**CS9: US/UK Experience rating methods** divided by an ocean

# SEMINAR ON KEINSURANCE JUNE 8-9, 2021 · VIRTUAL EVENT

CAS

# CS9: US/UK Experience rating methods divided by an ocean

CARe Seminar, June 8-9, 2021 – Virtual Event

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## CS9: US/UK Experience rating methods, divided by an ocean

- Introduction Caitlyn 5 mins
- Overview US/UK Methods Ana 25 mins
  - Similarities / differences between US, UK, Europe
  - Data collected, trends, LDFs, ALAE, rate changes, etc.
  - Claim trending and development excess methodologies

#### Ground-up and Excess Trend Illustration – Marni 10 mins

- Illustration of Ground-up and Excess Trend Issue
- Bars/Restaurants Illustrative Data
- GU and 900 xs 100 interconnections severity, frequency, pure premium

#### • Linking Trend and ILFs for Enhanced Estimates - Justin 15 mins

- Basics of Submitted Variance paper
- Applied to Bars/Restaurants data
- Bringing it together

#### • Impact of COVID on 2020 Results - Marni 10 mins

- Pricing / reserving impacts
- Impacts on projections in 2021
- Q&A 10 mins



## US/UK Experience rating methods, divided by an ocean

- This session will provide a comparison of basic experience rating calculations and **methods used in the US and UK**.
- **Trending and developing claims** are the cornerstone of experience rating. In this presentation, we will discuss several commonly asked questions including what period should be considered for inflation and how to assess the 'maturity' of claims reported and reserved late. We will provide an overview of a number of methods across regions for trending claims for inflation and methods for developing claims to ultimate in an excess of loss layer. Development methods that split IBNER and IBNR will be discussed.
- We will illustrate the important interconnection between severity and frequency trends on excess trend estimation, including the usage of various methods utilizing simulation highlighted in a submitted Variance article
- The session will also include the **impacts of COVID** on the distortion of experience rating factors such as loss development, trend measures, and profitability indications during the various historical and projected phases of the COVID pause and the anticipated turnaround.



# **Trending and Claims Development Methods – Global Perspective**

## Ana Mata



## Outline

- Overview of different pricing methods and assumptions
- Claims trending methodologies
  - Average date of loss method
  - Calendar year method (incremental payments)
  - Closed claim date (adjusted for open claims)
- Claims development methods for excess layers
  - Excess development
  - Split IBNER vs. IBNR (various options)



## **Data differences**

Item	USA	UK	Europe/RoW
Limits profile	Banded profile or individual risk download	Banded profile by attachment and limit (lowest attachment and total limit stacked) OR full risk download with a stacked code.	Unlimited coverages, profile banded by limit offered.
Gross triangles	Often provided, if not Schedule P used.	Some provide gross incurred triangles most don't. Upon request may provide plan loss ratio or ULRs for last 5 years.	Rarely provided, if at all paid triangles. May provide plan gross loss ratio.
Rate changes	Standard in submission or easy to get, rate filings, etc.	Better in most recent years, but calculations not standard, often questionable.	Rarely provided or based on anecdotal evidence but getting better.
Historic premium, which premium?	Often premium subject to treaty or a good proxy (EP for LOD and WP for RAD).	Gross or net of commission? Written or earned depending on Lloyd's non-Lloyd's market.	Most treaties 1/1, not an issue, but could be EP for RAD.
Individual claims progression	Often include Indemnity and ALAE, policy limits/sum insured and deductibles, paid and O/S.	ALAE not split, but often treaties are inclusive of ALAE. Limits by claims sometimes provided. Indemnity paid and O/S, but ALAE just paid. Property often only latest position.	ALAE not split, but often treaties are inclusive of ALAE. Limits by claims rarely provided. Indemnity paid and O/S, but ALAE just paid. Property often only latest position.
ILFs/Curves	Some cedant's may share this information, particularly medmal writers. Rely on ISO curves.	Everyone struggles for curves, so may not share due to lack of them. Power curves commonly used for Casualty and Swiss Re curves for Property.	Everyone struggles for curves, so may not share due to lack of them. Power curves commonly used for Casualty and Swiss Re curves for Property.



## **Data issues**



nstitute and Faculty of Actuaries



Analysing the disconnect between the reinsurance submission and global underwriters' needs

Property per risk

by the IFoA / CAS International Pricing Research Working Party

John W. Buchanan (chair), Mohamed S. Afify, Shayne Andrews, Enrico Biffis, Chris Boggs, Lawrence Cheng, Paul Gates, Eric Greenhill, Yin Hang, Kevin Hilferty, Mandy Kisala, Xiao-Xuan (Sherwin) Li, Ana J. Mata, Eoin O'Baoighill, Josiah Ogungbesan, Adam P. Shrubshall, Bei Zhou

1 August 2017 (Reprint)

http://www.actuaries.org.uk/practice-areas/pages/international-pricing-research-working-party

Paper covers at length data requirements vs benchmark assumptions when pricing a reinsurance contract: in the absence of submission, actuaries make more conservative assumptions.



### How much does quality of submission vary by region?

#### Figure 37 - Survey: Submission quality rank (1=poor, 5=excellent)





## **Differences in pricing methods**

Method	Sub-item	USA	UK	Europe
Experience	Claims	Often constant trend. Average loss method from	Wide variations: Avg loss date, CY, differentiate	Trends by year. Calendar year for incremental
	trending	avg loss date of past to average loss date of	between closed and open claims.	payments and outstanding from year end.
		future.		
	Layer	Not an issue	Apply average index factor to all trended claims,	Apply average index factor to all trended claims,
	indexation		claim.	fitted.
	Claims	Create excess triangle of trended losses seems	Wide variations: trend, layer, create excess	Individual claims development applied to open
	development	preferred approach. Apply excess LDFs to	triangle, excess LDFs vs. Trend, develop open	claims in order to fit curves for "exposure rating".
		aggregate losses in layer.	claims, layer and aggregate. IBNR from claim count pattern.	May also create excess triangles.
Exposure	Trending	Standard to trend parameters for parametric	Some do but most don't. Tables of ILFs	Curve fitted each time for specific accounts. Power
	parameters	curves. Each curve has an effective date.	untrended and power curves scale invariant.	curves are scale invariante, inflation does not matter.
	ALAE	Clear understanding of indemnity only vs	Some adjust for ALAE but most don't. Main	Curve follows data presentation. Power curves: do
	included or	indemnity plus ALAE curves and appropriate	adjustment need to policy limit, but often	they include or exclude ALAE??
	not?	adjustments done.	missed. Power curves: do they include or	
	Adjustments?		exclude ALAE??	
	Limits profile	Standard methodology taking into account limits	Depends on data presentation: aggregate	Fit a curve to cedant's data and use
	vs. unlimited	profile if available.	banded profile vs individual policies with stack	frequency/severity approach. Rare use of "limits
	coverages		code.	profile" approch
Mixed/Hybrid		1) Experience rat	te (loss cost %) low credible layer, use curve to e	extrapolate burn cost
		2) Experience rate frequency at lo	ow reference attachment, use curve to extrapolate	e frequency and severity from curve.
		3) Experience rate (loss cost %)	) from lowest attachment all programme, then us	e the curve to split between layers.
			4) Hybrid method*	
Aggregate loss distributions		1) L	ognormal or gamma approximation fitting mean a	and CV
			2) Poisson model with total or partial severity	
		3) Model for frequency and se	verity then combine using simulation, recursive a	Igorith or Fast Fourier Transform

\*Buchanan, J and Angelina, M. The Hybrid Reinsurance Pricing Method: A Practitioner's guide.

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## **Trending methods**

- The purpose: to adjust for changes in the average loss cost between the historic period and the prospective treaty
- Methods:
  - Average loss method
  - Incremental paid method
  - Close date method



## **Average loss method**

Apply inflation from the actual date of loss or average date of loss in the historic period to the average date of loss in the future period

Data basis\Treaty basis	RAD	LOD
Accident Year	Middle of historic year to one year after treaty inception	Middle of historic year to half year after treaty inception
Underwriting year	One year after start of historic year to one year after treaty inception	One year after start of historic year to half year after treaty inception
Treaty year	Historic year to future year	Historic year to future year



## **Average loss method - Example**

• Treaty inception 1/1/2021, data on treaty basis



## **Calendar year method**

- Popular in Continental Europe
- Requires paid development at individual claim level
- Apply inflation to incremental payments by calendar year
  - From the average payment date between two evaluation dates to the average payment date between two evaluation dates in the future policy year
  - Add trended payments to arrive at cumulative trended paid
  - Trend outstanding amount from each evaluation date to future evaluation date



## **Calendar year method - Example**

Actual loss	reported			N 2	Evaluation da	ates			Year	Inflation
Treaty year		31/12/2014	31/12/2015	31/12/2016	31/12/2017	31/12/2018	31/12/2019	30/06/2020	2014	6%
2014	Cumulative paid	37,500	75,000	90,000	250,000	275,000	350,000	410,000	2015	6%
	Incremental paid	37,500	37,500	15,000	160,000	25,000	75,000	60,000	2016	4%
	Outstanding	112,500	75,000	110,000	50,000	175,000	75,000	0	2017	4%
	Cumlative incurred	150,000	150,000	2 <mark>00,000</mark>	300,000	450,000	425,000	410,000	2018	4%
									2019	2%
									2020	2%
				Futi	ure evaluation	n dates			2021	2%
Treaty year		31/12/2021	31/12/2022	31/12/2023	31/12/2024	31/12/2025	31/12/2026	30/06/2027	2022	4%
2021	Trended incremental paid	50,986	48,841	18,984	198,644	30,593	90,896	72,720	2023	4%
	Trended cumulative paid	50,986	99,827	118,812	317,456	348,049	438,945	511,665	2020	4%
	Trended outstanding	149,342	95,839	137,887	61,482	213,118	90,458	0	2024	4%
	Trended incurred	200,328	195,667	256,699	378,938	561,167	529,403	511,665	2025	4%
									2020	4%
Trending in	cremental payments								2028	4%
									2029	4%
	From date	01/07/2014	01/07/2015	01/07/2016	01/07/2017	01/07/2018	01/07/2019	31/03/2020	2020	4%
	To date	01/07/2021	01/07/2022	01/07/2023	01/07/2024	01/07/2025	01/07/2026	31/03/2027	2000	
	Trend factor	1.360	1.302	1.266	1.242	1.224	1.212	1.212	2031	4 /0
Trending ou	utstanding									
	From date	31/12/2014	31/12/2015	31/12/2016	31/12/2017	31/12/2018	31/12/2019	30/06/2020		
	To date	31/12/2021	31/12/2022	31/12/2023	31/12/2024	31/12/2025	31/12/2026	30/06/2027		
	Trend factor	1.327	1.278	1.254	1.230	1.218	1.206	1.218		

## **Closed claim date method**

- Rationale: The date when claim closed/settled is the time we now the value of the claims for certain.
- Closed claims: trend from close date of the expected close data in the prospective treaty year.
  - Assumes same number of years from treaty inception to closing date.
  - Most of the trend factor will come from (assumed) future inflation.
- Open claims:
  - Option 1: use the average date of loss method
  - Option 2: determine the expected close date using payment pattern (need to extend for slower than average claims)



## **Closed claim date method - Example**

• Treaty inception 1/1/2021, data on treaty basis



## Comments

- If inflation is assumed a contract rate p.a. all methods generate the same answer (same number of years between experience year and future year).
- Mostly an issue with long tail classes:
  - Underwriters' strong views about past vs. future inflation for bodily injury claims
- Limitations:
  - Average loss date always possible
  - Payment development at claim level not always available
  - Closing date not always available



## **Claims development methods**

- The purpose: to add IBNER and IBNR to bring claims in the layer to ultimate.
  - Open claims below the attachment (even post inflation) may develop into the layer (IBNER)
  - Claims reported to cedant but below claims reporting threshold may eventually make it to the layer (IBNR for reinsurers)
  - New claims reported to the carrier (pure IBNR for both)
- Biggest challenge for reinsurers is to estimate IBNR at layer level with limited data
- Methods:
  - Excess development method (IBNR and IBNER combined)
  - IBNER pattern to open claims, pure IBNR from claim count pattern



## Applying IBNR and IBNER factors for layered policies

- For long tail lines, reserving main issue for pricing
  - Reporting threshold often 50% of attachment
  - Cedant need not report claims unless incurred exceeds reporting threshold
  - Highly depends on cedant's case reserves handling practices
- Overall ceding company's reserves may be adequate, but IBNR allocation to claims very difficult
- What does IBNR stand for?

**I** Bought No Reinsurance OR Interesting But Not Relevant



## **Excess development method**

- Dominant method in the USA and Bermuda
- Steps:
  - Apply claims inflation to individual claims at each evaluation date (based on preferred method)
  - Apply layer to trended claims
  - Aggregate by year
  - Create trended incurred or paid triangle in the layer
  - Select a development pattern, use Chain Ladder or BF methods
- Does not capture possible IBNER from claims below attachment
  - Often select a development pattern at lower attachment



## **IBNER and IBNR patterns**

- Using gross ("ground up") individual claims (above the threshold) derive an IBNER pattern to be applied to open claims
- What is the maturity of a claim? Claims are reported and reserved at different times
- Three different assumptions about maturity of a single claim:
  - Option 1:Number of months between start date of cohort (AY, UY, TY) and As Of Date in data
  - Option 2: Number of months between report date (first reserve) and As Of Date in data
  - Option 3: Number of months between date when trended claims exceeded data threshold and As Of Date in data
  - Select appropriate method and apply selected IBNER pattern to open claims
- Pure IBNR using claims count pattern in the layer



## **Option 1: From start date of cohort**

Losses greater than \$1m at any point in timeData as of31/12/2020Claims inflation5% p.a.Earliest year of data2007Treaty Year2021Trended threshold1,979,932Basis of the dataTreaty year

Option 1: maturity from start of cohort to As Of Date

Treaty Year	Dec-07	Dec	-08	Dec-09	Dec-10	Dec-11	Dec-12	Dec-13	Dec-14	Dec-15	Dec-16	Dec-17	Dec-18	Dec-19	Dec-20	Months of maturity
2014	0		0	0	0	0	0	0	0	0	0	0	0	4,506,845	4,470,029	84
2019	0		0	0	0	0	0	0	0	0	0	0	0	1,936,183	1,053,520	24

Taking into account the start of the treaty year of the claim, the IBNER pattern will allocate more development to the 2019 claim.

Both claims were reported and reserved in calendar year 2019, both known for the same amount of time. May be understating the IBNER needed for the oldest claim.



## **Option 2: From report date (first reserved)**

Losses greater than \$1m at any point in time Data as of 31/12/2020 Claims inflation 5% p.a. Earliest year of data 2007 Treaty Year 2021 Trended threshold 1,979,932 Basis of the data Treaty year

Option 2: maturity from 'reseved year' to As Of Date

Treaty Year	D	ec-07	Dec-08	3	Dec-09	Dec-10	Dec-11	Dec-12	Dec-13	Dec-14	Dec-15	Dec-16	Dec-17	Dec-18	Dec-19	Dec-20	Months of maturity from report year
2014		0	C	)	0	0	0	0	0	0	0	0	0	0	4,506,845	4,470,029	24
2019		0	C	)	0	0	0	0	0	0	0	0	0	0	1,936,183	1,053,520	24

On a report or 'first reserved' basis, both claims will be assigned to 'report year' 2019 in the large loss triangle for IBNER purposes. Both receive the same IBNER loading.

This method does not differentiate between an small initial reserve vs a large initial reserve. Could be punitive to claims reserved with a large amount as more information may be available from the onset.



# **Option 3: From date trended claim > data threshold (de-trended)**

Losses greater than \$1m at any point in timeData as of31/12/2020Claims inflation5% p.a.Earliest year of data2007Treaty Year2021Trended threshold1,979,932Basis of the dataTreaty year

Option 3: maturity from when claim > de-trended threshold

Treaty Year	Dec-07	Dec-08	Dec-09	Dec-10	Dec-11	Dec-12	Dec-13	Dec-14	Dec-15	Dec-16	Dec-17	Dec-18	Dec-19	Dec-20	De-trended threshold
2014	0	0	0	0	0	0	0	0	0	0	0	0	4,506,845	4,470,029	710,681
2014	0	0	0	0	0	0	0	0	0	23,537	855,924	1,383,334	1,512,188	1,539,798	710,681
2018	0	0	0	0	0	0	0	0	0	0	0	0	1,044,112	1,044,112	863,838
2019	0	0	0	0	0	0	0	0	0	0	0	0	1,936,183	1,053,520	907,029
Under the 'Year firs	t exceeded th	ne threshold	d' definition	, triangles	will look lik	e this:					=				
Year	Dec-07	Dec-08	Dec-09	Dec-10	Dec-11	Dec-12	Dec-13	Dec-14	Dec-15	Dec-16	Dec-17	Dec-18	Dec-19	Dec-20	
2014															
2015											Clain	n in TY 20	14, but rese	rving above	threshold starts in 2017
2016											<b>↓</b>			_	
2017											855,924	1,383,334	1,512,1 <mark>8</mark> 8	1,539,798	
2018															
2019													7,487,140	6,567,662	
2020															
_				and and					,			·			

Focuses purely on when the claim reached the reporting threshold for reinsurers (meaningful reserve) and looks at how the claim moves from there. Two claims reaching the threshold the same year, are deemed 'comparable' for the purpose of maturity.

#### Example – Option 1 (from start date of cohort to As Of Date)

Treaty year	12	24	36	48	60	72	84	96	108	120	132	144	156	5 168	Commente
2007	2,101,625	3,595,429	5,533,145	8,487,699	6,348,787	6,898,319	7,174,484	5,757,321	5,489,949	5,124,054	5,100,850	4,774,137	4,774,137	7 4,773,067	Comments:
2008	909,067	10,766,502	18,499,951	19,799,168	20,305,164	24,853,836	24,177,310	22,101,445	18,078,344	18,688,241	18,948,451	18,959,296	18,888,927	7	
2009	11,275,192	25,546,500	37,280,363	37,775,260	43,693,670	44,541,764	47,601,887	50,543,749	49,272,898	49,267,352	49,484,895	49,525,760			
2010	2,144,488	11,439,000	18,660,256	23,845,020	27,271,205	33,453,753	29,652,832	29,377,922	28,802,435	28,802,435	28,803,337				Triangle of large
2011	5,324,615	14,272,630	17,189,534	15,658,225	20,626,511	27,243,804	30,513,546	30,842,400	33,051,364	32,364,021					lossos groator than
2012	18,281,666	34,761,727	31,870,182	42,953,541	55,007,814	63,871,605	65,485,575	65,500,380	64,867,755						losses greater than
2013	18,367,568	32,270,160	39,638,054	40,130,957	35,88 <mark>4,226</mark>	46,207,720	46,279,805	47,684,108							1m at any point in
2014	53,640,991	<mark>88,174,3</mark> 38	151,039,087	182,506,700	173,57 <mark>8,249</mark>	179,172,898	179,437,261								time
2015	43,955,454	83,671,678	132,531,917	158,355,667	159,1 <mark>70,195</mark>	170,738,047									time.
2016	11,748,438	17,586,997	26,244,967	30,184,396	29,391 <mark>,3</mark> 31										
2017	2,239,832	5,867,029	7,329,968	7,685,404											Does not
2018	1,012,334	2,061,802	2,061,802												
2019	11,410,314	10,527,651													differentiate
2020	0														between large and
															small case reserves
															from onset.
Treaty year	24:12	36:24	48:36	60:48	72 : 60	84 : 72	96 : 84	108:96	120 : 108	132 : 120	144 : 132	156 : 144	168 : 156		
2007	1.711	1.539	1.534	0.748	1.087	1.040	0.802	0.954	0.933	0.995	0.936	1.000	1.000		
2008	11.843	1.718	1.070	1.026	1.224	0.973	0.914	0.818	1.034	1.014	1.001	0.996			Large reserves
2009	2.266	1.459	1.013	1.157	1.019	1.069	1.062	0.975	1.000	1.004	1.001				posted earlier may
2010	5.334	1.631	1.278	1.144	1.227	0.886	0.991	0.980	1.000	1.000					
2011	2.681	1.204	0.911	1.317	1.321	1.120	1.011	1.072	0.979						be penalised.
2012	1.901	0.917	1.348	1.281	1.161	1.025	1.000	0.990							
2013	1.757	1.228	1.012	0.894	1.288	1.002	1.030								
2014	1.644	1.713	1.208	0.951	1.032	1.001									
2015	1.904	1.584	1.195	1.005	1.073										
2016	1.497	1.492	1.150	0.974											
2017	2.619	1.249	1.048												
2018	2.037	1.000													
2019	0.923														
2020															
Treaty year	24 : 12	36 : 24	48:36	60 : 48	72 : 60	84 : 72	96 : 84	108 : 96	120 : 108	132 : 120	144 : 132	156 : 144	168 : 156	Tail factor	
Avg all	2.932	1.395	1.161	1.050	1.159	1.015	0.973	0.965	0.989	1.003	0.979	0.998	1.000		
Wgt avg all	1.867	1.478	1.168	1.021	1.102	1.010	1.004	0.978	0.997	1.004	0.996	0.997	1.000		
Selected	2.932	1.395	1.161	1.050	1.159	1.015	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
LDF	5.858	1.998	1.433	1.234	1.176	1.015	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
% dev	17.07%	50.05%	69.80%	81.03%	85.04%	98.57%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	

#### Example – Option 3 (from date incurred > de-trended threshold)

Year 2007 2008	12 2,101,625 2,065,346	24 1,737,311 3,519,550	36 1,711,857 3,603,014	48 1,580,794 1,798,110	60 1,502,281 1,789,446	72 1,561,809 1,690,581	84 1,561,809 1,685,393	96 1,561,809 1,685,393	108 1,586,096 1,684,758	120 1,623,373 1,684,758	132 1,600,169 1,684,758	144 1,613,366 1,684,758	156 1,613,366 1,684,758	168 1,612,297	Comments:
2009	21,810,138	28,326,817	29,306,137	29,581,975	29,481,727	28,954,841	28,723,059	25,189,011	24,628,990	24,546,719	24,714,788	24,77 <mark>2,320</mark>			
2010	20,382,690	19,004,068	21,529,203	21,742,012	20,372,620	20,108,689	18,786,736	18,761,452	18,420,152	18,420,152	18,420,152				Year defined as year
2011	28,166,614	29,394,563	34,543,815	29,892,169	29,889,709	30,397,175	30,507,252	30,672,521	30,673,294	30,658,769					
2012	31,108,937	30,573,369	26,088,936	26,098,389	26,033,532	25,835,413	25,390,380	25,389,962	24,826,554						incurred > de-trended
2013	48,642,912	44,354,275	40,085,318	40,261,135	40,436,361	40,329,983	40,348,369	38,981,172							data threshold.
2014	78,681,012	85,221,968	75,926,382	76,006,460	75,121,76 <mark>4</mark>	75,320,177	75,319,909								
2015	107,884,000	121,410,053	131,014,840	136,382,888	135,275,62 <mark>2</mark>	140,027,874									
2016	129,671,476	125,396,941	120,416,285	122,032,449	124,439,782										Focuses on tail from
2017	91,018,484	88,720,567	90,817,384	90,315,802											'meaningful reserve'
2018	45,628,052	45,843,234	50,155,762												meaningraireserve
2019	24,048,330	21,851,309													
2020	3,682,011														More reasonable for IBNER purposes
Year	24 : 12	36 : 24	48 : 36	60 : 48	72 : 60	84 : 72	96 : 84	108 : 96	120 : 108	132 : 120	144 : 132	156 : 144	168 : 156		
2007	0.827	0.985	0.923	0.950	1.040	1.000	1.000	1.016	1.024	0.986	1.008	1.000	0.999		
2008	1.704	1.024	0.499	0.995	0.945	0.997	1.000	1.000	1.000	1.000	1.000	1.000			
2009	1.299	1.035	1.009	0.997	0.982	0.992	0.877	0.978	0.997	1.007	1.002				
2010	0.932	1.133	1.010	0.937	0.987	0.934	0.999	0.982	1.000	1.000					
2011	1.044	1.175	0.865	1.000	1.017	1.004	1.005	1.000	1.000						
2012	0.983	0.853	1.000	0.998	0.992	0.983	1.000	0.978							
2013	0.912	0.904	1.004	1.004	0.997	1.000	0.966								
2014	1.083	0.891	1.001	0.988	1.003	1.000									
2015	1.125	1.079	1.041	0.992	1.035										
2016	0.967	0.960	1.013	1.020											
2017	0.975	1.024	0.994												
2018	1.005	1.094													
2019	0.909														
2020															
YOA	24 : 12	36:24	48:36	60 : 48	72 : 60	84 : 72	96 : 84	108:96	120 : 108	132 : 120	144 : 132	156 : 144	168 : 156	Tail factor	
Avg all	1.059	1.013	0.942	0.988	1.000	0.989	0.978	0.992	1.004	0.998	1.004	1.000	0.999		
Wgt avg all	1.022	1.003	1.001	0.998	1.012	0.992	0.968	0.986	0.999	1.003	1.003	1.000	0.999		
Selected	1.059	1.013	1.000	1.000	1.000	1.000	0.978	0.986	1.000	1.000	1.000	1.000	1.000	1.000	
LDF	1.035	0.977	0.965	0.965	0.965	0.965	0.965	0.986	1.000	1.000	1.000	1.000	1.000	1.000	
% dev	96.66%	102.34%	103.68%	103.68%	103.68%	103.68%	103.68%	101.41%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	28

## **Final comments**

- The submission data tends to drive the method used
- Inflation method has significant impact on trended claims if inflation fluctuates significantly.
- Claims development method if applied consistently, results tend to be similar.
  - When IBNER and IBNR applied separately limits the use of the BF method that requires a single development pattern.
  - Can be adapted by working out an "implied pattern"
- Actuaries preferences driven by how they were trained
  - Actuarial exams
  - First reinsurer they worked for



# Interconnection – Severity and Frequency Trends

# Marni Novack



#### Measuring Ground-Up vs. Excess trend – Severity (Unadjusted-Assume no trend)

Trend Test - Base Case

This illustrative example assumes 5 years of data, with an actual average severity trend of 9% across all loss sizes, no frequency trend or increase in business written, and no change in the shape of the curve.

When estimating excess trend, if no trend is applied to the Y1 threshold of 25k, the indicated XS severity trend is understated because the severity trend pushes an extra claim into the XS layer in Y4. This also leads to an apparent frequency trend when there is none. The pure premium trend is also moderately overstated.

		1.08	1.08	1.10	1.10	
Clm #	Y1	Y2	<b>Y3</b>	Y4	Y5	
36	108.61	117.30	126.68	139.35	153.28	
35	80.45	86.89	93.84	103.22	113.54	
34	63.02	68.06	73.51	80.86	88.94	
33	49.72	53.70	57.99	63.79	70.17	
32	39.49	42.65	46.06	50.67	55.73	
31	31.59	34.12	36.85	40.53	44.58	
30	25.45	27.49	29.68	32.65	35.92	
29	20.64	22.29	24.07	26.48	29.13	
28	16.86	18.21	19.67	21.63	23.80	
27	13.87	14.98	16.18	17.80	19.58	
26	11.49	12.41	13.40	14.74	16.22	
25	9.58	10.35	11.17	12.29	13.52	
24	8.05	8.69	9.39	10.33	11.36	
23	6.81	7.35	7.94	8.74	9.61	
22	5.80	6.26	6.77	7.44	8.19	
21	4.97	5.37	5.80	6.38	7.01	
20	4.30	4.64	5.02	5.52	6.07	
19	3.74	4.04	4.36	4.80	5.28	
18	3.27	3.53	3.81	4.20	4.62	
17	2.89	3.12	3.37	3.71	4.08	
16	2.56	2.76	2.99	3.28	3.61	
15	2.29	2.47	2.67	2.94	3.23	
14	2.07	2.24	2.41	2.66	2.92	
13	1.87	2.02	2.18	2.40	2.64	
12	1.71	1.85	1.99	2.19	2.41	
11	1.57	1.70	1.83	2.01	2.22	
10	1.46	1.58	1.70	1.87	2.06	
9	1.36	1.47	1.59	1.74	1.92	
8	1.28	1.38	1.49	1.64	1.81	
7	1.21	1.31	1.41	1.55	1.71	
6	1.15	1.24	1.34	1.48	1.62	
5	1.10	1.19	1.28	1.41	1.55	
4	1.06	1.14	1.24	1.36	1.50	
3	1.04	1.12	1.21	1.33	1.47	
2	1.01	1.09	1.18	1.30	1.43	
1	1.00	1.08	1.17	1.28	1.41	

Severity Trend Vary Year by Year - No Frequency Trend

# V1 V2 V3 V4 V5 534 577 623 686 754

lotal Loss	534	577	623	686	/54	
Claim Count	36	36	36	36	36	
Average Severity	14.8	16.0	17.3	19.0	20.9	
Severity Change Check		1.080	1.080	1.100	1.100	1.090
	_					
Selected "Feeder" Trend		1.000	1.000	1.000	1.000	
Loss Threshold	25.0	25.0	25.0	25.0	25.0	
XS Total Loss	398	430	4 <mark>65</mark>	538	591	
XS Claim Count	7	7	7	8	8	
XS Average Severity	56.9	61.5	66.4	67.2	73.9	
Indicated Severity Change		1.080	1.080	1.012	1.100	1.068
On-Level Subject Premium	1,000	1,000	1,000	1,000	1,000	
GU Frequency	0.0360	0.0360	0.0360	0.0360	0.0360	
XS Frequency	0.0070	0.0070	0.0070	0.0080	0.0080	
Indicated Frequency Change		1.000	1.000	1.143	1.000	1.034
GU Burn	0.5343	0.5771	0.6233	0.6856	0.7541	
XS Burn	0.3983	0.4302	0.4646	0.5376	0.5913	
Indicated Pure Premium Change		1.080	1.080	1.157	1.100	1.104



#### Measuring GU vs. XS trend – Severity (Assuming 6% Trend)

Sev

If a proper "feeder" trend for the threshold is used, the threshold increases as the losses increase from the severity trend. As a result, the XS frequency trend correctly remains at 0% resulting in the proper severity and pure premium trends.

erity Trend V	vary year by	rear - No Fr	equency in	ena		
		1.08	1.08	1.10	1.10	
Clm #	¥1	Y2	Y3	Y4	Y5	
36	108.61	117.30	126.68	139.35	153.28	
35	80.45	86.89	93.84	103.22	113.54	
34	63.02	68.06	73.51	80.86	88.94	
33	49.72	53.70	57.99	63.79	70.17	
32	39.49	42.65	46.06	50.67	55.73	
31	31.59	34.12	36.85	40.53	44.58	
30	25.45	27.49	29.68	32.65	35.92	
29	20.64	22.29	24.07	26.48	29.13	
28	16.86	18.21	19.67	21.63	23.80	
27	13.87	14.98	16.18	17.80	19.58	
26	11.49	12.41	13.40	14.74	16.22	
25	9.58	10.35	11.17	12.29	13.52	
24	8.05	8.69	9.39	10.33	11.36	
23	6.81	7.35	7.94	8.74	9.61	
22	5.80	6.26	6.77	7.44	8.19	
21	4.97	5.37	5.80	6.38	7.01	
20	4.30	4.64	5.02	5.52	6.07	
19	3.74	4.04	4.36	4.80	5.28	
18	3.27	3.53	3.81	4.20	4.62	
17	2.89	3.12	3.37	3.71	4.08	
16	2.56	2.76	2.99	3.28	3.61	
15	2.29	2.47	2.67	2.94	3.23	
14	2.07	2.24	2.41	2.66	2.92	
13	1.87	2.02	2.18	2.40	2.64	
12	1.71	1.85	1.99	2.19	2.41	
11	1.57	1.70	1.83	2.01	2.22	
10	1.46	1.58	1.70	1.87	2.06	
9	1.36	1.47	1.59	1.74	1.92	
8	1.28	1.38	1.49	1.64	1.81	
7	1.21	1.31	1.41	1.55	1.71	
6	1.15	1.24	1.34	1.48	1.62	
5	1.10	1.19	1.28	1.41	1.55	
4	1.06	1.14	1.24	1.36	1.50	
3	1.04	1.12	1.21	1.33	1.47	
2	1.01	1.09	1.18	1.30	1.43	
1	1.00	1.08	1.17	1.28	1.41	

	Y1	Y2	Y3	¥4	Y5	
Total Loss	534	577	623	686	754	
Claim Count	36	36	36	36	36	
Average Severity	14.8	16.0	17.3	19.0	20.9	
Severity Change Check		1.080	1.080	1.100	1.100	1.090
Selected "Feeder" Trend		1.060	1.060	1.060	1.060	
Loss Threshold	25.0	26.5	28.1	29.8	31.6	
XS Total Loss	398	430	465	511	562	
XS Claim Count	7	7	7	7	7	
XS Average Severity	56.9	61.5	66.4	73.0	80.3	
Indicated Severity Change		1.080	1.080	1.100	1.100	1.090
On-Level Subject Premium	1,000	1,000	1,000	1,000	1,000	
GU Frequency	0.0360	0.0360	0.0360	0.0360	0.0360	
XS Frequency	0.0070	0.0070	0.0070	0.0070	0.0070	
Indicated Frequency Change		1.000	1.000	1.000	1.000	1.000
GU Burn	0.5343	0.5771	0.6233	0.6856	0.7541	
XS Burn	0.3983	0.4302	0.4646	0.5111	0.5622	
Indicated Pure Premium Change		1.080	1.080	1.100	1.100	1.090



#### Measuring GU vs. XS trend – Severity (Assuming 12% Trend)

Severity Trend Vary Year by Year - No Frequency Trend

However, if the feeder trend is too high, the threshold is trended too much leading to an observed negative trend in frequency. This also leads to a severity trend that is too high, and in this case a pure premium that is too low.

Under these simplifying assumptions, attempting to estimate excess trend without adjusting for an increase in threshold, or over-adjusting, will produce incorrect estimates.

Methods that also adjust for changing frequencies, business mix, deductible/ policy limit impacts, and postulating severity curve distributions should be incorporated when possible.

		1.08	1.08	1.10	1.10	
Clm #	Y1	Y2	Y3	Y4	Y5	
36	108.61	117.30	126.68	139.35	153.28	
35	80.45	86.89	93.84	103.22	113.54	
34	63.02	68.06	73.51	80.86	88.94	
33	49.72	53.70	57.99	63.79	70.17	
32	39.49	42.65	46.06	50.67	55.73	
31	31.59	34.12	36.85	40.53	44.58	
30	25.45	27.49	29.68	32.65	35.92	
29	20.64	22.29	24.07	26.48	29.13	
28	16.86	18.21	19.67	21.63	23.80	
27	13.87	14.98	16.18	17.80	19.58	
26	11.49	12.41	13.40	14.74	16.22	
25	9.58	10.35	11.17	12.29	13.52	
24	8.05	8.69	9.39	10.33	11.36	
23	6.81	7.35	7.94	8.74	9.61	
22	5.80	6.26	6.77	7.44	8.19	
21	4.97	5.37	5.80	6.38	7.01	
20	4.30	4.64	5.02	5.52	6.07	
19	3.74	4.04	4.36	4.80	5.28	
18	3.27	3.53	3.81	4.20	4.62	
17	2.89	3.12	3.37	3.71	4.08	
16	2.56	2.76	2.99	3.28	3.61	
15	2.29	2.47	2.67	2.94	3.23	
14	2.07	2.24	2.41	2.66	2.92	
13	1.87	2.02	2.18	2.40	2.64	
12	1.71	1.85	1.99	2.19	2.41	
11	1.57	1.70	1.83	2.01	2.22	
10	1.46	1.58	1.70	1.87	2.06	
9	1.36	1.47	1.59	1.74	1.92	
8	1.28	1.38	1.49	1.64	1.81	
7	1.21	1.31	1.41	1.55	1.71	
6	1.15	1.24	1.34	1.48	1.62	
5	1.10	1.19	1.28	1.41	1.55	
4	1.06	1.14	1.24	1.36	1.50	
3	1.04	1.12	1.21	1.33	1.47	
2	1.01	1.09	1.18	1.30	1.43	
1	1.00	1.08	1.17	1.28	1.41	

Trend Test - Base Case						
	Y1	Y2	Y3	Y4	Y5	
Total Loss	534	577	623	686	754	
Claim Count	36	36	36	36	36	
Average Severity	14.8	16.0	17.3	19.0	20.9	
Severity Change Check		1.080	1.080	1.100	1.100	1.090
Selected "Feeder" Trend		1.120	1.120	1.120	1.120	
Loss Threshold	25.0	28.0	31.4	35.1	39.3	
XS Total Loss	398	403	435	478	526	
XS Claim Count	7	6	6	6	6	
XS Average Severity	56.9	67.1	72.5	79.7	87.7	
Indicated Severity Change		1.179	1.080	1.100	1.100	1.114
On-Level Subject Premium	1,000	1,000	1,000	1,000	1,000	
GU Frequency	0.0360	0.0360	0.0360	0.0360	0.0360	
XS Frequency	0.0070	0.0060	0.0060	0.0060	0.0060	
Indicated Frequency Change		0.857	1.000	1.000	1.000	0.962
GU Burn	0.5343	0.5771	0.6233	0.6856	0.7541	
XS Burn	0.3983	0.4027	0.4349	0.4784	0.5263	
Indicated Pure Premium Change		1.011	1.080	1.100	1.100	1.072



#### **Measuring GU vs. XS trend – Including Frequency**

If we assume in Y3, the frequency falls such that every 5<sup>th</sup> claim is removed from the dataset:

- If no feeder trend is used, the severity trend leads to an apparent flat frequency with a lower than actual severity trend.
- If an appropriate feeder trend is used (6%), we see frequency and severity trends close to the actual trends in the data.
- If too high a feeder trend is used (12%), both the frequency and severity trends are overstated (frequency is too low, severity is too high)

•

everity Trend	d Vary Year by `	Year - Frequ	uency Trend			
		1.08	1.08	1.10	1.10	
m #	¥1	Y2	<b>Y3</b>	Y4	Y5	
36	108.61	117.30	126.68	139.35	153.28	
35	80.45	86.89	93.84	103.22	113.54	
34	63.02	68.06	73.51	80.86	88.94	
33	49.72	53.70				
32	39.49	42.65	46.06	50.67	55.73	
31	31.59	34.12	36.85	40.53	44.58	
30	25.45	27.49	29.68	32.65	35.92	
29	20.64	22.29	24.07	26.48	29.13	
28	16.86	18.21				
27	13.87	14.98	16.18	17.80	19.58	
26	11.49	12.41	13.40	14.74	16.22	
25	9.58	10.35	11.17	12.29	13.52	
24	8.05	8.69	9.39	10.33	11.36	
23	6.81	7.35				
22	5.80	6.26	6.77	7.44	8.19	
21	4.97	5.37	5.80	6.38	7.01	
20	4.30	4.64	5.02	5.52	6.07	
19	3.74	4.04	4.36	4.80	5.28	
18	3.27	3.53				
17	2.89	3.12	3.37	3.71	4.08	
16	2.56	2.76	2.99	3.28	3.61	
15	2.29	2.47	2.67	2.94	3.23	
14	2.07	2.24	2.41	2.66	2.92	
13	1.87	2.02				
12	1.71	1.85	1.99	2.19	2.41	
11	1.57	1.70	1.83	2.01	2.22	
10	1.46	1.58	1.70	1.87	2.06	
9	1.36	1.47	1.59	1.74	1.92	
8	1.28	1.38				
7	1.21	1.31	1.41	1.55	1.71	
6	1.15	1.24	1.34	1.48	1.62	
5	1.10	1.19	1.28	1.41	1.55	
4	1.06	1.14	1.24	1.36	1.50	
3	1.04	1.12				
2	1.01	1.09	1.18	1.30	1.43	
1	1.00	1.08	1.17	1.28	1.41	

Trend Test - Frequency Impact						
	Y1	Y2	Y3	Y4	Y5	
Selected "Feeder" Trend		1.000	1.000	1.000	1.000	
Loss Threshold	25.0	25.0	25.0	25.0	25.0	
XS Total Loss	398	430	407	474	521	
XS Claim Count	7	7	6	7	7	
XS Average Severity	56.9	61.5	67.8	67.7	74.4	
Indicated Severity Change		1.080	1.103	0.999	1.100	1.069
On-Level Subject Premium	1,000	1,000	1,000	1,000	1,000	
XS Frequency	0.0070	0.0070	0.0060	0.0070	0.0070	
Indicated Frequency Change		1.000	0.857	1.167	1.000	1.000
XS Burn	0.3983	0.4302	0.4066	0.4738	0.5211	
Indicated Pure Premium Change		1.080	0.945	1.165	1.100	1.069

Trend Test - Frequency Impact						
	Y1	Y2	Y3	Y4	Y5	
Selected "Feeder" Trend		1.060	1.060	1.060	1.060	
Loss Threshold	25.0	26.5	28.1	29.8	31.6	
- XS Total Loss	398	430	407	447	492	
XS Claim Count	7	7	6	6	6	
KS Average Severity	56.9	61.5	67.8	74.5	82.0	
ndicated Severity Change		1.080	1.103	1.100	1.100	1.096
On-Level Subject Premium	1,000	1,000	1,000	1,000	1,000	
S Frequency	0.0070	0.0070	0.0060	0.0060	0.0060	
Indicated Frequency Change		1.000	0.857	1.000	1.000	0.962
KS Burn	0.3983	0.4302	0.4066	0.4473	0.4920	
ndicated Pure Premium Change		1.080	0.945	1.100	1.100	1.054

Trend Test - Frequency Impact						
	Y1	Y2	Y3	Y4	Y5	
Selected "Feeder" Trend		1.120	1.120	1.120	1.120	
Loss Threshold	25.0	28.0	31.4	35.1	39.3	
XS Total Loss	398	403	377	415	456	
XS Claim Count	7	6	5	5	5	
XS Average Severity	56.9	67.1	75.4	82.9	91.2	
Indicated Severity Change		1.179	1.123	1.100	1.100	1.125
On-Level Subject Premium	1,000	1,000	1,000	1,000	1,000	
XS Frequency	0.0070	0.0060	0.0050	0.0050	0.0050	
Indicated Frequency Change		0.857	0.833	1.000	1.000	0.919
XS Burn	0.3983	0.4027	0.3769	0.4146	0.4561	
Indicated Pure Premium Change		1.011	0.936	1.100	1.100	1.034

#### Measuring Ground Up vs Excess trend – GL Restaurants and Bars (GU) - Example

#### ISO Size-of-Loss Matrix **Loss Ratio Analytics** Illustrative © Insurance Services Office, Inc., 2020 Market Segment: General Liability Est All Yr/Curr Yr LR: 64.6% / 69.7% Total Premium 12/2019: 4,746,903,293 PremOps-Combined 7 Year Severity Trend: 7.97% Total Incurred \$ Indemnity+Alae (Prorata): 2,943,098,984 All Companies - Restaurants and Bars All Year Trend: 4.86% (DeT=6%) Total Occurrences: 187,364 Avg Duration: Rpt 1.9 / Paid 3.3 Years All Causes of Loss VWA 7yr/all 100%/0% 1,000,000 xs 0 Countrywide Partial Loss Ratio 30 60.0 100% Severity **On Level Frequency On Level Loss Ratio** 25 50.0 80% 20 40.0 60% 30.0 15 40% 20.0 10 **GU Severity Trend** 20% 10.0 7-yr = 7.97% 0.0 0% 2001 2004 2007 2010 2013 2016 2019 2001 2004 2007 2010 2013 2016 2019 2001 2004 2007 2010 2013 2016 2019 1.4 Rate Index (Base = 2009) BI 1.2 86.8% 2-5yrs 61.9% 2-5yrs 1.0 37.5% 0.8 23.9% 4.5% Other 0.6 64.6% LR (AII) Paid 0.4 Rpt 3.3 **Cause of Loss Distr** 1.9 0.2 LDF Duration 0.0 2001 2004 2007 2010 2013 2016 2019

For GL-PremOps SOLM 2020 v1

PD

8.7%

Restaurants and Bars, with losses capped at \$1M detrended at 6%, the 7yr average severity trend is around 8%.

In recent years(since 2013), severity has increased more dramatically than in earlier years (since 2007) and even more than in the early 2000s.

Frequency trend is decreasing leading to a slight increase in loss ratio trend.



Source: ISO Size-of-Loss Matrix 2020

#### Measuring GU vs XS Trend – GL Restaurants and Bars 1M xs 0 - Incd/Paid Severity

#### Analysis Method: Premium (MW rate change) Apriori Trend = 0.06 Illustrative INCURRED Itimate Avg Sev Avg Sev 30,000.00 (Ind+ALAF (Ind+ALAE AY Prorata/# Ind YTY Change Ultimate Prem rorata/# Ind) 2001 12,316 12,316 26,418,224 25,000.00 2002 12,373 12,373 0.46% 34,241,946 2003 12,891 12,891 4.19% 89,788,338 2004 12,142 12,142 -5.81% 167,167,806 2005 13,303 13,303 9.56% 236,824,765 20,000.00 2006 11,889 -10.63% 245,963,726 11,889 14.578 2007 14,578 22.62% 250,357,596 2008 16,133 16,133 10.67% 285,409,877 15,000.00 2009 13,692 13,692 -15.13% 299,957,860 2010 14,478 14,478 5.74% 318,175,787 4.87% 2011 15,183 15,183 310,047,042 10,000.00 12.72% 17,114 2012 17,114 311,451,507 Feeder Trend = 6%Severity trend for GL--3.49% 2013 16,517 16,517 336,587,418 20.78% 339,675,204 2014 19,949 19,949 5,000.00 Severity Trend = 7.97% 2015 22,494 22,494 12.76% 345,064,752 2016 23,997 23,997 6.68% 361,864,972 2.01% 2017 24,480 24,480 354,383,488 0.00 2018 27,772 27,772 13.45% 354,196,220 2001 2003 2019 2005 2007 2009 2011 2013 2015 2017 2019 27,902 0.47% 369,056,938 27,902 Total/Average 329,203 329,203 5.99% 5.036.633.466 7.97% Trend 7 year —Avg Sev (Ind+ALAE Prorata/# Ind)

PremOps – Restaurants and Bars for both paid and incurred loss are approximately 8% when the limit is trended at 6%.

#### Analysis Method: Premium (MW rate change) Apriori Trend = 0.06

Trend - all year

PAID

	Ultimate Avg Sev (Ind+ALAE	Avg Sev (Ind+ALAE		
AY	Prorata/# Ind)	Prorata/# Ind)	YTY Change	Ultimate Prem
2001	12,316	12,316		26,418,224
2002	12,373	12,373	0.46%	34,241,946
2003	12,890	12,890	4.18%	89,788,338
2004	12,138	12,138	-5.83%	167,167,806
2005	13,294	13,294	9.52%	236,824,765
2006	11,878	11,878	-10.65%	245,963,726
2007	14,570	14,570	22.66%	250,357,596
2008	16,108	16,108	10.56%	285,409,877
2009	13,683	13,683	-15.05%	299,957,860
2010	14,524	14,524	6.15%	318,175,787
2011	15,133	15,133	4.19%	310,047,042
2012	17,086	17,086	12.91%	311,451,507
2013	16,541	16,541	-3.19%	336,587,418
2014	19,878	19,878	20.17%	339,675,204
2015	22,398	22,398	12.68%	345,064,752
2016	23,375	23,375	4.36%	361,864,972
2017	25,091	25,091	7.34%	354,383,488
2018	27,242	27,242	8.57%	354,196,220
2019	27,057	27,057	-0.68%	369,056,938
Total/Average	327,575	327,575	5.68%	5,036,633,466
	Trend 7 year		7.68%	
	Trend - all year		4.78%	

4.86%



#### Source: ISO Size-of-Loss Matrix 2020

#### Measuring GU vs XS Trend – Excess Severity GL-Restaurants and Bars – 900k xs 100k



Trend = ~6.5%



#### Measuring GU vs XS Trend – Excess Frequency GL-Restaurants and Bars – 900k xs 100k





# Linking Trend and ILFs for Enhanced Estimates

# **Justin Ranney**



## **Introduction to Method**

#### **Bayesian** Approach:

- 1. Credibility of Subline or Company Data
- 2. Reflect Line of Business, Claim Counts, Policy Limits, Layers and Trending
- 3. Incorporate Industry Trend or Economic Data
- 4. Natural application to parameter uncertainty or sensitivity testing.



- 1. Traditional Trend Study
- 2. Simulation Engine
- 3. Set of Prior Trends and Weights



## **Trend Study vs. Benchmarks**



## **Benchmarks:** Severity = 7% from GL OL&T Frequency = -5.3% from GL OL&T

9.0%

8.6%

8.4%

7.0%

5.6%

6.0%

6.4%

-6.0%

-4.0%

## **Simulation Approach – Severity Illustration**

5.0%	sted (Prior):	erlying Trend Te	"True" Und		6.0%	Trend applied to Layer: 6.0%	
Mean 4	Mean 3	Mean 2	Mean 1	Limit	Attachment	Claim Counts	Year
863,838	86,384	21,596	4,319	755,657	83,962	100	1
907,029	90,703	22,676	4,535	800,997	89,000	110	2
952,381	95,238	23,810	4,762	849,057	94,340	120	3
1,000,000	100,000	25,000	5,000	900,000	100,000	130	4
10%	15%	30%	45%	Mean Wts:			
			e Window	by Year cross Experienc	erage Severity I nulated Trend a	Calculate Av Measure Sim	1.
				10		Repeat	3.



## Severity - \$1M xs 0

						Weak Prior - Based on Industry									
						80.00%									
						70.00%									
						60.00%									
						50.00%									
						40.00%									
						Prob									
						30.00%									
						20.00%									
Trend Model - GU Severity						10.00%									
Analysis	Severity	/ Trend				10.00%									
LOB	Restaur	ants & Bars				0.00% 🖆									
Policy Limits	1,000,00	00				2.009	6 3.00	% 4.00	% 5.00	0% 6.00	0% 7.00	0% 8.00% 9.00% 10.00% 11.00% 12.0			
Attachment Point	0										Severity	/ Trend			
Trend applied to Limit & Attachment	6.00%							-	Likelihood of	Observation	Posterior Tr	rend Weight ————————————————————————————————————			
Number of Years	9														
Claims x Year	13713; 1	.1755; 13332	2; 11281; 100	50; 10284; 99	17; 9762; 923	6									
Observed Trend	8.43%	,													
Tolerance	0.25%														
Average Prior	7.00%														
A Priori Trends	2.00%	3.00%	4.00%	5.00%	6.00%	7.00%	8.00%	9.00%	10.00%	11.00%	12.00%				
Prior Trend Weight	2.50%	5.00%	7.50%	12.50%	15.00%	15.00%	15.00%	12.50%	7.50%	5.00%	2.50%				
Likelihood of Observation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	13.80%	41.40%	4.20%	0.00%	0.00%				
Joint Probability	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.07%	5.18%	0.32%	0.00%	0.00%				
Posterior Trend Weight	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	27.38%	68.45%	4.17%	0.00%	0.00%				
Average Simulated Trend	2.56%	3.41%	4.30%	5.12%	5.99%	6.87%	7.74%	8.61%	9.49%	10.40%	11.26%				
5.00% Percentile	1.89%	2.69%	3.63%	4.41%	5.25%	6.18%	7.04%	7.86%	8.68%	9.66%	10.53%				
95.00% Percentile	3.23%	4.08%	5.00%	5.84%	6.72%	7.58%	8.58%	9.39%	10.29%	11.23%	12.07%				

12.00%

## Severity – Excess Layer

Tend Model (excess using Weak Prior)           Analysis         Severity Trend           LOB         Restaurants & Bars           Policy Limits         900,000           Attachment Point         100,000           Tend Applete to Katachment         5.00%           Jumax Yaar         9           Jumax Yaar         9.0000           Attachment Point         100,000           Tend Applete to Katachment         6.00%           Jumax Yaar         9.0000           Attachment Point         100,000           Tend Applete to Katachment         9.0000           Jumax Yaar         9.0000           Attachment Point         100,000           Tend Applete to Katachment         9.0000           Jumax Yaar         9.0000           Applete to Katachment         9.0000           Jumax Yaar         9.00000           Applete to Katachment         9.0000           Jumax Yaar         9.00000           Applete to Katachment         9.00000           Jumax Yaar         9.00000           Applete to Katachment         9.00000           Jumax Yaar         9.00000           Jumax Yaar         9.000000           Justice Model Boxerotin							30.00%					•					
Trend Model (excess using Weak Prior)           Analysis         Severity Trend           LOB         Restaurants & Bars           Policy Linitis         900,000           Attachment Point         100,000           Trend Model (excess using Weak Prior)         30,000           Attachment Point         100,000           Trend Source         9           Calimis x Year         818, 693; 722; 698; 662; 653; 562; 567; 583           Diserved Trend         6.44%           Torearder         0.25%           Average Prior         8.7%           Apriori Trends         3.77%           3.77%         5.50%           15.00%         15.00%           15.00%         15.00%           15.00%         25.00%           15.00%         15.00%           15.00%         15.00%           15.00%         15.00%         15.00%           15.00%         15.00%         15.00%         15.00%         15.00%           15.00%         15.00%         15.00%         15.00%         15.00%         15.00%         15.00%         15.00%         15.00%         12.00%         2.50%         2.50%         12.00%         2.50%         2.50%         12.00%																	
Trend Model (excess using Weak Prior)           Analysis         Severity Trend           LOB         Restaurants & Bars           Policy Limits         900,000           Attachment Point         100,000           Attachment Point         100,000           Trend applied to Limit & Attachment         600%           Number of Years         9           Claims X Year         818, 693; 722; 698, 662; 657; 583           Observed Trend         6.4%           Tolerance         0.25%           Average Prior         8.7%           A Prior Trend Weight         2.50%           Uble Hold of Observation         5.60%           10off United Trend         5.60%           10off Variants         100,000           Trend weight         2.50%           Vior Trend Weight         2.50%           10off Variants         100,00%           Second Trend         3.77%           A Prior Trend Weight         2.50%           10off Variants         100%           10off Variants         3.20%           2.60%         15.00%         15.00%         15.00%         15.00%           10off Variante         10.5%         5.20%         5.20%         5.20							25.00%										
Trend Model (excess using Weak Prior)         Severity Trend           Analysis         Severity Trend           L0B         Restaurants & Bars           Policy Limits         900,000           Attachment Point         100,000           Trend splied to Limit & Attachment         600%           Number of Vears         9           Claims Vear         818; 693, 722; 698, 662; 657; 583           Observed Trend         6.44%           Tolerance         0.25%           Average Prior         8.7%           A Prior Trend Weight         2.50%         5.60%         7.50%         5.00%         2.50%         15.00%         15.00%         15.00%         12.00%         32.06%         32.06%           Joint Probability         0.15%         0.57%         7.7%         8.77%         17.7%         17.7%         12.77%         13.7%           Joint Probability         0.15%         0.57%         1.62%         2.80%         1.50%         1.05%         8.20%         2.20%         1.20%         2.50%         1.20%         2.50%         1.20%         2.50%         1.20%         2.50%         1.20%         2.50%         1.20%         2.50%         1.20%         2.50%         1.20%         2.50%																	
Tend Model (excess using Weak Prior)           Analysis         Severity Trend           DIB         Restaurants & Bars           Policy Limits         900,000           Attachment Point         100,000           Attachment Point         100,000           Attachment Point         100,000           Severity Trend         5.00%           Valuebre of Years         9           Claims X Year         818,693,722,698,662,653,662,653,662,657,583           Observed Trend         6.44%           Tolerance         0.25%           Average Prior         8.77%           A Prior Trend Weight         2.50%           1010 Thrends         1.140%           1050%         12.50%           1060%         12.50%           1060%         12.50%           1060%         12.50%           1070%         12.77%           1070%         12.77%           1070%         12.50%           1080%         1.40%           1090%         2.50%           1001         10.55%           1001         10.55%           1001         10.55%           1001         10.5%         5.82%							20.00%			/							
Trend Model (excess using Weak Prior)           Analysis           Severity Trend           LOB         Restaurants & Bars           Policy Linits         900,000           Attachment Point         0,000           Trend applied to Limit & Attachment         6,00%           Severity Trend							pility										
Tend Model (excess using Weak Prior)           Tend Model (excess using Weak Prior)           LOB         Restaurants & Bars           Policy Limits         900,000							0 15.00%										
Trend Model (excess using Weak Prior)           Analysis         Severity Trend           LOB         Restaurants & Bars           Policy Limits         900,000           Attachment Point         100,000           Attachment Point         000,000           Attachment Point         6.00%           Number of Years         9           Claims x Year         818, 693, 722; 698, 662; 653; 662; 653; 662; 653; 667; 583           Observed Trend         6.44%           Tolerance         0.25%           Average Prior         8.77%           Apriori Trends         3.77%           Apriori Trend S         7.77%           Soo%         7.50%         5.20%           Disclevention         5.80%         11.00%         15.00%           Disclevention         8.77%         7.77%         8.77%         7.77%           Average Prior         8.77%         7.77%         8.77%         7.50%         5.00%         2.50%           Prior Trend Weight         2.50%         5.00%         7.50%         5.00%         2.60%         2.50%         5.00%         2.60%           Potier Trend Weight         0.75%         2.50%         15.00%         15.00%         15.00%<							<b>□</b> _		/								
Trend Model (excess using Weak Prior)           Calabysis         Severity Trend           LOB         Restaurants & Bars           Policy Limits         900,000           Attachment Point         100,000           Trend Applied to Limit & Attachment         6.00%           Number of Years         9           Claims x Year         818; 693; 722; 698; 662; 653; 662; 657; 583           Observed Trend         6.44%           Tolerance         0.25%           Average Prior         8.77%           A Priori Trend Weight         2.50%           101cy Diservation         5.00%         7.50%         5.00%         2.60%           Prior Trend Weight         2.50%         5.00%         7.50%         5.00%         2.50%           Likelihood of Observation         5.80%         11.40%         19.60%         15.00%         12.50%         7.50%         5.00%         2.50%           Average Prior         8.77%         0.77%         15.00%         15.00%         12.50%         7.50%         5.00%         2.60%         12.60%         5.00%         2.50%         1.20%           Joint Probability         0.75%         2.96%         7.64%         16.62%         2.13%         17.77% <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>10.00%</td> <td></td>							10.00%										
Trend Model (excess using Weak Prior)           Analysis         Severity Trend           LOB         Restaurants & Bars           Policy Limits         900,000           Attachment Point         100,000           Trend Applied to Limit & Attachment         6.00%           Number of Years         9           Claims X Year         818; 693; 722; 698; 662; 653; 662; 667; 583           Observed Trend         6.44%           Tolerance         0.25%           Average Prior         8.77%           A Priori Trend Weight         2.50%           2.50%         7.50%         15.00%           Prior Trend Weight         2.50%           11.10%         12.50%           3.77%         4.77%           3.77%         4.77%           3.77%         4.77%           3.77%         4.77%           3.77%         4.77%           3.77%         4.77%           3.77%         1.250%           4.20%         2.2.00%         12.50%         15.00%           101 robability         0.15%         0.57%         1.77%         1.77%         1.77%         1.77%           0.101 robability         0.15%         0.26%<								/									
Analysis       Severity Trend         LOB       Restaurants & Bars         Policy Limits       900,000         Attachment Point       100,000         Trend applied to Limit & Attachment       6.00%         Number of Years       9         Claims X Year       818; 693; 722; 698; 662; 653; 662; 667; 583         Observed Trend       6.44%         Tolerance       0.25%         Average Prior       8.77%         A Prior Trend Weight       2.50%         1.500%       15.00%       15.00%       15.00%       12.07%       13.77%         Prior Trend Weight       2.50%       5.00%       7.77%       17.77%       17.77%       12.77%       13.77%         Prior Trend Weight       2.50%       5.00%       12.50%       15.00%       15.00%       15.00%       5.20%       2.50%       5.00%       14.7%       3.20%       4.26%       3.42%       3.39%       1.88%       0.63%       0.26%       0.03%         Joint Probability       0.15%       0.57%       1.47%       3.20%       4.26%       3.42%       3.39%       1.88%       0.63%       0.26%       0.03%       0.16%         Joint Probability       0.15%       0.57%       1.47%	Trend Model (excess using Weak Prior)						5.00%	_									
LOB       Restaurants & Bars         Policy Limits       900,000         Attachment Point       00,000         Trend applied to Limit & Attachment       6.00%         Joins x Year       818; 693; 722; 698; 662; 653; 662; 653; 662; 657; 583         Observed Trend       6.44%         Tolerance       0.25%         Average Prior       8.77%         A.Priori Trend Weight       2.50%         1.10%       15.00%         1.10%       15.00%         1.10%       15.00%         1.10%       12.77%         1.10%       13.00%         1.10%       11.00%         1.10%       11.00%         1.10%       11.00%         1.10%       11.00%         1.10%       11.00%         1.10%       11.00%         1.10%       11.00%         1.10%       11.00%         1.10%       11.00%         1.10%       11.00%         1.10%       11.00%         1.10%       11.00%         1.10%       11.00%         1.10%       11.00%         1.10%       11.00%         1.10%       11.00%         1.10% <td>Analysis</td> <td>Severity</td> <td>Trend</td> <td></td> <td></td> <td></td> <td></td> <td>+</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>~</td>	Analysis	Severity	Trend					+									~
Policy Limits       900,000       2.00%	LOB	Restaura	ants & Bars				0.00%	-	E 00%		7.00%		0.00%	44	0084	12 00%	
Attachment Point       100,000         Trend applied to Limit & Attachment       6.00%         Number of Years       9         Claims x Year       818; 693; 722; 698; 662; 653; 662; 657; 583         Observed Trend       6.44%         Tolerance       0.25%         Average Prior       8.77%         A Priori Trend Weight       2.50%       5.00%       7.50%       12.50%       15.00%       15.00%       12.50%       7.50%       5.00%       2.50%         Prior Trend Weight       2.50%       5.00%       7.50%       12.50%       15.00%       15.00%       15.00%       15.00%       2.60%       2.60%       2.50%         Joint Probability       0.15%       0.57%       1.47%       3.20%       2.26%       2.213%       17.77%       17.61%       9.77%       0.13%       0.16%         Average Simulated Trend       5.29%       5.88%       6.20%       6.39%       6.77%       7.00%       7.27%       7.52%       7.77%       7.99%       6.63%       6.31%       6.31%       6.51%       6.39%       7.56%       5.87%       6.13%       6.31%       6.62%       6.85%       9.20%	Policy Limits	900,000					5.00%		5.00%		7.00%	Severity	Trend	11.	0070	15.00%	
Trend applied to Limit & Attachment       6.00%       Image: Comparison of the comparison	Attachment Point	100,000										,					
Number of Years       9         Claims x Year       818; 693; 722; 698; 662; 653; 662; 657; 583         Observed Trend       6.44%         Observed Trend       6.44%         Octoreance       8.77%         Average Prior       8.77%       6.77%       7.77%       8.77%       9.77%       10.77%       11.77%       12.77%       13.77%         Prior Trend Weight       2.50%       5.00%       7.50%       12.50%       15.00%       15.00%       8.40%       5.20%       1.20%         Joint Probability       0.15%       0.57%       1.47%       3.20%       4.26%       3.42%       3.39%       1.88%       0.63%       0.26%         Average Simulated Trend       5.29%       5.58%       5.82%       6.20%       6.39%       6.77%       7.77%       8.07%       7.27%       7.52%       7.77%       1.35%       0.16%         S.00% Percentile       5.29%       5.68%       5.82%       6.20%       6.39%       6.77%       7.00%       7.27%       7.52%       7.77%       7.99%       0.65%       0.65%       6.85%       9.20%         S.00% Percentile       4.29%       4.56%       4.73%       5.08%       5.35%       5.65%       5.87%       6.13%	Trend applied to Limit & Attachment	6.00%							-	Likelihood of C	Observation	Posterior Tr	end Weight —	Prior Trend W	eight		
Claims x Year       818; 693; 722; 698; 662; 653; 662; 653; 662; 653; 583         Observed Trend       6.44%         Dolserved Trend       0.25%         Average Prior       8.77%       4.77%       5.77%       6.77%       7.77%       8.77%       9.77%       10.77%       11.77%       13.77%         A Priori Trends       3.77%       4.77%       5.77%       6.77%       7.77%       8.77%       9.77%       10.77%       11.77%       13.77%         Prior Trend Weight       2.50%       5.00%       7.50%       15.00%       15.00%       15.00%       15.00%       8.40%       5.20%       1.20%         Joint Probability       0.15%       0.57%       1.47%       3.20%       4.26%       3.42%       3.39%       1.88%       0.63%       0.26%       0.03%         Average Simulated Trend       5.29%       5.58%       5.82%       6.20%       6.39%       6.77%       7.00%       7.27%       7.52%       7.77%       7.99%       5.05%       6.30%       6.39%       5.35%       5.65%       5.87%       6.13%       6.31%       6.62%       6.85%       9.20%         Average Simulated Trend       5.29%       5.58%       5.82%       6.20%       6.39%       5.75% <t< td=""><td>Number of Years</td><td>9</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td><td></td><td></td><td></td><td></td></t<>	Number of Years	9											1				
Observed Trend Tolerance       6.44% 0.25%         Average Prior A Apriori Trends       8.77% 3.77%       4.77%       5.77%       6.77%       7.77%       8.77%       11.77%       12.77%       13.77%         Prior Trend Weight       2.50%       5.00%       7.50%       15.00%       12.50%       7.50%       5.00%       2.50%         Likelihood of Observation       5.80%       11.40%       19.60%       25.60%       22.80%       22.60%       15.00%       8.40%       5.20%       1.20%         Joint Probability       0.15%       0.57%       1.47%       3.20%       4.26%       3.42%       3.39%       1.88%       0.63%       0.26%       0.03%         Average Simulated Trend       5.29%       5.58%       5.82%       6.20%       6.39%       6.77%       7.00%       7.27%       7.52%       7.77%       7.99%         5.00% Percentile       4.29%       4.56%       4.73%       5.08%       5.35%       5.65%       5.87%       6.13%       6.31%       6.62%       6.85%         95.00% Percentile       6.30%       6.51%       6.93%       7.54%       7.77%       8.04%       8.50%       8.57%       8.86%       9.20%	Claims x Year	818; 693;	; 722; 698; 66	52; 653; 662;	667; 583												
Tolerance       0.25%         Average Prior       8.77%         A.Yroin Trends       3.77%       4.77%       5.77%       6.77%       7.77%       8.77%       9.77%       10.77%       11.77%       12.77%       13.77%         Priori Trends       3.77%       4.77%       5.77%       6.77%       7.77%       8.77%       9.77%       10.77%       11.77%       12.77%       13.77%         Priori Trend Weight       2.50%       5.00%       7.50%       12.50%       15.00%       12.50%       15.00%       2.50%       5.00%       2.50%         Joint Probability       0.15%       0.57%       1.47%       3.20%       4.26%       3.42%       3.39%       1.88%       0.63%       0.26%       0.03%         Average Simulated Trend       5.29%       5.58%       5.82%       6.20%       6.39%       6.77%       7.00%       7.27%       7.52%       7.77%       7.99%         5.00% Percentile       4.29%       4.56%       4.73%       5.08%       5.35%       5.65%       5.87%       6.13%       6.31%       6.62%       6.85%         5.00% Percentile       6.30%       6.51%       7.54%       7.7%       8.04%       8.50%       8.57%       8.86%	Observed Trend	6.44%											100				
Average Prior       8.77%       8.77%       4.77%       5.77%       6.77%       7.77%       8.77%       9.77%       10.77%       11.77%       12.77%       13.77%         Prior Trends       3.77%       4.77%       5.77%       6.77%       7.77%       8.77%       9.77%       10.77%       11.77%       12.77%       13.77%         Prior Trend Weight       2.50%       5.00%       7.50%       15.00%       15.00%       15.00%       5.00%       2.50%         Joint Probability       0.15%       0.57%       1.47%       3.20%       4.26%       3.42%       3.39%       1.88%       0.63%       0.26%       0.03%         Average Simulated Trend       5.29%       5.58%       5.82%       6.20%       6.39%       6.77%       7.00%       7.27%       7.52%       7.77%       7.99%         5.00% Percentile       4.29%       4.56%       4.73%       5.08%       5.35%       5.65%       5.87%       6.13%       6.31%       6.62%       6.85%         95.00% Percentile       6.30%       6.51%       7.28%       7.54%       7.77%       8.04%       8.50%       8.57%       8.86%       9.20%	Tolerance	0.25%															
A Prior Trends       3.77%       4.77%       5.77%       6.77%       7.77%       8.77%       9.77%       10.77%       11.77%       12.77%       13.77%         A Prior Trend Weight       2.50%       5.00%       7.50%       12.50%       15.00%       15.00%       12.50%       5.00%       2.50%         Likelihood of Observation       5.80%       11.40%       19.60%       25.60%       28.40%       22.80%       22.60%       15.00%       1.20%         Joint Probability       0.15%       0.57%       1.47%       3.20%       4.26%       3.42%       3.39%       1.88%       0.63%       0.26%       0.03%         Posterior Trend Weight       0.75%       2.96%       7.64%       16.62%       22.13%       17.77%       17.61%       9.74%       3.27%       1.35%       0.16%         Average Simulated Trend       5.29%       5.88%       5.82%       6.20%       6.39%       6.77%       7.00%       7.27%       7.52%       7.77%       7.99%         5.00% Percentile       4.29%       4.56%       4.73%       5.08%       5.35%       5.65%       5.87%       6.13%       6.31%       6.62%       6.85%         95.00% Percentile       6.30%       6.51%       6.93%<	Average Prior	8.77%															
Prior Trend Weight       2.50%       5.00%       7.50%       12.50%       15.00%       12.50%       7.50%       5.00%       2.50%         Likelihood of Observation       5.80%       11.40%       19.60%       25.60%       28.40%       22.80%       22.60%       15.00%       5.20%       1.20%         Joint Probability       0.15%       0.57%       1.47%       3.20%       4.26%       3.42%       3.39%       1.88%       0.63%       0.26%       0.03%         Posterior Trend Weight       0.75%       2.96%       7.64%       16.62%       22.13%       17.77%       17.61%       9.74%       3.27%       1.35%       0.16%         Average Simulated Trend       5.29%       5.58%       5.82%       6.20%       6.39%       6.77%       7.00%       7.27%       7.52%       7.77%       7.99%         5.00% Percentile       4.29%       4.56%       4.73%       5.08%       5.35%       5.65%       5.87%       6.13%       6.62%       6.85%         95.00% Percentile       6.30%       6.51%       6.93%       7.28%       7.54%       7.77%       8.04%       8.50%       8.57%       8.86%       9.20%	A Priori Trends	3.77%	4.77%	5.77%	6.77%	7.77%	8.77%	9.77%	10.77%	11.77%	12.77%	13.77%					
Likelihood of Observation       5.80%       11.40%       19.60%       25.60%       28.40%       22.80%       22.60%       15.00%       8.40%       5.20%       1.20%         Joint Probability       0.15%       0.57%       1.47%       3.20%       4.26%       3.42%       3.39%       1.88%       0.63%       0.26%       0.03%         Posterior Trend Weight       0.75%       2.96%       7.64%       16.62%       22.13%       17.77%       17.61%       9.74%       3.27%       1.35%       0.16%         Average Simulated Trend       5.29%       5.58%       5.82%       6.20%       6.39%       6.77%       7.00%       7.27%       7.52%       7.77%       7.99%         5.00% Percentile       4.29%       4.56%       4.73%       5.08%       5.35%       5.65%       5.87%       6.13%       6.31%       6.62%       6.85%         95.00% Percentile       6.30%       6.51%       6.93%       7.28%       7.54%       7.77%       8.04%       8.50%       8.57%       8.86%       9.20%	Prior Trend Weight	2.50%	5.00%	7.50%	12.50%	15.00%	15.00%	15.00%	12.50%	7.50%	5.00%	2.50%					
Joint Probability       0.15%       0.57%       1.47%       3.20%       4.26%       3.42%       3.39%       1.88%       0.63%       0.26%       0.03%       0.03%         Posterior Trend Weight       0.75%       2.96%       7.64%       16.62%       22.13%       17.77%       17.61%       9.74%       3.27%       1.35%       0.16%         Average Simulated Trend       5.29%       5.58%       5.82%       6.20%       6.39%       6.77%       7.00%       7.27%       7.52%       7.77%       7.99%         5.00% Percentile       4.29%       4.56%       4.73%       5.08%       5.35%       5.65%       5.87%       6.13%       6.31%       6.62%       6.85%         95.00% Percentile       6.30%       6.51%       6.93%       7.28%       7.54%       7.77%       8.04%       8.50%       8.57%       8.86%       9.20%	Likelihood of Observation	5.80%	11.40%	19.60%	25.60%	28.40%	22.80%	22.60%	15.00%	8.40%	5.20%	1.20%					
Posterior Trend Weight       0.75%       2.96%       7.64%       16.62%       22.13%       17.77%       17.61%       9.74%       3.27%       1.35%       0.16%         Average Simulated Trend       5.29%       5.58%       5.82%       6.20%       6.39%       6.77%       7.00%       7.27%       7.52%       7.77%       7.99%         5.00% Percentile       4.29%       4.56%       4.73%       5.08%       5.35%       5.65%       5.87%       6.13%       6.31%       6.62%       6.85%         95.00% Percentile       6.30%       6.51%       6.93%       7.28%       7.54%       7.77%       8.04%       8.50%       8.57%       8.86%       9.20%	Joint Probability	0.15%	0.57%	1.47%	3.20%	4.26%	3.42%	3.39%	1.88%	0.63%	0.26%	0.03%					
Average Simulated Trend       5.29%       5.58%       5.82%       6.20%       6.39%       6.77%       7.00%       7.27%       7.52%       7.77%       7.99%         5.00% Percentile       4.29%       4.56%       4.73%       5.08%       5.35%       5.65%       5.87%       6.13%       6.31%       6.62%       6.85%         95.00% Percentile       6.30%       6.51%       6.93%       7.28%       7.54%       7.77%       8.04%       8.50%       8.57%       8.86%       9.20%	Posterior Trend Weight	0.75%	2.96%	7.64%	16.62%	22.13%	17.77%	17.61%	9.74%	3.27%	1.35%	0.16%					
5.00% Percentile       4.29%       4.56%       4.73%       5.08%       5.35%       5.65%       5.87%       6.13%       6.31%       6.62%       6.85%         95.00% Percentile       6.30%       6.51%       6.93%       7.28%       7.54%       7.77%       8.04%       8.50%       8.57%       8.86%       9.20%	Average Simulated Trend	5.29%	5.58%	5.82%	6.20%	6.39%	6.77%	7.00%	7.27%	7.52%	7.77%	7.99%					
95.00% Percentile         6.30%         6.51%         6.93%         7.28%         7.54%         7.77%         8.04%         8.50%         8.57%         8.86%         9.20%	5.00% Percentile	4.29%	4.56%	4.73%	5.08%	5.35%	5.65%	5.87%	6.13%	6.31%	6.62%	6.85%					
	95.00% Percentile	6.30%	6.51%	6.93%	7.28%	7.54%	7.77%	8.04%	8.50%	8.57%	8.86%	9.20%					

900 xs 100; Weak Prior

## Frequency – Excess Layer

							Excess Layer Frequency									
						Probability									35.00% 30.00% 25.00% 20.00% 15.00% 10.00%	
Trend Excess Freq															5.00%	
Analysis	Frequen	cy Trend					•									
LOB	0														00%	
Policy Limits	N/A					-7.00%		-6.00%	-	5.00%	-4.00%	-3.00%		-2.00%	-1.00%	
Attachment Point	100,000										Severity Tren	d				
Trend applied to Limit & Attachment	6.00%									d of Observation	- Posterior Tre	end Weight —— Prior T	rend Weight			
Number of Years	8															
<i>Expected</i> Claims x Year	484; 523	8; 528; 536; 5	562; 551; 551	L; 574												
Observed Trend	-3.96%											20				
Tolerance	0.25%															
Average Prior	-3.74%															
A Priori Trends	-6.24%	-5.74%	-5.24%	-4.74%	-4.24%	-3.74%	-3.24%	-2.74%	-2.24%	-1.74%	-1.24%					
Prior Trend Weight	2.50%	5.00%	7.50%	12.50%	15.00%	15.00%	15.00%	12.50%	7.50%	5.00%	2.50%					
Likelihood of Observation	0.00%	0.60%	3.20%	16.00%	31.80%	31.20%	16.00%	6.40%	1.00%	0.40%	0.00%					
Joint Probability	0.00%	0.03%	0.24%	2.00%	4.77%	4.68%	2.40%	0.80%	0.08%	0.02%	0.00%	(C)				
Posterior Trend Weight	0.00%	0.20%	1.60%	13.32%	31.77%	31.17%	15.98%	5.33%	0.50%	0.13%	0.00%					
Average Simulated Trend	-6.24%	-5.73%	-5.24%	-4.76%	-4.23%	-3.79%	-3.20%	-2.74%	-2.29%	-1.76%	-1.22%			276		
5.00% Percentile	-7.16%	-6.72%	-6.26%	-5.76%	-5.28%	-4.69%	-4.28%	-3.83%	-3.33%	-2.82%	-2.40%					
<i>95.00% Percentile</i>	-5.30%	-4.78%	-4.30%	-3.81%	-3.26%	-2.76%	-2.13%	-1.72%	-1.28%	-0.61%	-0.17%					

## **Severity & Frequency – Layering & Relationships**

Severity & Frequency Implications (Layer	ring)									
Trend applied to Mean Severity	8.77%									
Trend applied to Limit & Attachment	6.00%									
Policy Limits	900,000									
Attachment Point	100,000									
	Year									
Layer Severity	N	N-1	N-2	N-3	N-4	N-5	N-6	N-7	N-8	N-9
Mixed Exponential (Expected Val)	200,826	188,071	176,127	164,941	154,467	144,659	135,476	126,878	118,829	111,294
% YOY Change	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%	6.77%	6.77%	
	Year									
Layer Frequency	N	N-1	N-2	N-3	N-4	N-5	N-6	N-7	N-8	N-9
Mixed Exponential (% Exceeding Att)	0.064	0.063	0.061	0.060	0.058	0.057	0.056	0.054	0.053	0.052
Ground-Up Frequency (Relative)	0.572	0.609	0.648	0.689	0.733	0.780	0.830	0.883	0.940	1.000
Excess Frequency	0.037	0.038	0.040	0.041	0.043	0.044	0.046	0.048	0.050	0.052
% YOY Change	-3.78%	-3.76%	-3.75%	-3.74%	-3.72%	-3.71%	-3.70%	-3.68%	-3.67%	
Exponential Trend Fit	-3.74%									
Trend applied to Mean Severity	8.50%									
Trend applied to Limit & Attachment	6.00%									
Policy Limits	900,000									
Attachment Point	100,000									
	Year									
Layer Severity	N	N-1	N-2	N-3	N-4	N-5	N-6	N-7	N-8	N-9
Mixed Exponential	200,826	188,203	176,374	165,289	154,901	145,167	136,046	127,500	119,492	111,990
% YOY Change	6.71%	6.71%	6.71%	6.71%	6.71%	6.70%	6.70%	6.70%	6.70%	
	Year									
Layer Frequency	N	N-1	N-2	N-3	N-4	N-5	N-6	N-7	N-8	N-9
Mixed Exponential (% Exceeding Att)	0.064	0.063	0.061	0.060	0.059	0.058	0.056	0.055	0.054	0.053
Ground-Up Frequency (Relative)	0.572	0.609	0.648	0.689	0.733	0.780	0.830	0.883	0.940	1.000
Excess Frequency	0.037	0.038	0.040	0.041	0.043	0.045	0.047	0.049	0.051	0.053
% YOY Change	-3.99%	-3.98%	-3.97%	-3.96%	-3.95%	-3.94%	-3.93%	-3.92%	-3.91%	

-3.96%

## **Overall conclusions**

Despite different observed severity and frequency trends between Ground Up and Excess Layers, there is minimal evidence of differing severity trend for larger losses within this study.

Extremely important to understand the data to which trend estimates will be applied

				Implied Ground
			Cred-Wtd	Up Sev from
Analysis	Observed	Prior	Ground Up	Excess Freq
\$1M xs 0 Severity	8.4%	7.0%	8.8%	
\$1M xs 0 Frequency	-6.0%	-5.3%	-6.0%	
Excess Severity	6.4%	8.8%	8.4%	
Excess Frequency	-4.0%			8.5%



# Impact of COVID on 2020 Results

## Marni Novack



#### Sample Year-end 2020 COVID Triangle Data – Total General Liability

			Loss Year Lo	ss Month	3	6	9	12	15	18
# Incurred Claims (I+A)			2017	3	23,250	4,897	(699)	(669)	25	132
			2017	6	25,041	6,367	(1,382)	(323)	160	132
			2017	9	26,047	4,344	(634)	(131)	(5)	28
			2017	12	20.631	5.685	(446)	(228)	(151)	191
			2018	3	24.326	4.927	(1.024)	(441)	305	(149)
			2018	6	23 667	5 863	(912)	59	(236)	161
	1 2 mor		2010	0	23,007	6,039	(312)	(502)	106	52
	1-3 1103		2018	10	23,323	6,039	42	(302)	100	120
	70.076		2018	12	19,599	6,099	(715)	(179)	85	128
3-yr	/0,3/6		2019	3	22,800	4,565	(428)	(195)	/8	(230)
	69,165	Covid	2019	6	20,457	6,584	347	(150)	(263)	223
	71,753	Drop-off	2019	9	21,783	6,680	(419)	(594)	340	12
F	59,115	Act/Exp	2019	12	19,085	5,071	(1,076)	242	(89)	
Exp	23,459	0.742	2020	3	17,397	1,918	(79)	(109)		
	23,055	0.534	2020	6	12,317	4,042	(98)			
	23,918	0.713	2020	9	17,055	3,784				
Cum'l CvRR 0.669	19,705	0.688	2020	12	13,559					
				as Manth	2	6	0	12	15	10
		a man litera			9 700	4 202	3 090	2.510	1 701	1 022
•	Average incurred ind	ennity	2017	5	3,703	4,295	3,080	2,310	1,791	1,032
			2017	6	7,099	3,804	3,231	1,761	1,986	1,558
			2017	9	8,170	3,980	2,708	2,101	1,993	2,117
			2017	12	8,483	4,261	3,255	2,833	2,238	1,910
			2018	3	8,972	4,986	3,223	3,278	1,750	2,145
			2018	6	8,549	4,113	3,248	2,168	1,993	1,925
	1-3 mos		2018	9	8,674	4,517	2,658	2,183	1,996	1,864
	27.265		2018	12	9,520	3,885	3,734	2,458	2,034	2,014
3-yr	27,265		2019	3	9,584	4,946	3,248	2,671	2,128	2,268
	25,176	Covid	2019	6	8,928	4,455	2,844	2,843	2,156	1,888
	26,430	Drop-off	2019	9	9,586	4,068	2,765	2,541	1,787	2,176
- T	27,469	Act/Exp	2019	12	9,466	4,918	3,742	2,631	2,816	
Exp	9,088	1.111	2020	3	10,097	4,957	3,480	3,315		
-	8,392	1.148	2020	6	9,632	5,657	3,287			
	8,810	1.086	2020	9	9,566	5,582				
Cum'l CvRR 1.151	9,156	1.255	2020	12	11,492					
			Loss Year	Loss Month	3	6	9	12	15	18
	Farned Premium		2017	3	2 111 740 763	16 304 423	11 033 109	13 482 558	7 969 872	(12 034 118)
			2017	6	2,120,120,845	13,121,636	14,718,043	8,959,281	18,717,772	(7.321.495)
			2017	9	2,121,809,029	16,178,895	11,925,901	18.765.922	19,298,862	1.997.250
			2017	12	2,118,673,596	13,618,443	19,774,824	20,484,786	10,100,825	4,799,732
			2018		2,136,350,192	4,138,494	19.385.181	9.522.551	11.521.504	3,209,277
			2018	6	2,158,504,782	4 310 999	11 691 691	11,680,771	9 710 361	(15,754,766)
	1-3 mos		2018	9	2 184 500 770	15 651 674	12 075 185	10 867 339	16 624 927	4 909 363
	2 5 1105		2018	12	2,199,288,761	3.592.848	9.641.553	16.251.197	12.599.982	5,960,932
3.	vr 6.451.779.210	5	2019	3	2.203.688.261	(15.690.944)	19.004.466	14.976.240	10.997.868	2,201,755
5	6.491.502 502	- Covid	2019	5	2.212.876.875	13.796.493	15.415.262	12.690.835	3.201.996	2,655,118
	6.528.749 70	Dron-off	2019	9	2,222,439,902	24.579.496	12,415 484	2,385,786	3.046.932	(927,636)
	6.550.559 824	Act/Exp	2019	12	2,232,597,467	17,441,414	2,060,602	4,372,410	(2.685.364)	(527,030)
F.	xp 2.150.593.072	2 1.042	2020	3	2,241,561,553	(3,480,016)	(7,447,425)	(6,188,742)	(_,000,004)	
	2.163.834.167	7 1.008	2020	6	2,180,414,648	14.788.345	846.631	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
	2,176,249 900	0.987	2020	9	2,147,635,610	13,229,535	0.0,001			
Cumil Cupp 1 002	2,192,510,041	0.079	2020	12	2,124,422,100	10,220,000				

Illustrative

For Total General Liability, we are seeing decreases in 2020 for frequency, with increases in severity.

For Earned premium, we do not see very much of an impact in 2020 so far, but there are indications that the premium is coming down due to audits at later evaluations



Source: ISO Size-of-Loss Matrix Quarterly - 5/2021

#### Sample Year-end 2020 COVID Triangle Data – GL-Restaurants and Bars

# Incurred Claims (I+A)			Loss Year	Loss Month	3	6	9	12	2 15	18
			2017	3	2,942	(303)	(236)	(76	.) (17)	(8)
			2017	6	2 932	(112)	(213)	(89	(25)	6
			2017	0	2,552	(150)	(223)	(65	) (42)	(40)
		2017	10	2,634	(155)	(237)	(00	) (43)	(45)	
		2017	12	2,597	(185)	(230)	(60	) (60)	6	
			2018	3	2,773	(143)	(270)	(103	) 2	(20)
			2018	6	2,811	(96)	(271)	(103	) (50)	(34)
1-3 mos			2018	9	2,625	(59)	(207)	<mark>(80</mark>	) (36)	(3)
			2018	12	2,347	114	(264)	(40	) (62)	10
3-yr	8,273		2019	3	2,558	(105)	(138)	(107	) (20)	(41)
	8 389	Covid	2019	6	2 646	68	(253)	(66	(97)	(22)
	8 159	Dron off	2019	9	2,010	(100)	(172)	(215	(37)	(22)
	3,133		2015	10	2,700	(100)	(172)	(215		0
- [	7,428	Act/Exp	2019	12	2,484	(13)	(412)	(46	(16)	
Exp	2,758	0.836	2020	3	2,306	(487)	(117)	(42	)	
	2,796	0.295	2020	6	825	55	(77)			
	2,720	0.558	2020	9	1,518	19				
Cum'l CvRR 0.554	2,476	0.528	2020	12	1,307					
			Loss Vear	Loss Month	3	6	9	12	15	18
	demnity	2017	3	5 850	4 430	1 449	1 399	947	865	
	uennity	2017	5	5,606	2,990	2 /13	1,555	1 3 2 3	815	
		2017	· 0	5,000	2,550	2,413	1,104	1,525	1 705	
	2017	12	5 711	2,015	2,110	1,300	2 9 2 2	(225)		
			2017	12	5,711	3,545	2,700	1,738	2,552	(233)
			2018		6,571	3,217	1,402	1,920	1,552	1,000
1.2			2018		6,460	2,645	2,213	1,519	1 4 9 4	1,628
	1-5 mos		2018	9	0,760	3,800	2,742	2,552	1,484	1,621
2			2018	12	7,700	4,100	5,120	1,958	1,212	1,114
5-у	10 144	Cardal	2019	5	7,566	3,777	1,074	1,555	1,742	1,710
	19,144		2019	6	7,077	2,217	2,184	2,453	1,157	2,350
	19,011	Drop-on	2019	12	6,792	3,710	2,704	2,557	1,355	1,049
Eve	20,118	1.002	2019	12	7 294	3,214	3,734	2,341	2,471	
CX	6,070	1.092	2020	5	7,284	4,709	2,025	1,090		
	6,581	0.042	2020	0	5,576	3,344	2,430			
	0,557	0.966	2020	9	0,520	4,707				
Cum'I CVRR 1.025	6,706	1.189	2020	12	7,974					
				1. Sec. 1. Sec		/S				
			Loss Year	Loss Month	3	6	9	12	15	18
	Earned Premium		2017	3	96,712,291	(1,075,516)	688,506	391,737	243,965	122,477
			2017	6	92,139,960	767,621	296,824	295,323	447,888	64,007
			2017	9	91,235,199	585,442	287,148	435,050	376,166	190,191
			2017	12	91,014,627	574,563	472,407	445,220	284,296	55,917
			2018	3	90,488,729	747,782	587,585	345,120	563,454	165,769
			2018	6	91,455,477	500,027	246,734	621,314	643,083	(97,037)
	1-3 mos		2018	9	92,397,231	526,028	738,237	653,893	317,351	(51,240)
			2018	12	94,194,713	1,012,317	699,666	400,873	457,413	61,400
3-у	r 282,754,411		2019	3	95,553,390	463,873	378,006	391,152	578,784	(97,179)
	280,143,643	Covid	2019	6	96,548,206	755,931	329,976	667,207	(16,201)	(218,707)
	281,892,098	Drop-off	2019	9	98,259,668	120,659	98,060	(710,975)	(349,767)	(770,483)
	286,084,291	Act/Exp	2019	12	100,874,951	(292,974)	(1,212,214)	(1,400,163)	(2,080,784)	
Exp	94,251,470	1.061	2020	3	99,998,141	(2,328,613)	(644,185)	(1,071,921)		
	93,381,214	0.980	2020	6	91,531,298	(923,513)	(1,427,443)			
	93,964,033	0.932	2020	9	87,548,350	(464,990)				
	05 261 420	0 002	2020	12	95 125 027					

#### Illustrative

For Restaurants and Bars, we are seeing larger decreases in 2020 for frequency than for Total GL, with lower increases in severity.

For Earned premium, we are seeing a little bit of a drop in earned premium in Q2 and Q3 (10%) with some downward development that we have not seen in prior years.



Source: ISO Size-of-Loss Matrix Quarterly - 5/2021

#### Impact of Covid on 2020 Reported Losses - GL, CAu, CP, BOP Total Classes









SOLM AQRQ - Total Paid Indemnity- 12/31/2020 125.0% 100.0% Ratio 86.2% ention 75.0% Ret 50.0% Covid 25.0% 0.0% AQ: 2020 (Cum'I thru Q4) Total BOP Property (All No CAT Incl All Other) BOP Liability (All COL) GL (All COL) CAu (All COL) CP (All No CAT Incl All Other)

#### Illustrative

When taking the total across all class groups, the Property lines had a 3.9% Claims drop-off and a 3.2% Indemnity drop-off. The Casualty lines had a 36.6% Claims drop-off and a 25.7% Indemnity drop-off.

When taking the total across all class groups and all lines of business, we see that there has been a drop-off of 30.1% for Incurred Claims and 14.3% for Incurred Indemnity.



#### Impact of Covid on 2020 Reported Losses - GL, CP, BOP – Restaurants/Bars

Illustrative







For Restaurants and Bars, year-to-date, we can see that BOP **Property and CP** experienced an increase in Incurred Claims, while BOP Liability and GL experienced a dropoff in Incurred Claims.

For Incurred Indemnity, all four LOBs experienced a drop-off. However, the drop-offs for BOP Liability and GL were larger than the dropoffs for BOP Property and CP.



SOLM AQRQ - Restaurants & Bars - Incurred Indemnity-12/31/2020 100.0% 90.0% 75.3% 80.0% čat 70.0% 60.0% 50.0% 40.0% 30.0% 20.0% 10.0% 0.0% AQ: 2020 (Cum'lthru Q4) Total BOP Property (All No CAT Incl All Other) BOP Liability (All COL) GL (All COL) CP (All No CAT Incl All Other)





#### Impact of Covid on 2020 Reported Losses – GL Classes, Ground-up and XS 25k





#### SOLM AQRQ - GL - Incurred Indemnity - 25k - 12/31/2020



Restaurants and Bars

Emergency/Government Services Hospitals and Nursing Homes Retail

#### Illustrative

For all claim sizes thru 12/31/2020, # incurred claims and \$ incurred indemnity fell 33% and 23%, respectively. Entertainment and Recreation, Hotels and Motels, Restaurants and Bars, and Schools fell the most (about 50% in 2020). Food processing had an increase in \$ incurred.

Larger claim sizes ( $\geq 25K$ ), saw less of a decline than total claims (20% and 17% respectively for incurred claims and indemnity). The same 4 class groups saw the biggest drop-off, with food processing being the outlier.



150.0%





#### Source: ISO Size-of-Loss Matrix Quarterly - 5/2021

#### **COVID Impacts on 2020 Overall Loss Levels and 2021 Projections**

- Pricing and reserving actuaries rely heavily on a consistent set of historical experience and statistics to project the future. The **distorting impact of COVID** is causing generally major reduced 2020 loss levels, with some cases of increased loss activity. These varying impacts are expected to continue into 2021.
- Wide-spread impacts will be seen not only on reported and settled development and trend patterns, but also on size-of-loss distributions and profit levels by cause of loss, market and shelter jurisdiction. To include 2020 experience in 2021 projections, proper adjustments will require robust benchmarking statistics, and increasingly sophisticated modeling approaches.
- With extensive vaccine availability, and economic activity resuming under various recovery shapes in 2021, GL and other insurance losses are projected to snap (or ooze) back to prior expected levels, with perhaps heightened loss levels in various classes as demand for services increases.
- Like with the Great Recession, the impacts and return towards normalcy may take many quarters if not years to assess, even with the best of data. Relying on unadjusted 2020 loss levels, will quite likely result in significantly underestimated 2021 and subsequent loss levels.



# **QUESTIONS & COMMENTS**

