO Size-of-Loss Matrix – 2015 using 3% detrend assumption and 5-year VWA (allyr VWA Umbrella); excludes claims <5k

Size of Loss Trend - Aggregated Approach
Umbrella Illustration

Illustrative

Umbrella - Sample	Ultimate Indemnity Layer Average Severity				
AY	1M	1M x1M	3M x 2M	5M x 5M	10M x 10M
2001	128,124	496,337	1,156,507	2,031,703	3,787,136
2002	112,837	500,289	1,164,616	1,825,342	3,896,855
2003	199,920	515,619	1,261,796	1,981,223	4,511,312
2004	238,872	514,376	1,150,577	1,752,186	3,184,168
2005	279,754	530,171	1,198,460	1,759,328	3,126,886
2006	296,185	564,455	1,423,586	1,685,495	3,083,991
2007	318,008	556,915	1,323,596	1,685,986	3,528,367
2008	349,417	567,026	1,371,068	2,169,936	4,282,643
2009	356,458	574,593	1,296,332	2,115,759	3,399,095
2010	355,472	596,721	1,467,096	2,150,624	4,104,448
2011	360,414	581,937	1,456,157	2,109,516	2,448,684
2012	342,671	611,370	1,370,251	2,327,702	3,602,342
2013	350,994	621,706	1,379,880	1,960,331	5,050,442
2014	384,401	630,540	1,321,310	2,030,285	4,870,895
2015	367,087	822,831	1,652,868	3,285,759	3,493,006
All Year	7.22%	2.49%	1.80%	2.27%	0.58%
Trend 05-14	2.73%	1.71%	0.69%	2.36%	3.67%
Trend 09-14	0.83%	1.82%	-0.43%	-1.10%	8.02%
Trend 09-15	0.78%	4.48%	1.66%	4.04%	4.10%

Source: ISO Size-of-Loss Matrix – 2016v4 using 3% detrend assumption and all-year VWA

Different Data Available

EUROPE

- In general, **almost no market data available** for Europe
  - Exception: Germany
- Amount of client specific data **varies by country**
- Even in "good" countries (UK), the data **varies by company**
  - Standard Motor market questionnaire
- Rate changes - Rate change info **provided by cedent**, *sometimes* with supporting calcs

USA

- ISO collects data from all **member companies**
  - Loss costs, exposure curves
- Amount of data **varies by company**
  - Companies **more open to reinsurer visits** in the US
- Rate changes – Due to regulation, **usually filed** with state insurance departments, esp. personal lines

Source: CARe-London 2007, Casualty Pricing Approaches (Doug Lacoss))

SIZE OF LOSS TREND MATTERS – GLOBAL REINSURANCE JUNE 2017

AWAC.COM

SIZE OF LOSS TRENDS - REINSURANCE

- Determining trend by size of loss - issues
- UK Motor trend – an emerging story
- US Liability observations
- Reserving practices and implications for trend

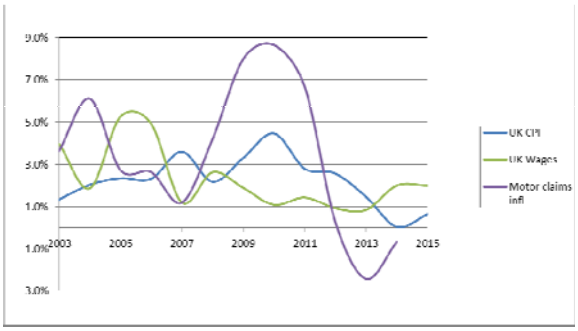
AWAC.COM

DETERMINING LOSS TRENDS BY SIZE IN REINSURANCE - ISSUES

- Paucity of data
- Heterogeneity within data
    - Property damage versus Bodily injury
    - Loss versus ALAE
    - XL reinsurance covers totality of claim irrespective of source
- Methodology for determining “large” versus “small” claims
    - Threshold derivation
    - Ultimate claims versus claims at development point
    - Allowance for exposure changes
    - Settlement year versus accident year approaches
- Reliability of data sources – particularly acute internationally
    - Relevance of older years
    - Outlier claims
- Variability in reserving practices
- Legal and societal impacts

UK MOTOR TREND – ALL CLAIMS

- Majority of UK Motor claims arise from Property Damage
- Property Damage claims driven by material values, labour costs
- Smaller claims (and thus overall claims burden) linked to consumer price inflation and wage index
- Motor claims inflation in graph calculated from Milliman study (“Driving for Profit, July 2016)
    - Based on average gross claim incurred per year
    - Year-on-year volatility – implied average trend 3%-3.5%
    - Real increase of motor claims approximately 1%



ALLIED WORLD
AWAC.COM

UK MOTOR TREND – BODILY INJURY CLAIMS

- High Bodily Injury trend in UK (before recent discount rate change)
  - Large claims driven by BI trend
  - Costs of care increasing rapidly (also consider loss of earnings)
    - Trend further impacted by application of Periodic Payment Orders (PPOs) for particular cases (generally under very large losses)
  - BI trend quantified by International Underwriting Association studies and various broker studies, including AonBenfield
  - Previous shocks have affected trend
    - Reduction of discount rate from 4.5% to 3% (1999) and further to 2.5% (2001)
    - Introduction of PPOs (2003)

DETERMINING LOSS TRENDS BY SIZE IN REINSURANCE – LARGE UK MOTOR CLAIMS

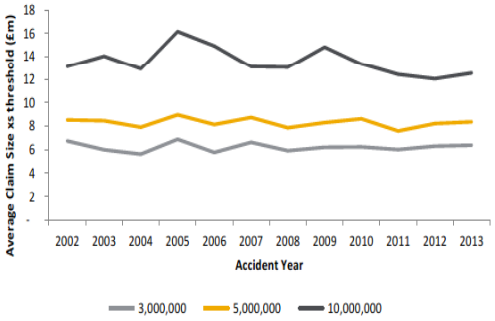
- AonBenfield study (UK Motor & Liability Review – Large Loss Inflation Study, 2016) utilises largest claims in UK motor database
- Derive trend based on claims at certain point of development (assuming stable reserving approach), adjust for exposure change
- Consider implied trend per claims year by comparing average claim in that cohort against average claim in later claim year
- Overall average of sample below = 6%, removing 2007 = 7%
  - Results exhibit volatility
  - Similar trend observed if one considers other sample sets / development periods
  - Similar results if an excess of loss layer is considered

UK MOTOR CLAIMS
TREND IMPLIED BY LARGEST BI LOSSEES

Original Claim Year	Later Claim Year for Comparison 2010	2011	2012	2013
2004	8%	6%	10%	8%
2005	3%	2%	6%	5%
2006	7%	4%	9%	7%
2007	1%	-1%	6%	4%
2008	8%	3%	11%	7%

ALLIED WORLD
AWAC.COM

DETERMINING LOSS TRENDS BY SIZE IN REINSURANCE – UK MOTOR CLAIMS

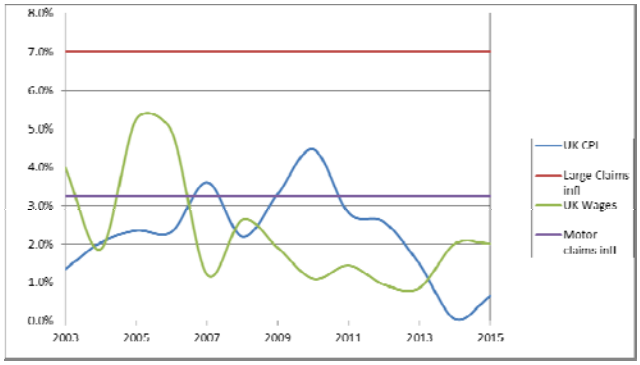


- Consider average severity above threshold (£3M, £5M, £10M)
- If claims are inflated at 7%, average severity remains stable

Source : AonBenfield – UK Motor & Liability Review – Large Loss Inflation Study. 2016

UK MOTOR TREND – LARGE CLAIMS

- Trend factor selection of 7% implies real (social) inflation of approximately 5% (given wage inflation circa 2.5%)
- Consistent with prior International Underwriting Association / Association of British Insurers studies
  - Fourth IUA study (covering 1996 to 2006) concluded average BI claims increasing at 6.5% pa - claims inflation was 12% for claims between £2M and £5M



UK MOTOR TREND – EMERGING STORY (DISCOUNT RATE)

- Discounting of future payments under Casualty claims in UK (Bodily Injury cases)
  - Significant lump sum payments made in UK Motor & UK Liability claims
    - Mainly to cover future costs of care & lost earnings
- Discount rate of 2.5% set in 2001, based on real yields on UK Index-Linked Gilts (ILGs)
  - "Conservative investor, safe investments"
  - Ignored reinvestment risk
- Discount rate reviewed in 2012 – remained at 2.5%
  - UK ILG real yields at that point approximately -0.5%
- Further review completed by Lord Chancellor in February 2017
  - Discount rate reduced from 2.5% to -0.75% to correspond with current real yields in UK ILGs

IMPACT OF CHANGING DISCOUNT RATE - UK BODILY INJURY CASES

- Quantum of change unexpected – prior to announcement, most commentators anticipated 1% to 1.5% change, if any
- Impact felt by consumers and taxpayers
  - Increased costs to NHS estimated at £1BN
  - Higher motor insurance premiums – estimated at £75 on average (representing approximately 15% increase, given average motor premium of £500)
- Significant deterioration in results for motor insurers and (particularly) reinsurers – gearing effect on excess of loss layers from large BI claims
  - Immediate alteration to motor insurance premiums charged
  - Potential for large increases in XL rates charged by reinsurers – 50% cited

UK DISCOUNT RATE CHANGE – XL REINSURER / LARGE LOSS ASPECT

- Calculation of impact critically dependent on two assumptions
  - Age of injured party (as opposed to driver)
  - Percentage of claim which is subject to discounting
- Difficult to determine – often not provided in basic claims advices provided to reinsurers
  - Some studies use 40 year old / 60% subject to discounting as default
  - Given sensitivity to assumptions, could use 35 year old / 65% subject to discounting
  - Consideration of largest claims for particular UK cedant – 65% assumption reasonable, age potentially even lower

UK DISCOUNT RATE CHANGE – IMPACT ON FGU CLAIMS

- Large difference in results as one modifies discount rate
- Multipliers below applied to annual cost of care / lost income based on 40 year-old male
- Uplift factor allows for both increase in multiplier and percentage subject to discounting
  - Table below based on 60% of claim subject to discounting

Discount Rate	2.50%	1.50%	1.00%	-0.75%
Multiplier	26.52	32.39	36.11	55.84
Uplift factor		1.13	1.22	1.66

- Results particularly sensitive to age assumption (future cost of care dominant for younger claimants) and somewhat variable according to percentage subject to discounting – see next slide

UK DISCOUNT RATE CHANGE – PARAMETER SENSITIVITY

- Tables below illustrate change in claim uplift factors, based on claimant age and percentage of claim subject to discounting
- Uplift factors if discount rate decreases from 2.5% to -0.75%
    - Reasonable selection highlighted – as example, £5M outstanding claim would now revise to £9.1M

	Percentage subject		
Age	60%	65%	70%
30	1.85	1.93	2.00
35	1.76	1.82	1.88
40	1.66	1.72	1.77

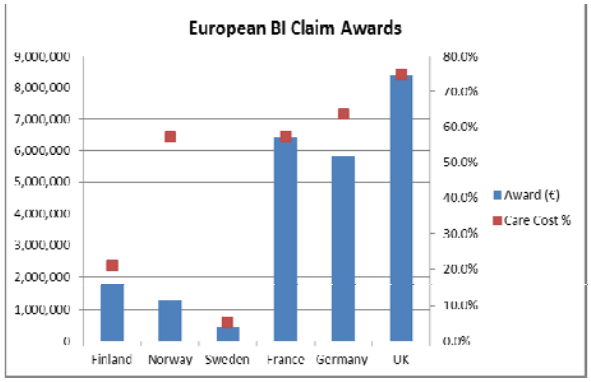
- Uplift factors if discount rate reduces from 2.5% to 0% (perceived worst case prior to February 2017)

	Percentage subject		
Age	60%	65%	70%
30	1.54	1.59	1.63
35	1.49	1.53	1.57
40	1.44	1.47	1.51

- If discount rate decreased from 2.5% to 1% (expectation prior to February 2017), £5M claim would increase to slightly over £6M

SIZE OF LOSS DIFFERENTIALS – EUROPEAN MOTOR

- Consideration of "large" claims differs across Europe, driven by divergent societal and legal approaches to bodily injury claims
- Payments for cost of care vary substantially
- Example below – award under tetraplegic bodily injury case



Source : SCOR Global P&C – The Compensation of Motor Bodily Injury Claims in the Nordic Insurance Markets, June 2010

SIZE OF LOSS TRENDS – US LIABILITY

- Higher volumes of data available in US – still some limitations
- ISO General Liability and Commercial Auto trend studies
  - Data now available in Size of Loss Matrix model
- GL split into Owners Landlords Tenants (OLT), Manufacturers and Contractors, Products and Local Products / Completed Operations
  - Further sub-divisions into Bodily Injury & Property Damage for severity trend
    - Indemnity and ALAE separately & combined
  - Severity trend information shown for $100K basic limit and for total limits
  - Frequency trend data also provided

SIZE OF LOSS TRENDS – US GENERAL LIABILITY

- Consider OLT BI – largest class, circa $1BN of loss per annum
- 10 years history presented up to December 2015
  - Accident years ending June and December each year
  - Circa 20,000 occurrences per annum
  - Aggregated losses including / excluding ALAE
  - Average severities for total loss, indemnity only and ALAE used for determining trend
- Severity trend for losses capped at $100K = 4.9%, based on total limits = 4.9%

OWNERS LANDLORDS & TENANTS
BODILY INJURY - TOTAL LIMIT (AMOUNTS IN $)

Accident Year End	Losses and ALAE	Loss + ALAE Severity	Indemnity Severity
30/06/2006	773,308,871	38,749	30,004
31/12/2006	781,465,665	40,207	30,957
30/06/2007	839,542,426	40,768	31,660
31/12/2007	918,873,795	43,095	33,695

Derived from ISO Circular AS-GL-2017-003-005 (used with permission).

ALLIED WORLD
AWAC.COM

US LIABILITY TRENDS – OBSERVATIONS ON OLT RESULTS

- Potential noise from ALAE trend - higher than indemnity
  - Using 10 year severity trend fit, loss only = 3.4%, ALAE = 7.5%
  - Confluence of trend factors
- Little variation in trend between losses capped at $100K and total losses, based on all years or last eight
  - However, notably higher trend across total limits if one considers years up to 2013 – large claims have higher trend?

OWNERS LANDLORDS & TENANTS
CALCULATED SEVERITY TRENDS

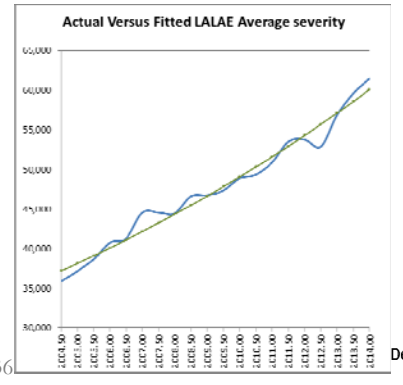
End date	No of years	$100K Limits	Total Limits
2015	10	4.88%	4.94%
2015	8	4.76%	4.72%
2015	6	4.77%	4.44%
2013	8	4.68%	5.12%
2013	6	4.24%	4.82%

Derived from ISO Circular AS-GL-2017-003-005 (used with permission).

US LIABILITY TRENDS – OLT OUTPUTS

OWNERS LANDLORDS & TENANTS
CALCULATED SEVERITY TRENDS

End date	No of years	$100K Limits	Total Limits
2015	10	4.9%	4.9%
2015	9	4.9%	4.8%
2015	8	4.8%	4.7%
2015	7	4.6%	4.5%
2015	6	4.8%	4.4%
2014	8	4.6%	4.7%
2014	6	4.0%	4.2%
2013	8	4.7%	5.1%
2013	6	4.2%	4.8%



- Adding further years to comparison may lead to different conclusion as to trend level and "large versus small" loss trends
- Underlying data exhibits variability, as can be seen from graph - trend factors vary from -3% to +16%

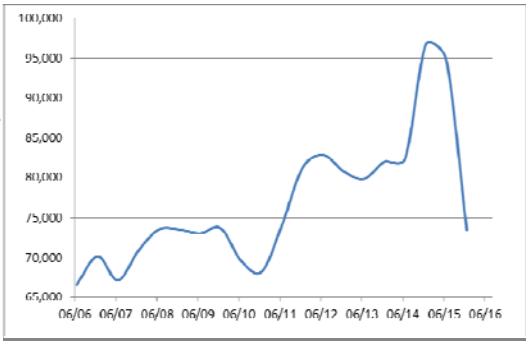
Derived from ISO Circular AS-GL-2017-003-005 (used with permission).

US LIABILITY TRENDS – M&C

- Second-largest Liability class - $4.5BN claims over 10 years
- Based on period ending 2015 – trend factor approximately 3%, appears that larger claims attract lower trend
- More difficult to ascertain trend level or "large versus small" comparison when calculation period is amended
- Underlying average loss data exhibits noise

MANUFACTURERS & CONTRACTORS CALCULATED SEVERITY TRENDS

End date	No of years	$100K Limits	Total Limits
2015	10	3.5%	2.8%
2015	8	3.6%	2.9%
2015	6	4.5%	3.9%
2014	9	3.3%	3.1%
2014	6	4.0%	4.5%
2013	8	2.9%	2.6%



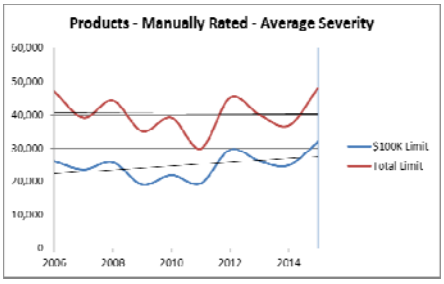
Derived from ISO Circular AS-GL-2017-003-005 (used with permission).
Data has been scaled (Y-axis average severity)

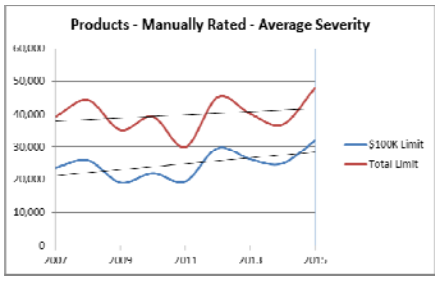
ALLIED WORLD

AWAC.COM

US LIABILITY TRENDS

- Largest datasets exhibit variability in average loss
  - Difficulty in determining trend rates and assessing how these vary with size of loss
- Reflected in goodness of fit results (to some degree)
  - R-squared for most OLT analyses circa 0.95
  - For MC analyses, range of 0.6 to 0.8
- Situation repeated for smaller classes



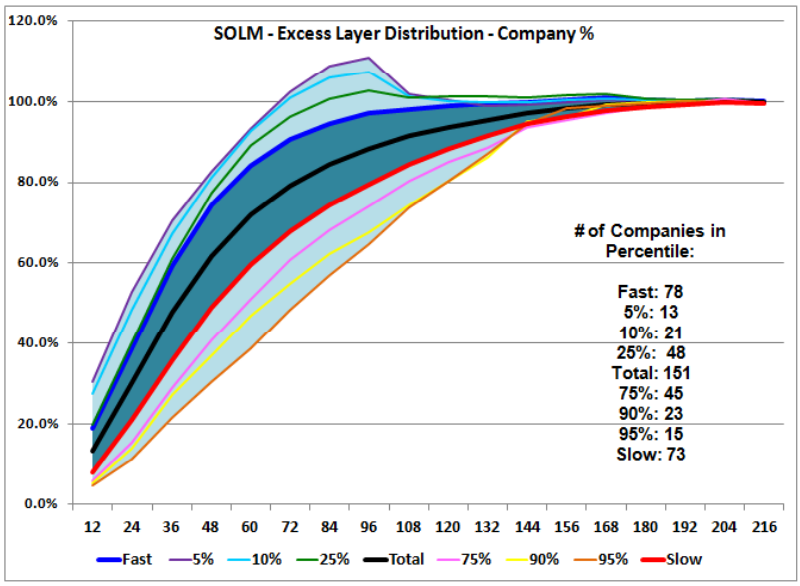


Derived from ISO Circular AS-GL-2017-003-005 (used with permission).
Data has been scaled (Y-axis average severity)

ALLIED WORLD

AWAC.COM

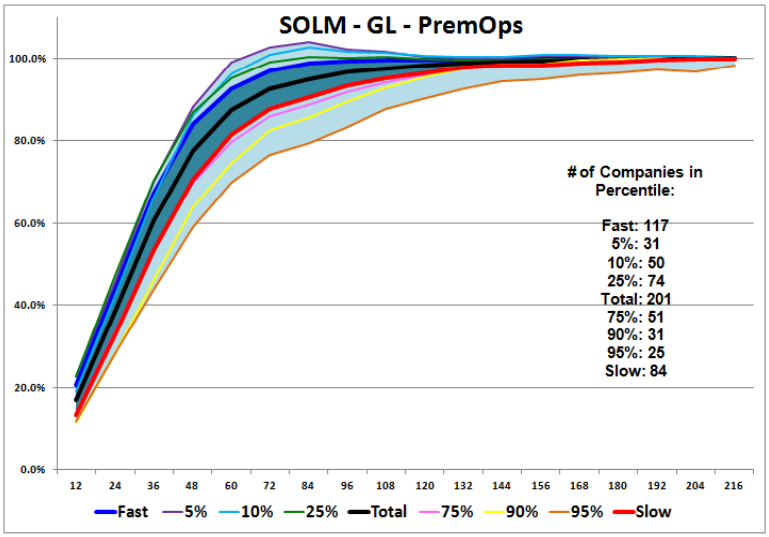
ISO SIZE OF LOSS MATRIX REPORTING SPEED PERCENTILES – SAMPLE (PRODUCTS -ALL CLASSES)



Note: Above shows LDF pattern for excess layer 4.9M x 100k used in bifurcation of Slow vs. Fast companies by LOB

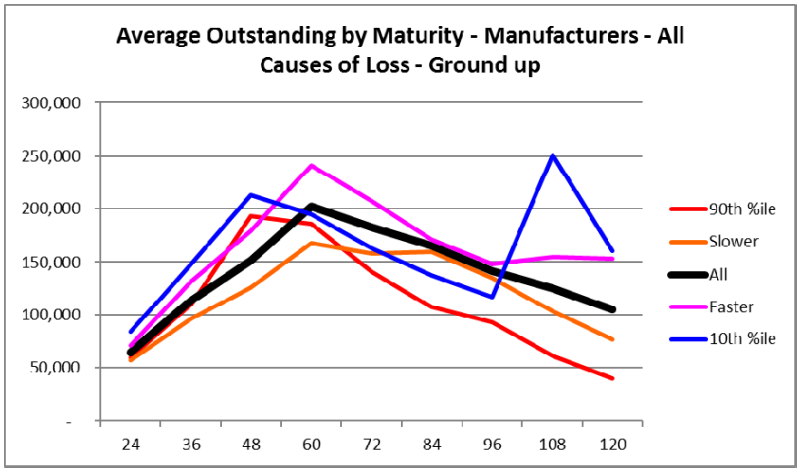
Source : ISO Casualty London Workshops, March 2017

ISO SIZE OF LOSS MATRIX REPORTING SPEED PERCENTILES – SAMPLE (GENERAL LIABILITY)



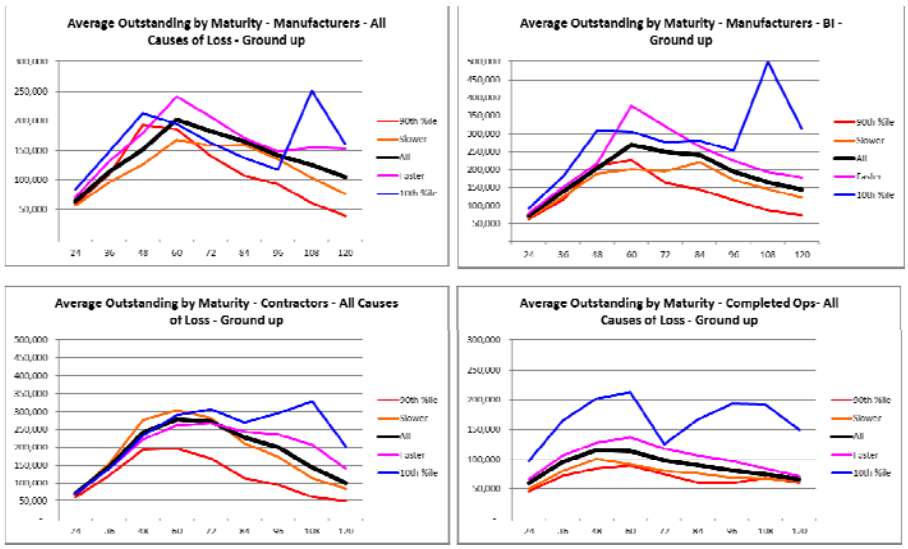
Source : ISO Casualty London Workshops, March 2017

AVERAGE OUTSTANDING LOSS BY COMPANY LDF SPEED



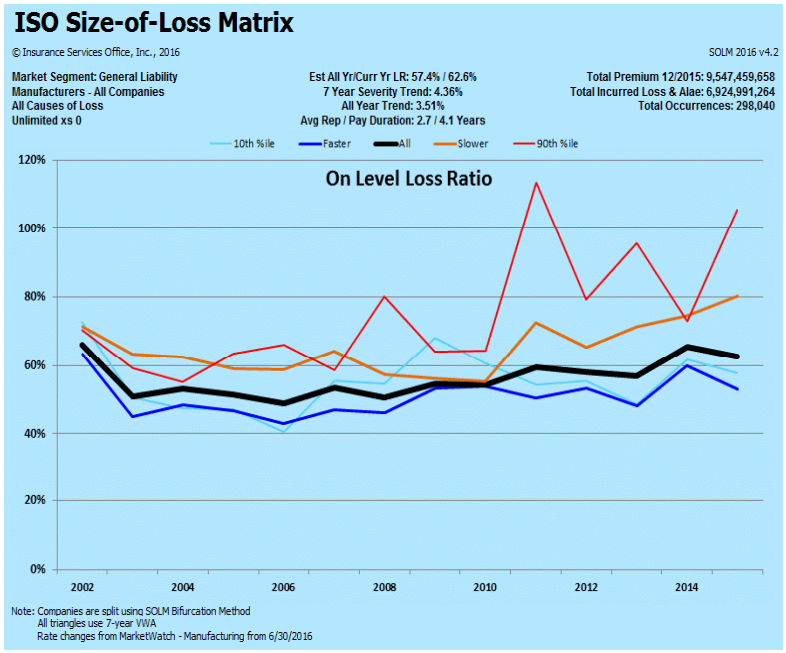
Source : ISO Casualty London Workshops, March 2017

AVERAGE OUTSTANDING LOSS VERSUS COMPANY LDF SPEED – MULTIPLE LINES



Source : ISO Casualty London Workshops, March 2017

COMPARISON OF LOSS RATIOS AGAINST REPORTING SPEED – GENERAL LIABILITY



Source : ISO Casualty London Workshops, March 2017

ZURICH

Trend In Excess Layers

CARe, June 2017
Vagif Amstislavskiy, FCAS, MAAA
with a great help from Christine Stefanello and Peter Del Prete

Zurich North America

Agenda:

- Quick Overview:
  - The data – it is credible, reliable and sufficient to reach a conclusion (in my opinion, anyway).
  - The main Observation: Over the last 15 years, the observed Severity trend in the Excess layers was less than 'Primary' trend.
  - Possible conclusion: Trend has not been uniform for all losses. In a recent history, trend was inversely proportional to the size of loss.
- Data: History, quantity and quality
- Empirical Results – multiple ways to look at the data to assess a trend
- Main Conclusion and possible consequences
- *Loss Development – LDFs for Open Claims (see Appendix 2 for details)*

Quick Overview

- This discussion will address Medical Malpractice claims for Hospitals, but overall conclusion might be applicable to a broader range of 'Liability' products
- Zurich has participated in Med Mal market over the last 20 years.
- During our underwriting process, we were able to compile data from our submissions. This data includes '**ground up**' information for all claims. It also contains fairly detailed exposure information. We will refer to it as 'Database' throughout the presentation
- Zurich has summarized and made public some of this information since 2005 (via 'Perspectives' / 'Healthcare Risk Insights' and 11 issues, usually at ASHRM).
- For many years (and probably still) this has been the largest continuously updated database of this kind with respect to both quality and quantity of reported losses: losses in tens of billions of dollars and claims in hundreds of thousands.

Quick Overview - continued

- I believe that underlying data provides for a very credible sample. Consequently, the conclusions from our study, as unexpected as they might seem, could, indeed, be a fairly accurate representation of reality.
- Over the last 15 years we observed a steady decrease in Med Mal severity trend.
- During this period, we have observed a surprisingly low trend in the Excess layers. In fact, **The Observed Severity Trend in Excess layers was less than Overall trend and even lower than a trend on a Primary layer** (e.g. limited to $1m).
- During this presentation, we will try to support this notion as well as to share some of the techniques and methodologies which can be useful in evaluating losses in the Excess layers.

A Problem, An Observation and A Possible Conclusion

Problem:
Misestimating of a trend, even by a few points, often leads to a material error in the 'on-leveling' procedure. This is especially true in reserving for excess layers.

Observation:
Trend in Excess layer was actually less than in Primary layer

Possible Conclusion:
- **Trend is not uniform for losses of all sizes.**
- **Trend is 'size-of-loss' dependent.**
- **'Large' claims are trended less than 'Small' claims**

Trend in Excess Layers.

Here is my view of a simplified process of selecting a trend in excess layers. The figures below reflect outcomes based on a 'generic' loss distribution with mean of about $300k and St. Dev of about $2.5m.

Trend in a 'primary' layer (e.g. base rate) is usually known with a some degree of certainty – from variety of industry publications and company's own data.

Even with a very benign primary trend, estimates of an 'excess' trend could be material.

2%

Observed **Primary** Trend

Using lognormal assumption, 2% primary trend would imply 3% ground up trend.

3%

Estimated **Ground Up** Trend

Using lognormal assumption, 3% ground up trend would imply 5% trend in $15m x $10m layer.

5%

Estimated **$15m x $10m** Trend

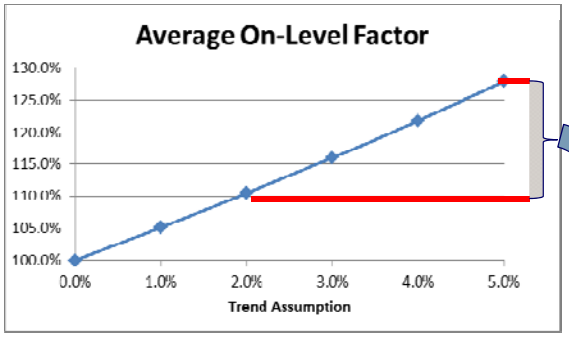
View of on-level losses is greatly impacted by the trend selection

Here is a hypothetical scenario of the on-level procedure. In this example, we will use last five years, not counting the current one. We will project ultimate losses one year forward and calculate the average on-level factor

Year
5th Prior
4th Prior
3rd Prior
2nd Prior
1st Prior
Current
Projected

Ultimate Loss

Trend and take the average



Over 15% difference

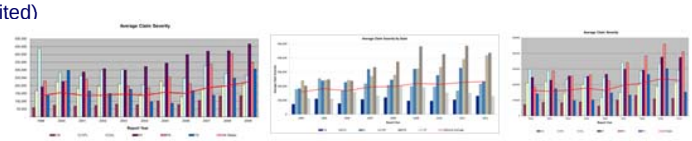
Considering generally long term nature of Excess Liability coverage, on-leveling procedure is very sensitive to even a small changes in trend assumption.

Data – We have a Huge Database

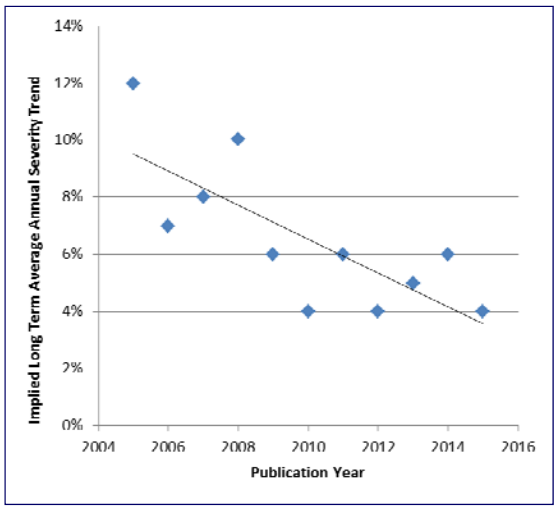
We have an access to the extensive data on Medical Mal Practice losses. We collect submission data from medical facilities seeking coverage. Over the years we have shared a summary of this information via our Perspectives and Healthcare Risk Insights reports

Data

Prior 'Perspectives' and 'Risk Insights' Publications – Severity Trend Observations
(Ground up and unlimited)



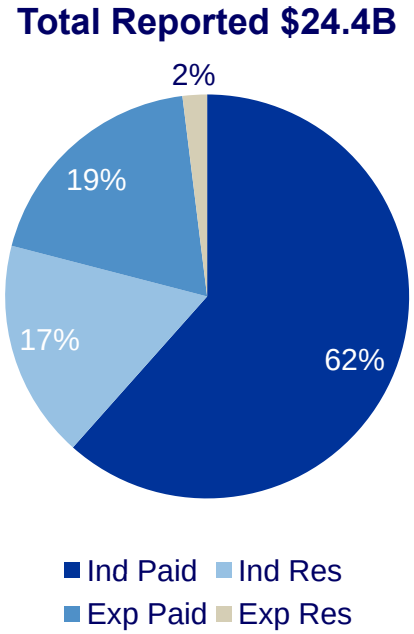
Publication Year	Report Years Available	Implied Long Term Average Annual Severity Trend
2005	1994-2002	12%
2006	1994-2003	7%
2007	1994-2004	8%
2008	1995-2005	10%
2009	1996-2006	6%
2010	1997-2007	4%
2011	1998-2008	6%
2012	1999-2009	4%
2013	2002-2010	5%
2014	2003-2011	6%
2015	2004-2012	4%

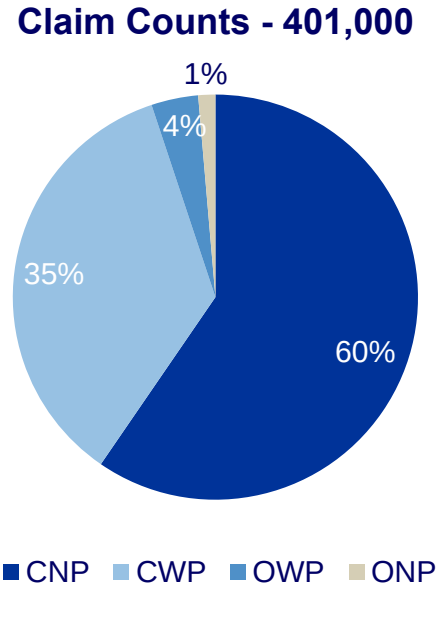


Trends from publications '06, '07, '11, '14 and '15 represent the last 5 to 7 years of data from each respective dataset. Trends referenced from the remaining publications use all data in each respective dataset.

Zurich's Submission Database – the latest one

Industry-wide data – Report Years 2005 - 2013





Zurich's Submission Database

Industry-wide data – Report Years 2005 - 2013

Total Reported

Total Claim Counts:	401 K
Projected Ultimate Claim Counts:	159 K
Total Incurred:	24.4 B
Total Incurred – Developed:	26.6 B

Just the Indemnity

Total Claim Counts:	83 K
Projected Ultimate Claim Counts:	80 K
Total Indemnity:	19.3 B
Total Indemnity – Developed:	21.1 B

Just How Big is the Latest Database?

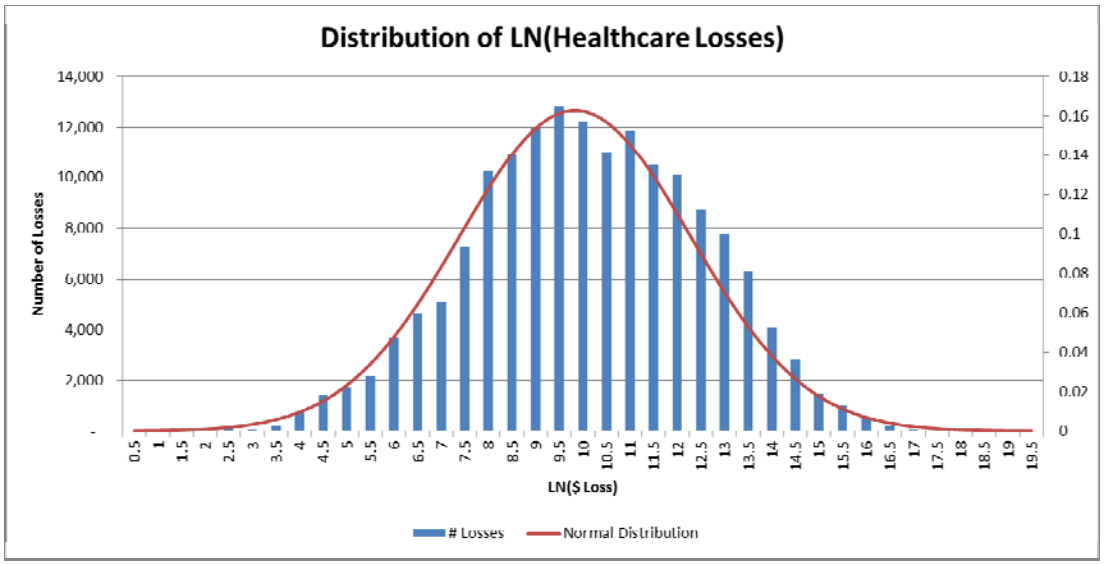
High Level Statistics

- Robust submission database consisting of 9 report years of data
- Losses from thousands of individual locations across the country
  - From all 50 states and Washington DC
  - From various hospitals and outpatient facilities
- Valuation dates, though different depending on when the submission was received, are recent
- Over 25,000 claims have a total indemnity portion at or above $100,000. Of these claims, over 4,500 have total indemnity at or above $1,000,000
  - These numbers represent the total indemnity **before** development
  - 95% of total claims are closed

This data is close to the 'ultimate', but still is subject to some development.

Distribution of Healthcare Losses

Empirical distribution does resemble a Lognormal Distribution. It is just an empirical distribution, not on-level.



Trend

- Now, after we compile a extensive database of historical losses, we can turn our attention to calculating severity trend.
- We will examine the common historical approach of selecting excess trend.
- We will assess alternative methodologies and question common assumptions regarding inflationary pressure on insured losses.
- We will look at the trend in the Indemnity portion of Hospitals Med Mal loses. However, overall phenomenon and main conclusions might be applicable to a broader range of 'liability' products (especially those with potentially large 'punitive' component of the total loss)

The most common assumption about trend could be incorrect

- **We accept the fact that trend could be dependent on a multitude of factors: state, industry, area of ops, coverage, peril and …**
- **However, the most common trend assumption is that trend is *independent* of the size of a loss:**

$$X \rightarrow a\,X$$

For All Xs

- **We have strong evidence to suggest that Trend IS size-dependent.**
- **The 'transformation' function is not linear, but a function of size of loss**

$$X \rightarrow f(X)\,X$$

Are Healthcare Claims Exhibiting a Constant Trend?

- With a positive constant trend, we expect to see a higher trend in the excess layers. This is due to a well known leverage effect on the excess losses:
  1. For losses above the limit, the trend is entirely in the excess layer
  2. Losses just below the limit are pushed into the excess layer by the trend, which in turn creates new losses for the excess layer

- However, our empirical data has produced very different results. Thus, the assumption of a constant trend must be in question.

- Furthermore, **evidence suggests that Large claims experience lower trend than Small claims.** The argument can be made for even a 'negative' trend in excess layers.

- There appears to be 'step' in the middle of the experience period. However, this 'step' is not enough to compensate for overall lower trend in excess layers.

Example – Limited Average Severity Trend

Hypothetical Lognormal Distribution Assuming 3% Annual Trend

Report Year	Hypothetical Distribution Expected Limited Average Severity						
	100K	1M	3M	5M	10M	15M	Unlimited
2005	48,000	125,197	154,222	163,237	171,268	174,168	178,940
2006	48,586	127,983	158,220	167,676	176,141	179,213	184,307
2007	49,172	130,817	162,309	172,225	181,145	184,398	189,836
2008	49,759	133,698	166,489	176,885	186,283	189,727	195,530
2009	50,346	136,628	170,764	181,660	191,559	195,203	201,395
2010	50,934	139,605	175,134	186,551	196,975	200,831	207,436
2011	51,522	142,631	179,600	191,561	202,535	206,614	213,658
2012	52,110	145,707	184,164	196,692	208,242	212,556	220,067
2013	52,698	148,831	188,829	201,947	214,100	218,661	226,667

Trend	1.17%	2.19%	2.56%	2.70%	2.83%	2.88%	3.00%

As the limit increases, trend also increases

Example – Trends in the Layer

Hypothetical Lognormal Distribution Assuming 3% Annual Trend

Report Year	Hypothetical Distribution Expected Severity in the Layer					
	1M	2M x 1M	2M x 3M	5M x 5M	5M x 10M	x 15M
2005	125,197	29,025	9,015	8,031	2,900	4,771
2006	127,983	30,237	9,456	8,465	3,072	5,094
2007	130,817	31,492	9,916	8,920	3,253	5,438
2008	133,698	32,791	10,396	9,398	3,443	5,803
2009	136,628	34,136	10,896	9,899	3,644	6,192
2010	139,605	35,528	11,418	10,424	3,856	6,605
2011	142,631	36,968	11,961	10,974	4,079	7,044
2012	145,707	38,458	12,528	11,550	4,314	7,510
2013	148,831	39,998	13,118	12,153	4,561	8,006
Trend	**2.19%**	**4.09%**	**4.80%**	**5.32%**	**5.82%**	**6.68%**

With the constant trend for all losses, we expect to see a significantly higher trend in the excess layers than in the lower layers

Analysis of Ground-Up Severity Trends

Limited Average Severity – **Empirical Data**

Report Year	Ultimate Indemnity Severity Limited to:						
	100K	500K	1M	3M	5M	10M	Unlimited
2005	44,440	115,537	154,120	213,781	234,257	251,802	257,063
2006	42,897	109,680	143,674	190,226	204,898	215,328	221,373
2007	44,295	112,519	149,390	205,539	227,927	244,280	251,177
2008	45,814	115,293	151,137	208,097	228,269	241,107	245,271
2009	46,679	120,289	160,827	225,183	249,054	263,943	269,338
2010	47,271	125,905	169,696	238,069	262,635	281,068	289,093
2011	47,582	124,736	168,617	232,791	256,948	278,229	287,573
2012	47,427	124,194	167,576	229,280	250,834	269,054	278,732
2013	50,280	127,909	169,472	230,043	250,681	264,153	269,587
Total	**46,530**	**83,656**	**120,141**	**160,202**	**220,309**	**241,791**	**257,752**

Overall Trend	**1.63%**	**1.81%**	**2.02%**	**2.08%**	**2.12%**	**2.15%**	**2.22%**
Trend 05-08	1.24%	0.19%	-0.20%	-0.03%	0.29%	-0.04%	-0.15%
Trend 09-13	1.53%	1.10%	0.93%	0.05%	-0.33%	-0.42%	-0.35%

For periods 2005-2008 and 2009-2013, the lower limits experience larger trend than the higher limits, which are trending negatively. **This is not what we would expect if trend were constant and followed linear transformation: X=>aX.**

Analysis of Severity Trends

Severity in the Layer – **Empirical Data**

Report Year	Ultimate Indemnity Severity in the Layer			
	1M	4M x 1M	5M x 5M	5M x 10M
2005	154,120	80,137	17,545	3,894
2006	143,674	61,225	10,430	3,302
2007	149,390	78,536	16,353	5,754
2008	151,137	77,132	12,838	2,395
2009	160,827	88,226	14,889	2,961
2010	169,696	92,939	18,433	3,766
2011	168,617	88,331	21,280	4,521
2012	167,576	83,258	18,220	4,233
2013	169,472	81,209	13,472	3,336
Total	**160,202**	**81,589**	**15,961**	**3,785**

Trend 05-13	**2.02%**	**2.36%**	**2.54%**	**0.16%**
Trend 05-08	-0.20%	1.35%	-4.76%	-8.64%
Trend 09-13	0.93%	-2.72%	-2.09%	3.62%

These trends are inconsistent with the constant trend assumption

Let's examine a Survival Function, (1-CDF)

Hypothetical Lognormal Distribution Assuming Annual Trend of 3%

We can view number of claims penetrating the limit as a survival function at that limit. If trend is constant by size, we would expect 'survival' rate to increase over time

Report Year	1 - CDF Expected Percentage of Claims > X									
	50K	100K	250K	500K	1M	3M	5M	10M	15M	25M
2005	42.40%	28.21%	13.88%	7.07%	3.17%	0.68%	0.30%	0.09%	0.04%	0.01%
2006	43.05%	28.76%	14.25%	7.29%	3.29%	0.71%	0.31%	0.09%	0.04%	0.01%
2007	43.69%	29.33%	14.62%	7.52%	3.41%	0.75%	0.33%	0.10%	0.04%	0.02%
2008	44.34%	29.89%	15.00%	7.76%	3.54%	0.78%	0.35%	0.10%	0.05%	0.02%
2009	44.99%	30.47%	15.38%	8.00%	3.67%	0.82%	0.36%	0.11%	0.05%	0.02%
2010	45.64%	31.04%	15.78%	8.25%	3.80%	0.86%	0.38%	0.11%	0.05%	0.02%
2011	46.29%	31.63%	16.18%	8.50%	3.94%	0.89%	0.40%	0.12%	0.06%	0.02%
2012	46.94%	32.21%	16.58%	8.76%	4.08%	0.94%	0.42%	0.13%	0.06%	0.02%
2013	47.60%	32.80%	16.99%	9.02%	4.23%	0.98%	0.44%	0.13%	0.06%	0.02%

More claims are pushing past all limits, but we specifically want to highlight the larger limits. If a positive constant trend existed for healthcare claims, we would have a greater percentage of "big" claims now than in the past, as evidenced by the expected survival function. This, however, is contrary to what we are witnessing in the empirical data.

Empirical results present a very different pattern

It appears that larger claims experience LOWER trend and smaller claims experience HIGHER trend.

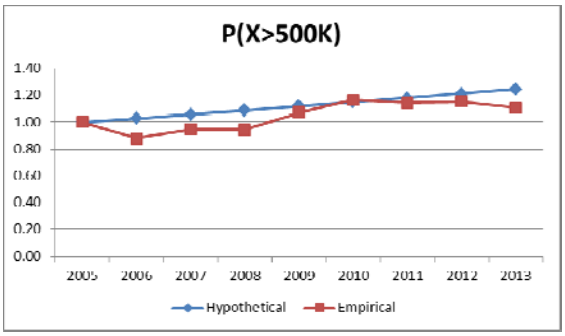
Report Year	1 - Empirical CDFs Percentage of Ultimate Indemnity Claims > X									
	50K	100K	250K	500K	1M	3M	5M	10M	15M	25M
2005	39.36%	30.06%	17.90%	10.12%	5.04%	1.44%	0.56%	0.12%	0.05%	0.00%
2006	37.62%	28.12%	17.06%	8.92%	4.19%	1.09%	0.39%	0.11%	0.03%	0.01%
2007	39.46%	29.20%	17.04%	9.60%	4.86%	1.55%	0.60%	0.13%	0.04%	0.00%
2008	40.69%	30.30%	17.67%	9.56%	4.72%	1.55%	0.59%	0.08%	0.03%	0.00%
2009	42.27%	31.55%	18.77%	10.83%	5.42%	1.81%	0.69%	0.12%	0.01%	0.01%
2010	42.43%	32.71%	20.07%	11.81%	5.94%	1.77%	0.75%	0.13%	0.06%	0.01%
2011	42.82%	32.77%	19.81%	11.57%	5.93%	1.73%	0.77%	0.17%	0.04%	0.02%
2012	42.31%	32.76%	20.11%	11.65%	6.41%	1.42%	0.74%	0.12%	0.06%	0.02%
2013	42.43%	32.03%	20.13%	11.20%	5.98%	1.52%	0.60%	0.12%	0.05%	0.01%

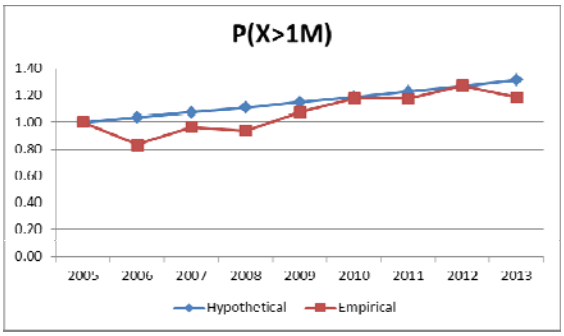
More claims are pushing past lower limits than in the past, which is expected.

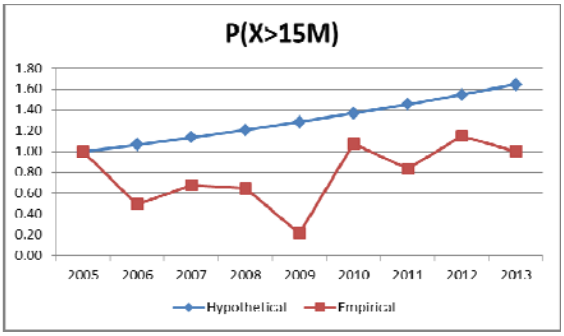
However, we have approximately the same percentage of "big" claims in the past as now. **If trend were constant by size, we would not expect this observation.**

Graphical Representation – Indexed CDF

Results are indexed to 2005, hypothetical distribution assumes 3% trend.







- Lower limits losses appear to be trending as expected
- Large loses, however, are lagging behind the trend

Conditional CDFs, yet another view

What if we truncate losses to remove "small" claims?

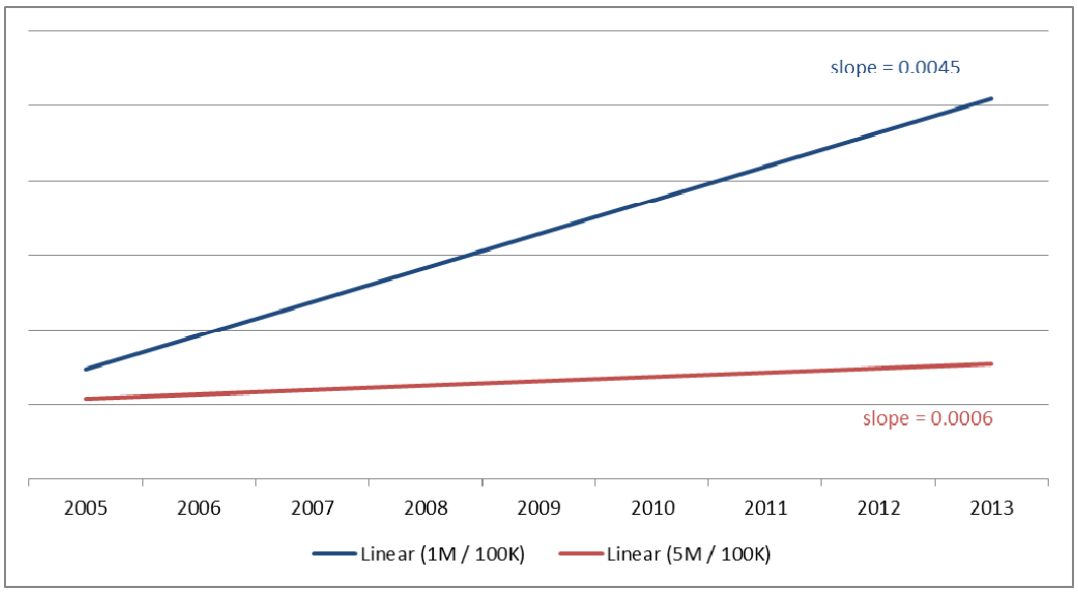
- Empirical CDFs are conditional on claims being greater than $100K

Report Year	Empirical CDF given X > 100K							
	250K	500K	1M	3M	5M	10M	15M	25M
2005	0.4046	0.6633	0.8323	0.9521	0.9814	0.9960	0.9982	1.0000
2006	0.3936	0.6830	0.8511	0.9613	0.9860	0.9963	0.9991	0.9995
2007	0.4164	0.6713	0.8336	0.9469	0.9794	0.9955	0.9988	1.0000
2008	0.4168	0.6845	0.8441	0.9488	0.9807	0.9973	0.9989	1.0000
2009	0.4052	0.6567	0.8284	0.9428	0.9780	0.9960	0.9996	0.9996
2010	0.3863	0.6389	0.8182	0.9460	0.9772	0.9961	0.9982	0.9996
2011	0.3955	0.6469	0.8190	0.9471	0.9766	0.9949	0.9986	0.9993
2012	0.3861	0.6444	0.8043	0.9567	0.9776	0.9963	0.9981	0.9994
2013	0.3713	0.6503	0.8134	0.9524	0.9814	0.9964	0.9983	0.9997

As one would expect, CDFs are decreasing over time, meaning more losses are pushing past these lower limits.

Even after truncating losses to remove "small claims", the CDFs at the higher limits remain fairly constant over time. This is not in line with the constant trend assumption.

Percentage of Claims Greater than 1M and 5M Conditioned on Claims Being Greater than 100K



Graph has been indexed to show both trend lines at the same starting point

Conditional CDFs, continued

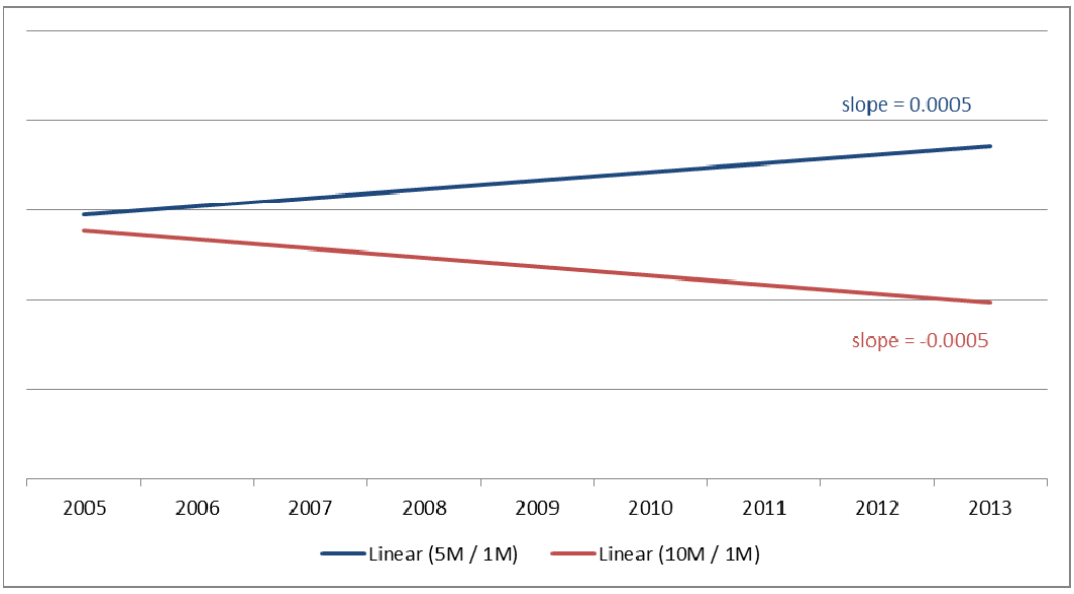
What if we truncate losses to remove those under $1M?

- If we truncate our data to remove losses under $1M, it becomes more apparent that, although losses are breaching the $1M mark somewhat more frequently now than in the past, fewer losses are, however, exceeding the higher limits.

Report Year	Empirical CDF given X > 1M				
	3M	5M	10M	15M	25M
2005	0.7143	0.8889	0.9762	0.9894	1.0000
2006	0.7398	0.9060	0.9749	0.9937	0.9969
2007	0.6807	0.8762	0.9728	0.9926	1.0000
2008	0.6715	0.8759	0.9830	0.9927	1.0000
2009	0.6667	0.8721	0.9769	0.9979	0.9979
2010	0.7027	0.8745	0.9788	0.9903	0.9981
2011	0.7079	0.8708	0.9719	0.9925	0.9963
2012	0.7787	0.8854	0.9809	0.9904	0.9968
2013	0.7452	0.9001	0.9806	0.9911	0.9985

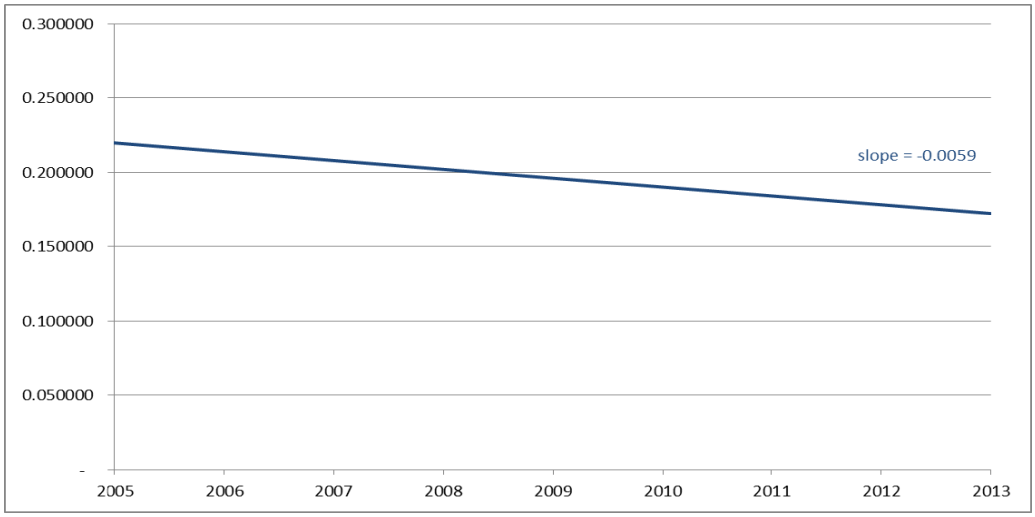
If trend was constant for all losses, we would observe a decreasing CDF over time, as loss amounts would increase and more claims would push past these higher limits.

Percentage of Claims Greater than 5M and 10M Conditioned on Claims Being Greater than 1M



Graph has been indexed to show both trend lines at the same starting point

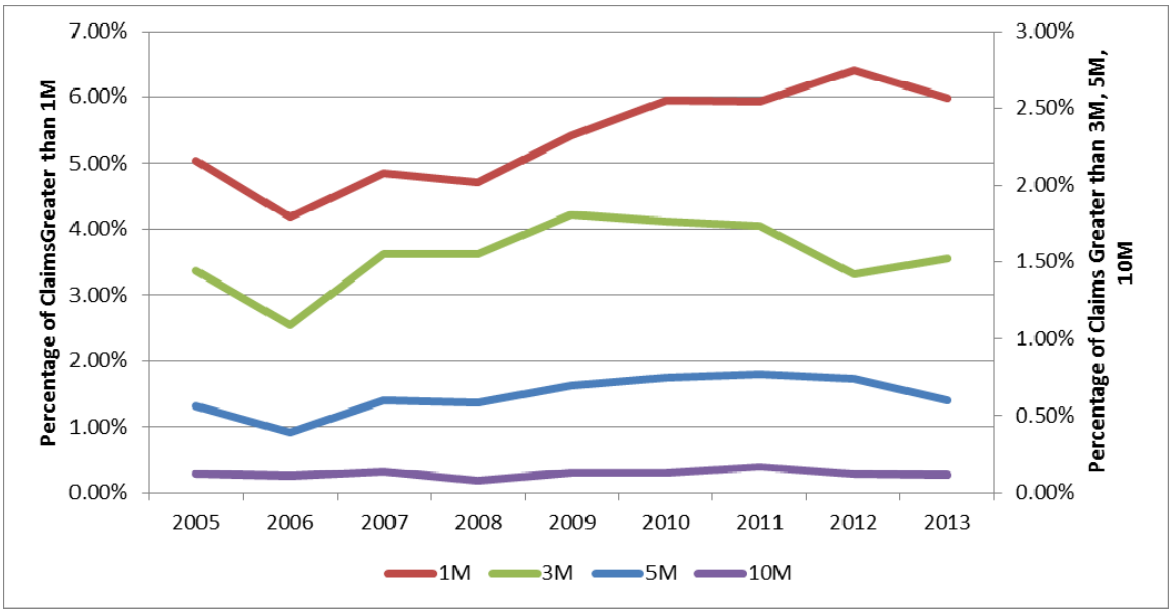
Percentage of Claims Greater than 10M Conditioned on Claims Being Greater than 5M



- If healthcare claims were trending linearly, we would not expect this ratio of Claims > $10M to Claims > $5M to be decreasing over time

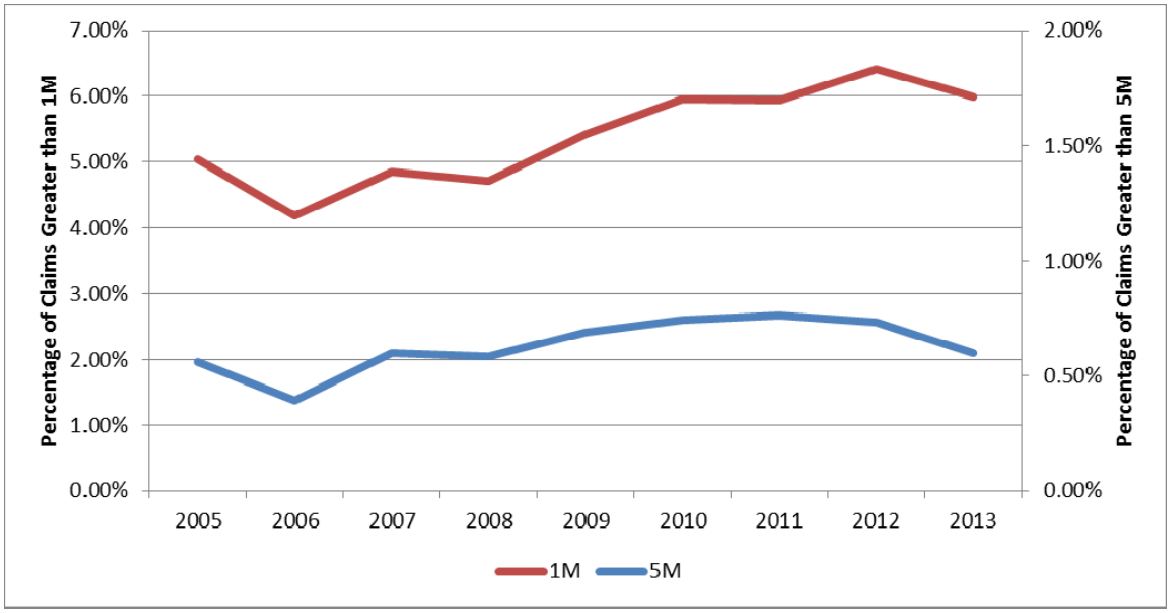
Percentage of Claims Greater than X

Developed to Ultimate



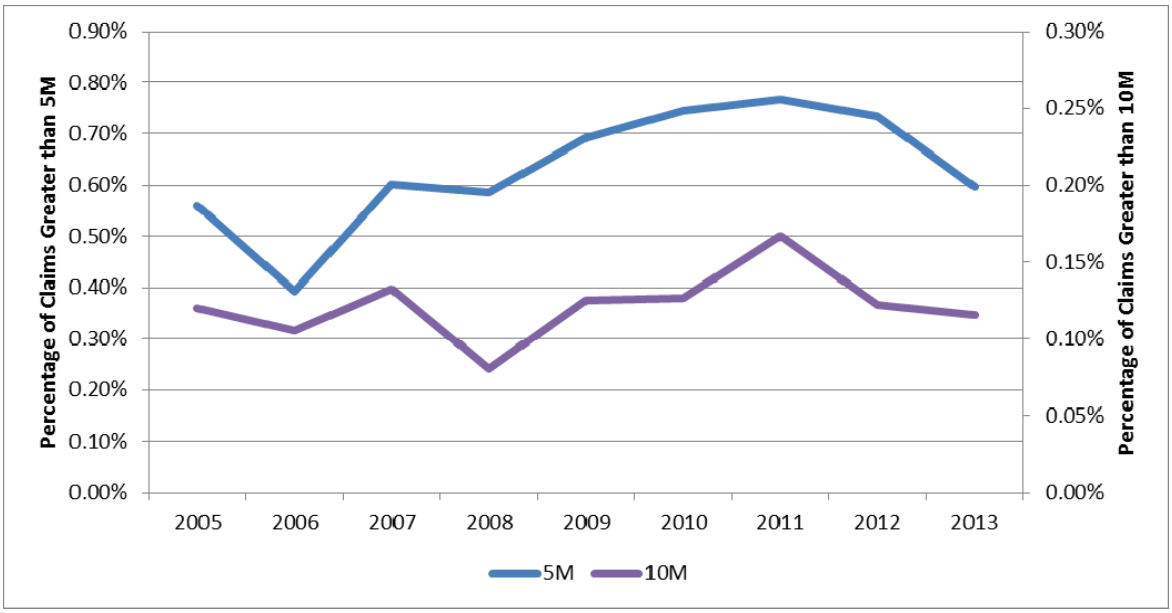
Percentage of Claims Greater than 1M and 5M

Developed to Ultimate



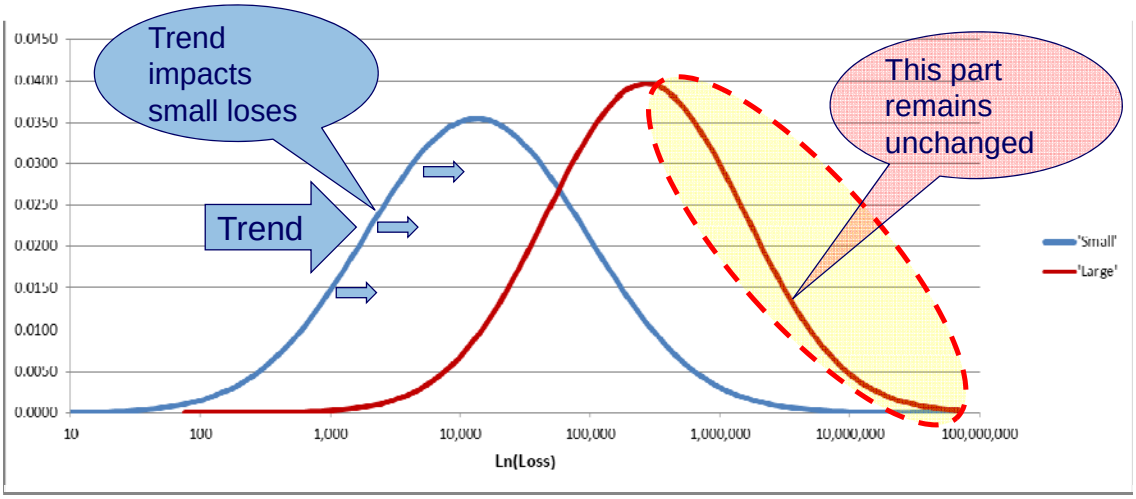
Percentage of Claims Greater than 5M and 10M

Developed to Ultimate



This dynamic can be visualized as a sum of two distributions.

Trend impacts small losses as ‘blue’ distribution is moved to the right. However, ‘red’ distribution remains fairly constant as large losses are not impacted to the same degree.



Main Conclusion:

There is strong evidence to suggest that severity trend is not constant by size of loss.

A few things to remember

- **Excess trend IS NOT automatically higher than Primary**
- **For Med Mal (and a few other ‘liability’ lines) over the recent decade, ‘Large’ claims have experienced less trend than ‘Small’ claims.**
- **If we are using a common trend assumption (e.g. ‘trend is constant by size’), our on-level factors could be significantly overstated.**

A few thoughts as to why we observe such a phenomenon.

What is a 'large' sum of money?
Perception…

- Evidence suggests that these 'large' losses are not subject to the same inflationary pressures as 'small' losses.
  - Large losses are likely to be impacted by the **perception** of what 'a large sum of money' is.
  - Social Economics appears to play a big role.
    1. Late 90s early 2000s: internet bubble changed the perception of '$1m' – people became millionaires overnight – **the social definition of a 'large sum of money' changed drastically** (period of high trends)
    2. Early 2000s to present (after internet bubble burst) – **the social definition of a 'large sum of money' has not changed materially** (period of low to moderate trends).
    3. In my opinion, we were ready for another 'jump' in 2008-2009, but 'Great Recession' reset our expectations
    4. For extremely large sums of money (i.e. $15m+) – **the social definition of '$15m' has not changed materially** (it **was** 'a lot' of money in 2001 in 2007 and **is** still 'a lot' of money in 2016).

Appendix 1

- Hypothetical example with potential non-linear transformation (e.g. trend) – Simplified case.

Simplified Example
Hypothetical Example: will not work for all X

Assume X has a transformation as follows

$X \rightarrow a X^{b}$

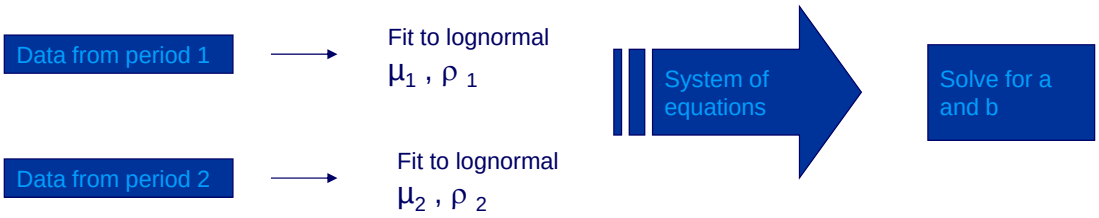
Then, assuming a lognormal distribution and using 1st and 2nd moments we can solve for μ_2 and ρ_2 in terms of μ_1 and ρ_1

Recursive relationship:

$\mu_2 = \ln(a) + b\,\mu_1$

$\rho_2 = b\,\rho_1$

Now, by looking at blocks of data such as:



Appendix 2

- Potential LDF methodology for open claims only.

Loss Development – few obvious observations.

- In order to analyze severity trend, we need to examine ultimate losses (or derivative of that set) as a time series.
- Consequently, we need to develop our claims to their ultimate values.
- The outcome of a trend study is very sensitive to this development.
- This is especially true if we study trend in Excess layers. Trend in excess layers is highly dependent on the variance of underlying distribution.

- Our development procedure should **'preserve' both: the 'true' underlying *mean* AND the *variance*** of the ultimate loss distribution (which is currently yet unknown). The CV (St. Dev/Mean) of the distribution is very important.

Developing Open Claims

Traditional Approach vs Developing Just the Open Claims

The traditional approach to developing claims applies Ultimate LDFs to total losses

- When an Ultimate LDF is applied to total losses, the IBNER on historical years (claims made policies) is effectively spread between both open and closed claims.
- This approach could preserve the mean of the distribution, but will not be effective with respect to the variance.

Developing just the open claims 'preserves' ultimate CV and provides for a better estimate of excess losses: individually and in total.

- It is not perfect, but it is a step in a right direction.
- Should not introduce any bias into the total ultimate loss.

Traditional Development Approach

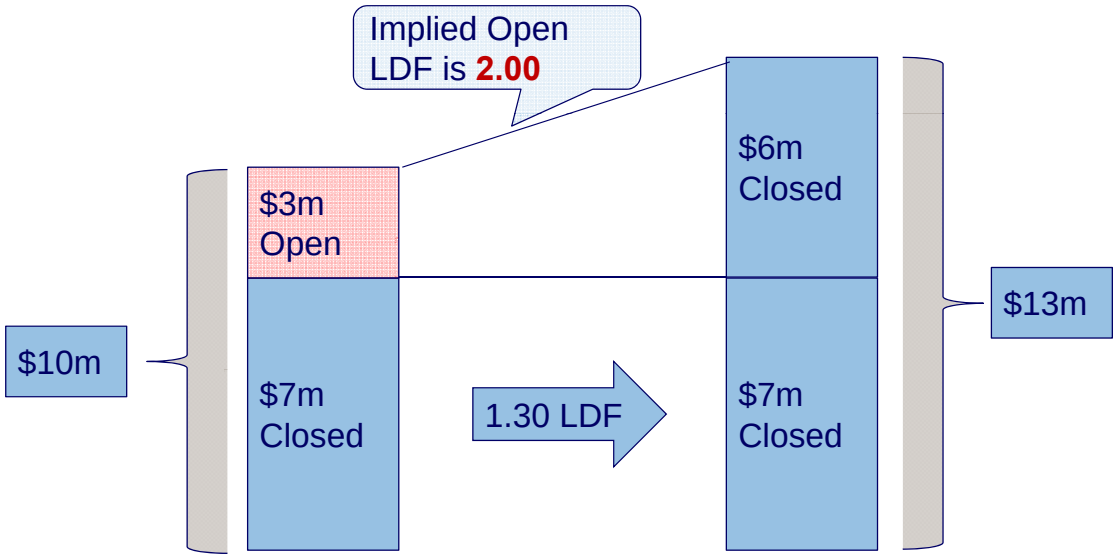
An Example (generic, applicable to any LDF methodology)

?

Where is the development REALLY coming from on claims made policies?
Are the 'reported on closed' claims changing?

?

Open LDF – Simple Concept



$$\text{Open Claim Ult LDF} = \frac{\$13 - \$7}{\$10 - \$7} = 2.00$$

Developing Open Claims

Determining the Open Claim Ultimate LDFs

Conceptually, the formulae will look like this:

The Open Claim Ult LDF is as follows:

$$\frac{\text{Estimated Ultimate} - \text{Paid on Closed}}{\text{Reported} - \text{Paid on Closed}}$$

If we express it in terms of LDFs and %s, then we have the following formulae for Open Claims Ult LDF:

$$\frac{\text{Ult LDF} - \text{Paid on Closed \%}}{1 - \text{Paid on Closed \%}}$$

Developing Open Claims

It sounds more difficult than it really is. Here is the simplification:

- **We can use the implied open claim multipliers to adjust our Ultimate LDFs to be Open Claim Ultimate LDFs**
- $\textbf{Open Claim Ult LDF} = (\textbf{Ult LDF} - 1) \times \textbf{Open Claim Multiplier} + 1$
- **In this case, Open Claim Multiplier is simply $1/(1-\text{Paid on Closed \%})$**
- **This will simplify the procedure and prevent the 'reversals' in the data.**

Developing Open Claims

Calculating the Open Claim Ultimate LDF

- We can estimate the Paid on Closed % claims at different ages (some time we can use claim count triangles or paid triangles as a proxy)

1. • Reported Loss Triangle
2. • Paid on Closed Loss Triangle
3. • Paid on Closed as % of Reported Triangle
4. • Select an Open Claim Multiplier as 1 / (1 - Average % Paid on Closed), for each maturity
5. • Open Claim Ult LDF = (Ult LDF – 1)*Open Claim Multiplier + 1

Developing Open Claims

Calculating the Open Claim Ultimate LDF – Simplified Example

Reported Claims ($)

PY	12m	24m	36m	48m	60m
2009	2,000	2,040	2,081	2,122	2,165
2010	2,100	2,142	2,185	2,229	
2011	2,205	2,249	2,294		
2012	2,315	2,362			
2013	2,431				

Paid on Closed ($)

PY	12m	24m	36m	48m	60m
2009	800	1,240	1,736	1,910	2,005
2010	840	1,302	1,823	2,005	
2011	882	1,367	1,914		
2012	926	1,435			
2013	972				

All loss development at 36 months will come from only 17% of the reported claims

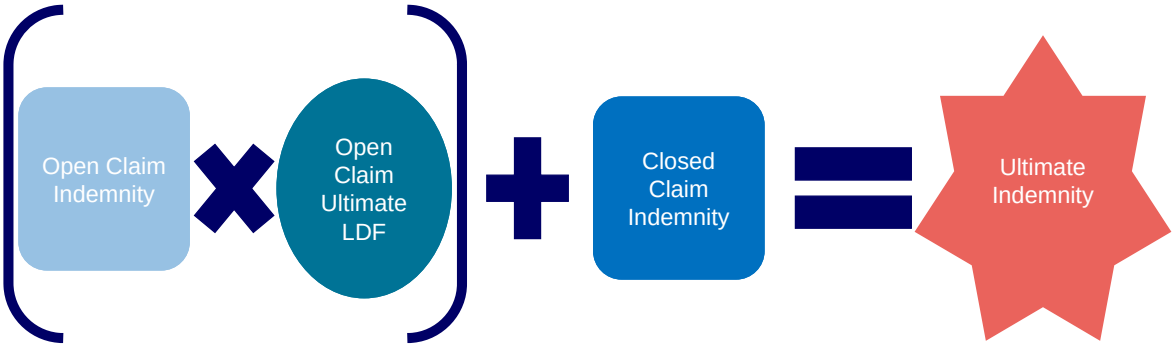
Paid on Closed as % of Reported

PY	12m	24m	36m	48m	60m
2009	0.40	0.61	0.83	0.90	0.93
2010	0.40	0.61	0.83	0.90	
2011	0.40	0.61	0.83		
2012	0.40	0.61			
2013	0.40				

This numbers usually appear in a nice increasing pattern

	12m	24m	36m	48m	60m
Average % Paid on Closed	**40%**	**61%**	**83%**	**90%**	**93%**
Average % Open	**60%**	**39%**	**17%**	**10%**	**7%**
Implied Open Claim Multiplier	**1.67**	**2.55**	**6.03**	**9.97**	**13.55**

Developing Open Claims



Developing Open Claims – Back to the Database

Checking for Bias – Using Total Incurred for Illustration Purposes

- No bias is introduced by developing just the open claims
- There is little development on the older report years
- The overall difference between the two methods is immaterial

Report Year	Total Incurred (000s)	Estimated Ultimate Incurred (000s)		Developing Open vs All	Impact of Development (Open Method)
		Developing All Claims	Developing Open Claims		
2005	2,433	2,439	2,436	**0%**	1.00
2006	2,176	2,186	2,180	**0%**	1.00
2007	2,628	2,651	2,640	**0%**	1.00
2008	2,727	2,771	2,757	**-1%**	1.01
2009	2,970	3,059	3,043	**-1%**	1.02
2010	3,034	3,203	3,189	**0%**	1.05
2011	2,965	3,286	3,292	**0%**	1.11
2012	2,835	3,417	3,404	**0%**	1.20
2013	2,621	3,679	3,702	**1%**	1.41
Total	**24,388**	**26,692**	**26,643**	**0%**	**1.09**

Virtually no difference in ultimates.
No bias is introduced by developing just the open claims.

Just a 9% impact from development

Disclaimer

The information in this presentation was compiled for informational purposes only, we do not guarantee any particular outcome. Any and all information contained herein is not intended to constitute legal advice. We do not guarantee the accuracy of this information or any results and further assume no liability in connection with this presentation. Past results and prior performance are not indicative of future outcomes. We undertake no obligation to publicly update or revise any of this information, whether to reflect new information, future developments, events or circumstances or otherwise. The subject matter of this presentation is not tied to any specific insurance product nor will adopting these policies and procedures ensure coverage under any insurance policy.

Questions and Discussion