Ratemaking, Product and Modeling

Virtual Seminar

July 28–29, 2020 • Online Event

Casualty Large Loss Trend

David Clark, Munich Re

Peter Magliaro, Zurich North America

Timothy McCarthy, ISO/Verisk

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.

Estimating Casualty Large Loss Trend

David R. Clark, FCAS

Munich Re America Services, Inc. – July 2020

Munich RE

Agenda

Munich RE

1. Business Question: What severity inflation should we apply to large losses?
2. A Thought Experiment and Related Statistical Model
   - Fitting to sample of large losses
   - The Pareto Problem
3. Conclusions

Business Question: Why are we doing this?

Munich RE

Business Context:

Focus on Excess/Umbrella or Nonproportional Reinsurance pricing

We are provided with a sample of large losses, but generally not all first dollar losses [i.e., “left truncated data”]

- For example: list of all losses greater than $500,000

What severity trend should be applied to large losses?
Is it different than the severity trend applied to small or total losses?

Modeling: What Loss Data to Use?

Munich RE®

Comparison of Sources:

	Insurance Losses	Verdict Data
Problems	• Highly Skewed • Truncation and Censoring (including unknown SIRs) • Loss Development • Only includes claims reported to the insurer (no public industry numbers)	• Highly Skewed • Mix of insured & non-insured events • Missing final awards after appeals • Missing many settlements • Count of cases is difficult (class actions versus MDL) • Missing defense costs
Advantages	• Matches what we are actually covering	• Full "from ground-up" amounts • "Headline" amounts are very influential to anchor future awards (even when amount is not final)

Modeling: A Thought Experiment

Suppose we know the “true” size-of-loss distribution.
It is the same shape each year, but with a constant inflation that changes the scale from one year to the next.

If we simulate losses from these distributions as our “submission data”, can we estimate the inflation rate used in the simulation?

$$F_j(x|x > T) = 1 - \left(\frac{B_j + T}{B_j + x}\right)^Q$$

Modeling: A Thought Experiment

Munich RE

We consider a model with a trend on the scale parameter "B"

Note that we do <u>not</u> want to estimate trend from the excess loss amounts.

Excess Loss Above Fixed Threshold

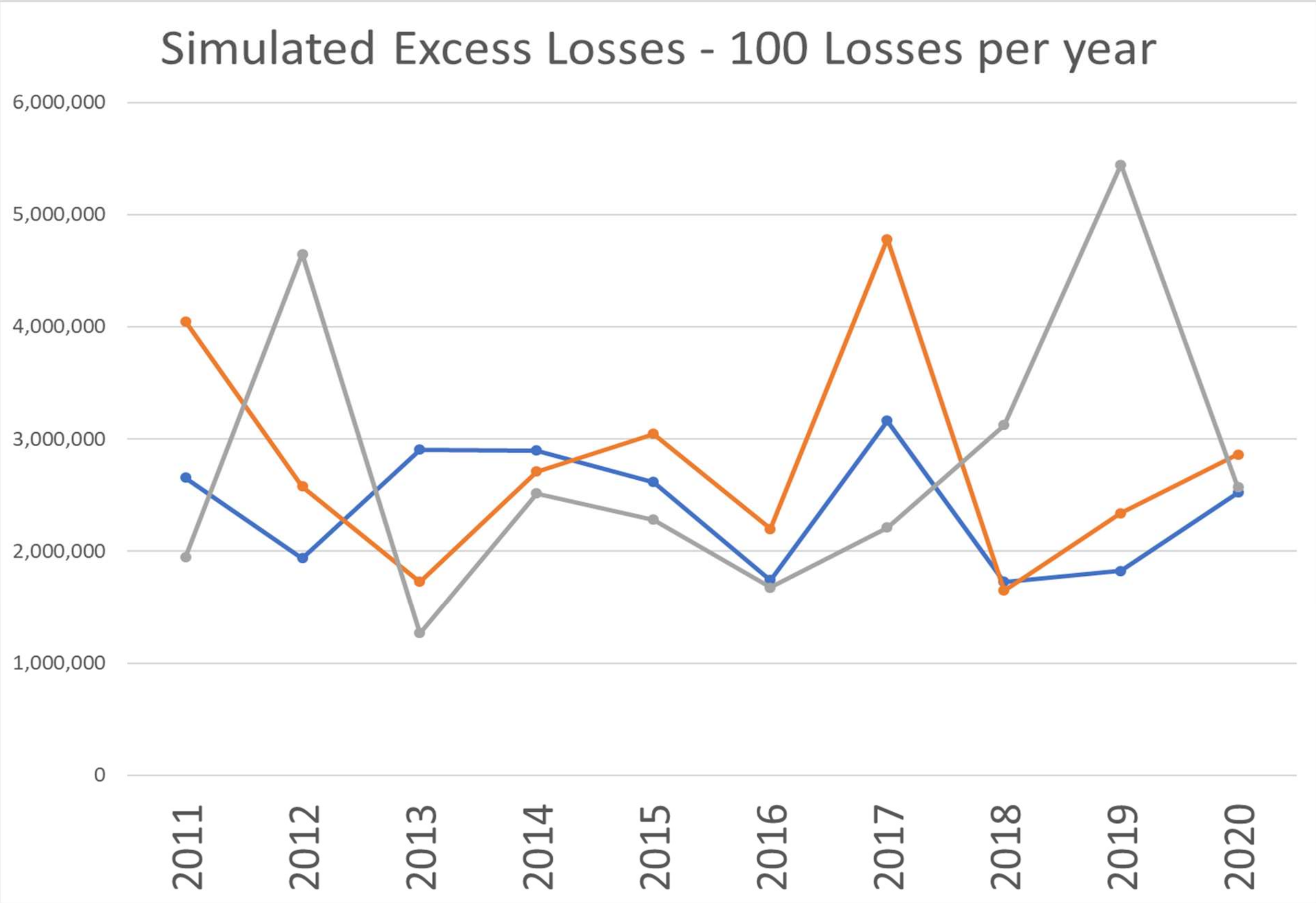
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
"True" Trend		**6.00%**	**6.00%**	**6.00%**	**6.00%**	**6.00%**	**6.00%**	**6.00%**	**6.00%**	**6.00%**
Q	1.300	1.300	1.300	1.300	1.300	1.300	1.300	1.300	1.300	1.300
B	100,000	106,000	112,360	119,102	126,248	133,823	141,852	150,363	159,385	168,948
Threshold T	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
E[X | x>T]	4,666,667	4,686,667	4,707,867	4,730,339	4,754,159	4,779,409	4,806,173	4,834,543	4,864,616	4,896,493
E[X-T | x>T]	3,666,667	3,686,667	3,707,867	3,730,339	3,754,159	3,779,409	3,806,173	3,834,543	3,864,616	3,896,493
Excess Trend		**0.55%**	**0.58%**	**0.61%**	**0.64%**	**0.67%**	**0.71%**	**0.75%**	**0.78%**	**0.82%**

$$E[\,X-T \mid x>T\,] = (B+T)/(Q-1)$$

Numbers for illustration only

Modeling: A Thought Experiment

Munich RE



Displaying results of the average annual excess losses gives an idea of the volatility.

The “true” inflation of 6% per year is not directly observable.

[Note: all losses are “uncapped”]

Modeling: A Thought Experiment

Munich RE

Maximum likelihood estimation (MLE) can be used to estimate the model parameters.

$$F_j(x_{i,j} | x_{i,j} > T) = 1 - \left(\frac{B_j + T}{B_j + x_{i,j}}\right)^Q$$

$$B_j = B \cdot (1 + trend)^j$$

$$Loglikelihood = \sum ln\left(f\left(x_{i,j} \mid B, Q, trend\right)\right)$$

Can expand to include:

- Censoring at policy limits
- Different trends by block of years (if trend changes)
- Alternative distributions forms (e.g. lognormal)

Modeling: A Thought Experiment

From a simulated sample of losses, we can estimate the parameters B, Q and the annual trend via maximum likelihood.

More importantly, we can estimate the error around our estimated trend.

Threshold	1,000,000
B	75,000
Q	1.3
Trend	6.00%

Number of Years	Number of Losses per Year: 10	50	100	1,000
5	208.89%	93.42%	66.06%	20.89%
10	66.16%	29.59%	20.92%	6.62%
15	33.22%	14.86%	10.51%	3.32%
20	20.09%	8.99%	6.35%	2.01%
25	13.40%	5.99%	4.24%	1.34%

Threshold	1,000,000
B	750,000
Q	1.3
Trend	6.00%

Number of Years	Number of Losses per Year: 10	50	100	1,000
5	36.01%	16.10%	11.39%	3.60%
10	11.82%	5.29%	3.74%	1.18%
15	6.12%	2.74%	1.93%	0.61%
20	3.81%	1.71%	1.21%	0.38%
25	2.63%	1.18%	0.83%	0.26%

Modeling: A Thought Experiment

Munich RE

The big difficulty is that as the B parameter becomes small relative to the threshold, the variance around our trend estimate increases greatly.

B=0 implies a single parameter Pareto, where trend cannot be estimated at all.

Threshold	1,000,000
B	10,000
Q	1.3
Trend	6.00%

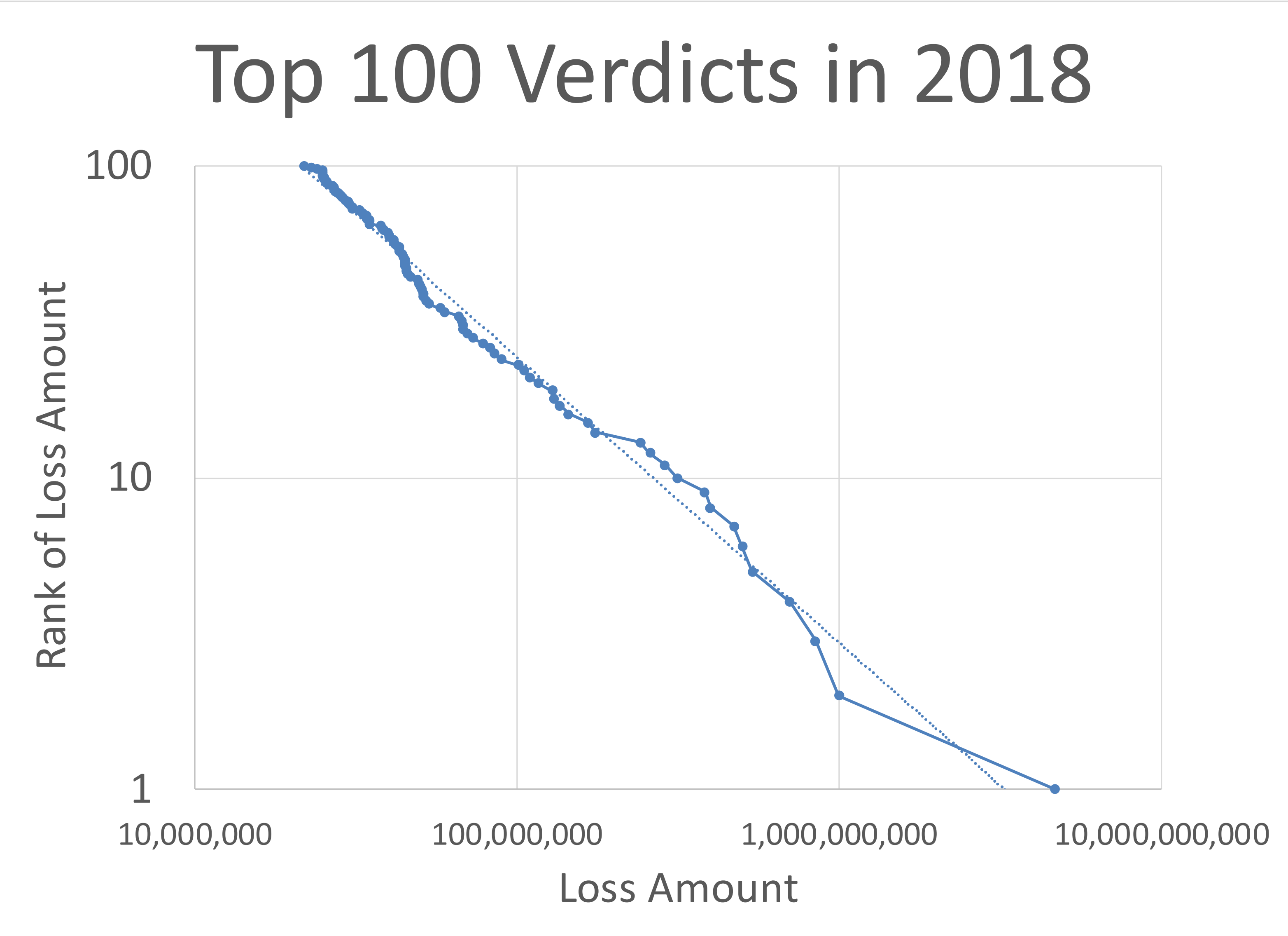
Number of Years	Number of Losses per Year: 10	50	100	1,000
5	1457.92%	652.00%	461.03%	145.79%
10	459.10%	205.32%	145.18%	45.91%
15	229.40%	102.59%	72.54%	22.94%
20	137.88%	61.66%	43.60%	13.79%
25	91.06%	40.72%	28.79%	9.11%

Threshold	1,000,000
B	100
Q	1.3
Trend	6.00%

Number of Years	Number of Losses per Year: 10	50	100	1,000
5	##########	64460.01%	45580.11%	14413.70%
10	45347.09%	20279.84%	14340.01%	4534.71%
15	22640.00%	10124.91%	7159.40%	2264.00%
20	13592.50%	6078.75%	4298.33%	1359.25%
25	8960.55%	4007.28%	2833.58%	896.06%

Modeling: The Pareto Problem

Munich RE



A test for the single parameter Pareto (SPP) is a log-log graph.

If this is approximately linear, then a SPP curve is indicated.

The slope of the line is the shape parameter Q.

But there is no scale parameter.

Source: National Law Journal
https://images.law.com/media/nationallawjournal/supplements/TVS_NLJ_2018/mobile/index.html

Modeling: The Pareto Problem

- The Pareto distribution (named for economist Vilfredo Pareto) was originally used for modeling wealth distribution. “Scale invariant” for all currencies.

- The single Parameter Pareto (SPP) is sometimes described as following a “power law” and works well for highly skewed phenomena.

- Brazauskas, et al describe how it creates difficulty in estimating trend.
  - They show that we can estimate trend BUT ONLY if we have a reliable exposure base and frequency is constant.

Modeling: What Data is Available?

Munich RE

- If we have 100% of ground-up losses:
  - Look at trend at each quantile
  - Fit parametric size-of-loss curve and see if “shape” changes

- If we have an exposure base, and count development:
  - Find trend that makes excess frequency “flat”
  - Fit parametric size-of-loss and frequency simultaneously

- If we only have collection of large losses:
  - Check first if losses are distributed as SPP
  - Fit parametric size-of-loss curve, with change to scale parameter

Conclusions

Munich RE

- If you only have a collection of large losses, you cannot estimate large loss trend by calculating the change in average loss by year.
  - *Well, you can – and many people do – but you do not get the right answer!*
  - *For a fixed threshold, this will generally understate the result.*

- Statistical models can help us estimate trend

- Statistical models can also help us measure the variance around our estimators

  [*avoid being "fooled by randomness" of highly skewed data*]

Thank you!

Selected References

Munich RE

Michael Fackler
"Inflation and Excess Insurance" (2011)
http://www.actuaries.org/ASTIN/Colloquia/Madrid/Papers/Fackler.pdf
See also chapter 6 of his PhD dissertation:
http://oops.uni-oldenburg.de/3227/

Vytaras Brazauskas, Bruce L. Jones and Ricardas Zitikis
"When Inflation Causes No Increase in Claim Amounts" (2009)
https://www.researchgate.net/publication/26843551_When_Inflation_Causes_No_Increase_in_Claim_Amounts

Vytaras Brazauskas, Bruce L. Jones and Ricardas Zitikis
"Trends in Disguise " (2015)
https://www.researchgate.net/publication/272247272_Trends_in_Disguise

Other discussions of the "Power Law"
https://www.statisticshowto.datasciencecentral.com/power-law/

Selected References

Munich RE

Stephen Philbrick
"A Practical Guide to Single Parameter Pareto Distribution" (PCAS 1985)
https://www.casact.org/pubs/proceed/proceed85/85044.pdf
[see section v. "Effect of Trend"]

Kurt Reichle and John Yonkunas
"Discussion of: A Practical Guide to Single Parameter Pareto Distribution" (PCAS 1985)
https://www.casact.org/pubs/proceed/proceed85/85085.pdf
They validate the conclusions on trend from Philbrick:
"Data we have examined support the conclusion that trend does not affect excess severity."

Stuart A. Klugman, Harry H. Panjer and Gordon E. Willmot
Loss Models: From Data to Decisions
[especially chapter on Frequency and Severity with Coverage Modifications]

ZURICH

Large Loss Trend
Excess Casualty Focus

2020 RPM - July 28-29th

Peter Magliaro, FCAS, MAAA
Technical Underwriting

Zurich North America

Agenda

ZURICH

- Inspiration
- What's been happening in the economy?
- What is a typical large loss?
- Play with some large numbers
- Back to actuarial considerations
- Today's new normal …

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 advise. 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 public 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 policy.

From CLRS 2016, *Trend in Excess Layers*, V. Amstislavskiy

ZURICH

Presentation Synopsis

- Main observation (slide 2): *Over the last 15 years, the observed Severity trend in the Excess Layers was less than "Primary" trend.*
- Loss Trend is not Uniform for all size of losses
- Open Claim Loss Development helps preserve the variance of the claims distribution
- Compare hypothetical trended distribution to actual loss experience at various layer losses, exceedance probabilities, etc…

- BUT, it is his final thought I would like to explore in more detail

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

ZURICH

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).

What's a lot of money?

Annual Income	Annual Yield (Net of Cost)					
Lot of Money	0.50%	1.00%	2.00%	3.00%	4.00%	5.00%
1,000,000	5,000	10,000	20,000	30,000	40,000	50,000
5,000,000	25,000	50,000	100,000	150,000	200,000	250,000
10,000,000	50,000	100,000	200,000	300,000	400,000	500,000
20,000,000	100,000	200,000	400,000	600,000	800,000	1,000,000
50,000,000	250,000	500,000	1,000,000	1,500,000	2,000,000	2,500,000
100,000,000	500,000	1,000,000	2,000,000	3,000,000	4,000,000	5,000,000

10-Year Treasury	1.69%	on 2/4/20
10-Year Treasury	0.65%	on 5/29/20
S&P 500 Yield	2.00%	

What’s a lot of money?

ZURICH

Annual Income	Annual Yield (Net of Cost)					
Lot of Money	0.50%	1.00%	2.00%	3.00%	4.00%	5.00%
1,000,000	5,000	10,000	20,000	30,000	40,000	50,000
5,000,000	25,000	50,000	100,000	150,000	200,000	250,000
10,000,000	50,000	100,000	200,000	300,000	400,000	500,000
20,000,000	100,000	200,000	400,000	600,000	800,000	1,000,000
50,000,000	250,000	500,000	1,000,000	1,500,000	2,000,000	2,500,000
100,000,000	500,000	1,000,000	2,000,000	3,000,000	4,000,000	5,000,000

10-Year Treasury	1.69%	on 2/4/20
10-Year Treasury	0.65%	on 5/29/20
S&P 500 Yield	2.00%	

Social Network (2010)
Aaron Sorkin

Jesse Eisenberg as
Mark Zuckerberg
(Facebook)

Justin Timberlake as
Sean Parker (Napster)

What's a lot of money?

Audience Poll – Raise of Hands

1. ***1,000,000 – 5,000,000***
2. ***5,000,000 – 10,000,000***
3. ***10,000,000 – 20,000,000***
4. ***20,000,000 – 50,000,000***
5. ***50,000,000 – 100,000,000***

Financial Indicators

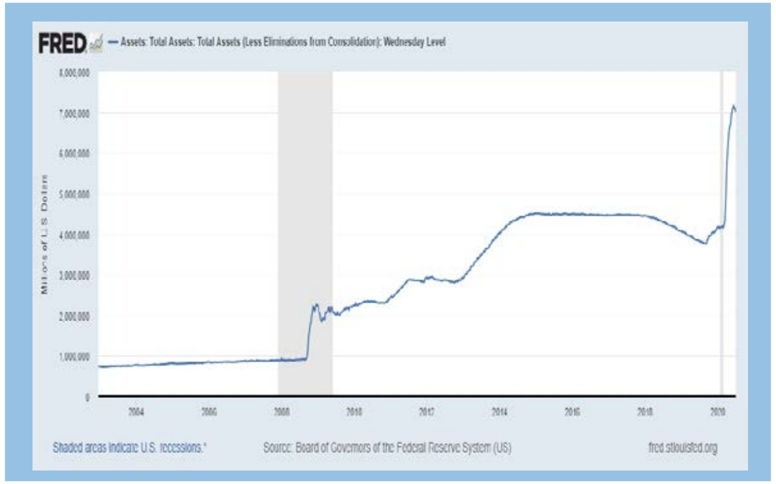
Pulled on 07/03/2020

Comments

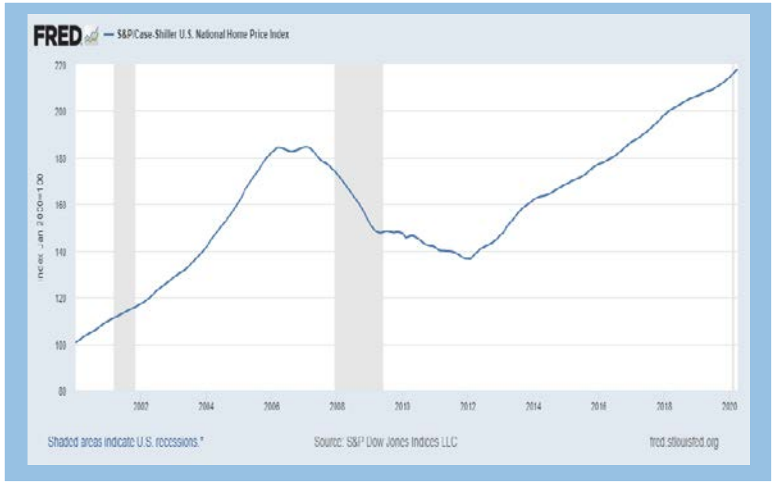
- Asset Bubble / Inflation?
  - US Stock market – all time highs
  - Negative Yielding Debt outside the US
- Gold
  - Alternate Currency
  - Inflation Hedge
- Central Bank Influence?

10 Year Treasury Rate

Federal Reserve Assets



S&P/Case – Shiller Housing Price Index



S&P 500

Gold Price (1 oz)

Source: FRED, Macrotrends.net - https://www.macrotrends.net/

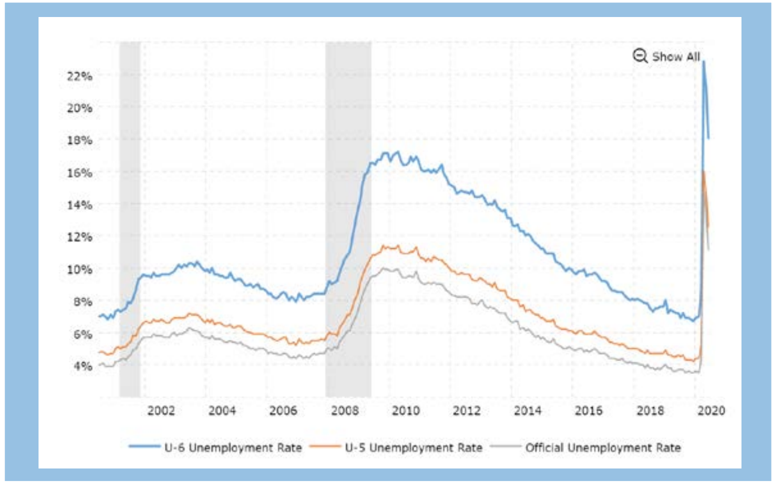
Economic Indicators

Pulled on 07/03/2020

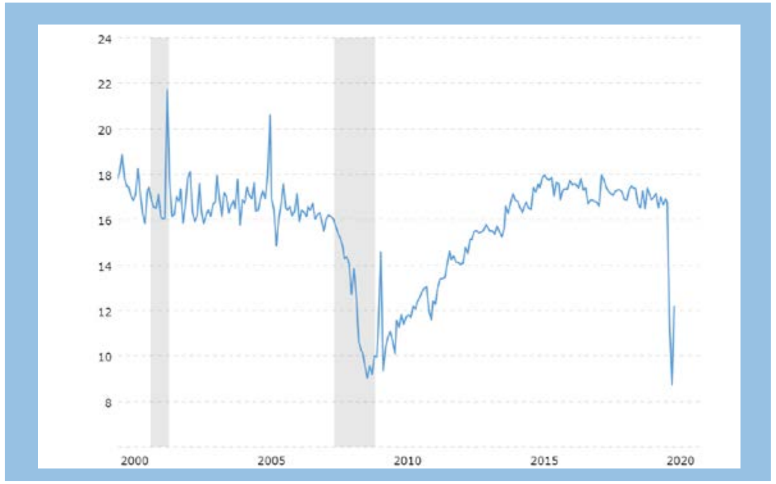
Comments

- “Exposure trend”
- Low inflation
  - Energy Costs
- Miles Driven – 2020 YTD at levels last seen in 2001

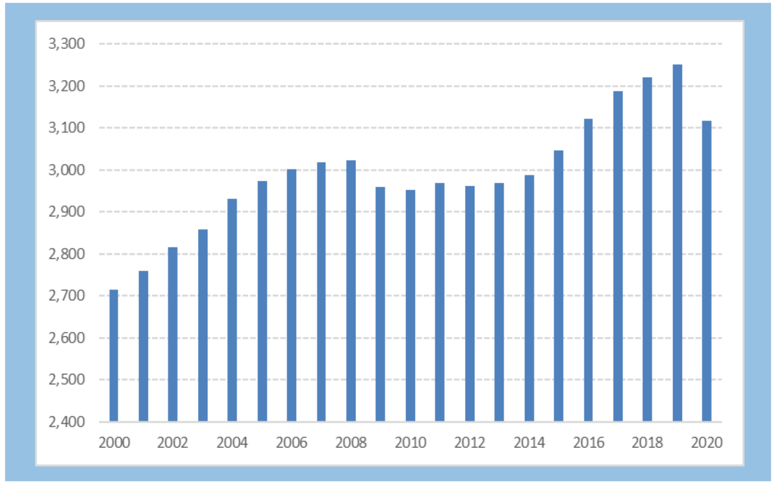
Unemployment Rate



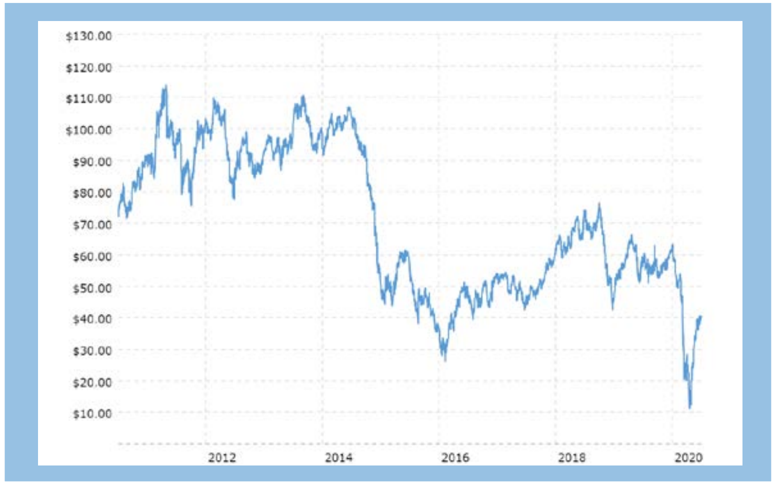
Auto & Light Truck Sales



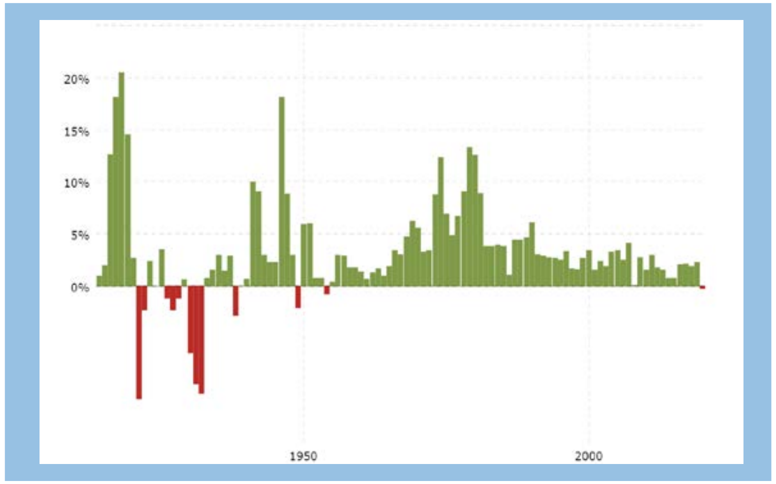
Miles Driven (B) – 12M MA Apr



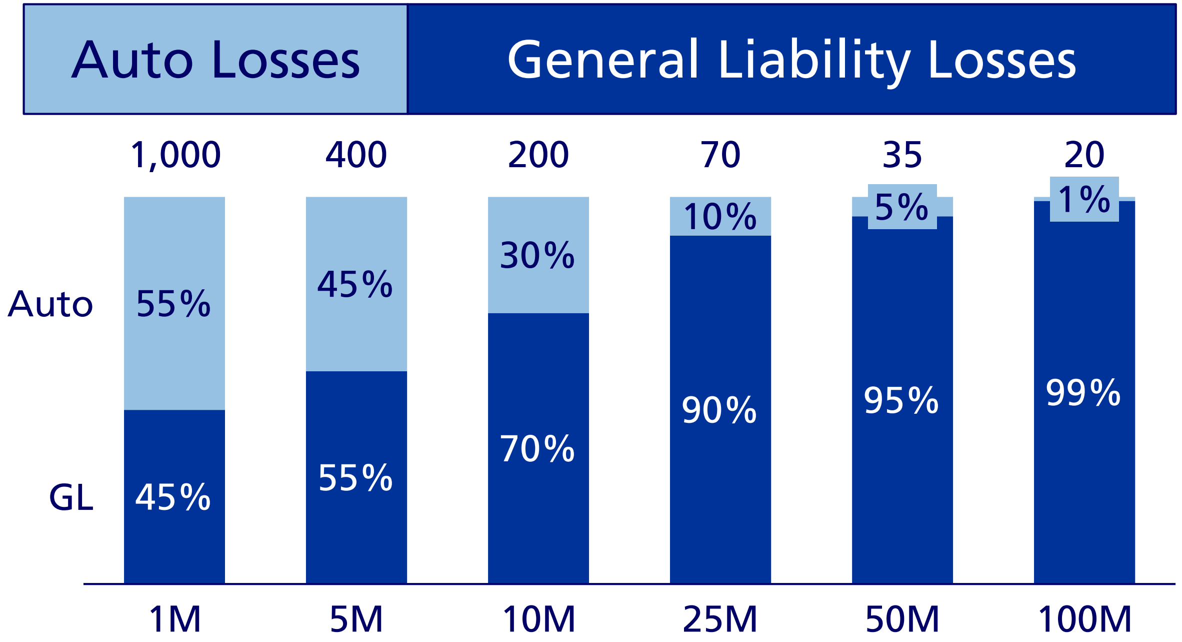
Crude Oil (per barrel)



Historical Inflation Rate (100 Years)



What is a typical large loss in Excess Casualty?



For Excess Casualty (Umbrella and Follow Form Umbrella policies), the similarity of losses covered decreases as you increase the insured loss amount

What are common traits of large losses: policy forms, covered losses (BI / PD), claims adjusters, lawyers, jurors …

Houston Explosion 1/24/2020

- 2 people killed
- 18 people went to the hospital
- 214 houses damaged (50 destroyed)

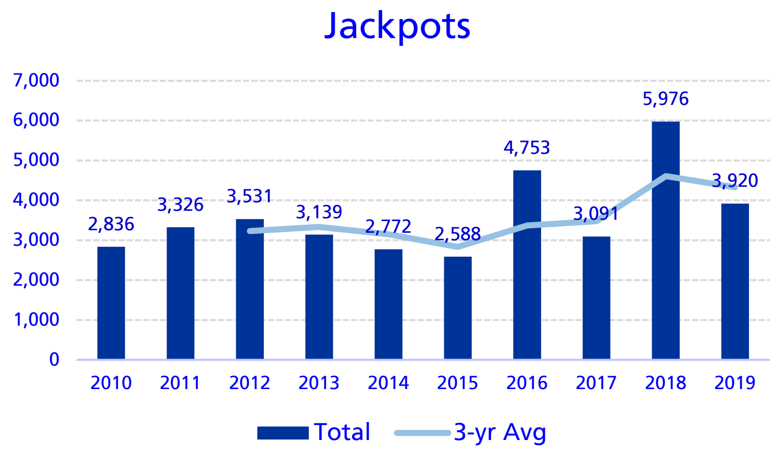
https://www.cnn.com/2020/01/24/us/texas-houston-explosion/index.html

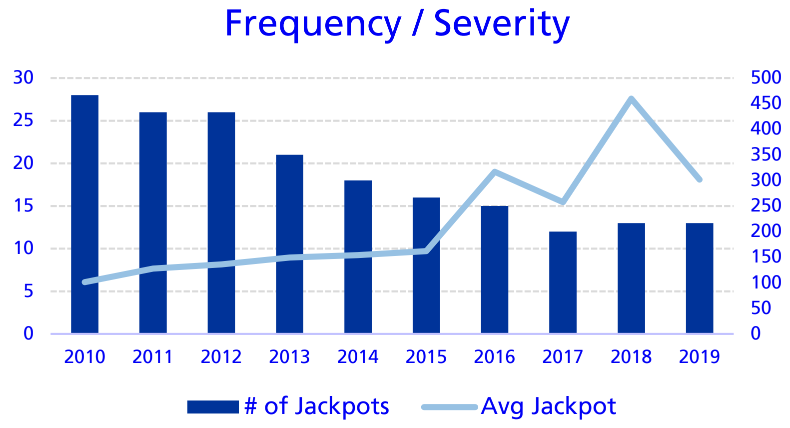
- Watson Grinding & Manufacturing

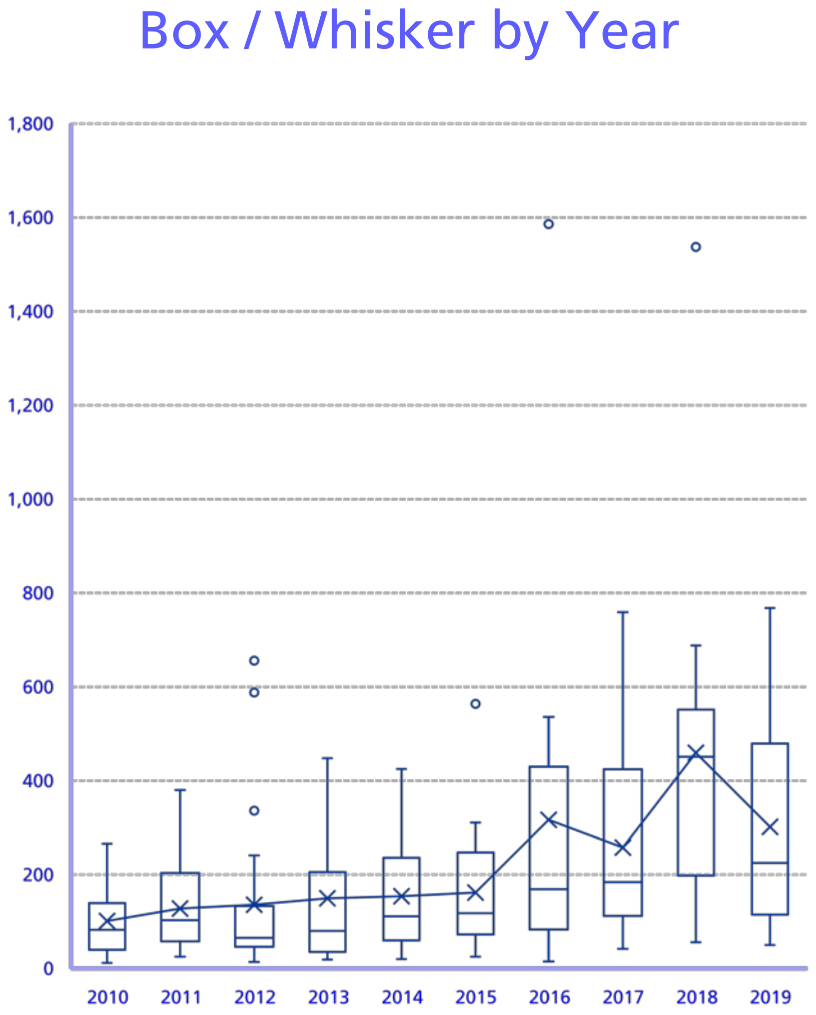
Loss mix / distribution is entirely for illustrative purposes

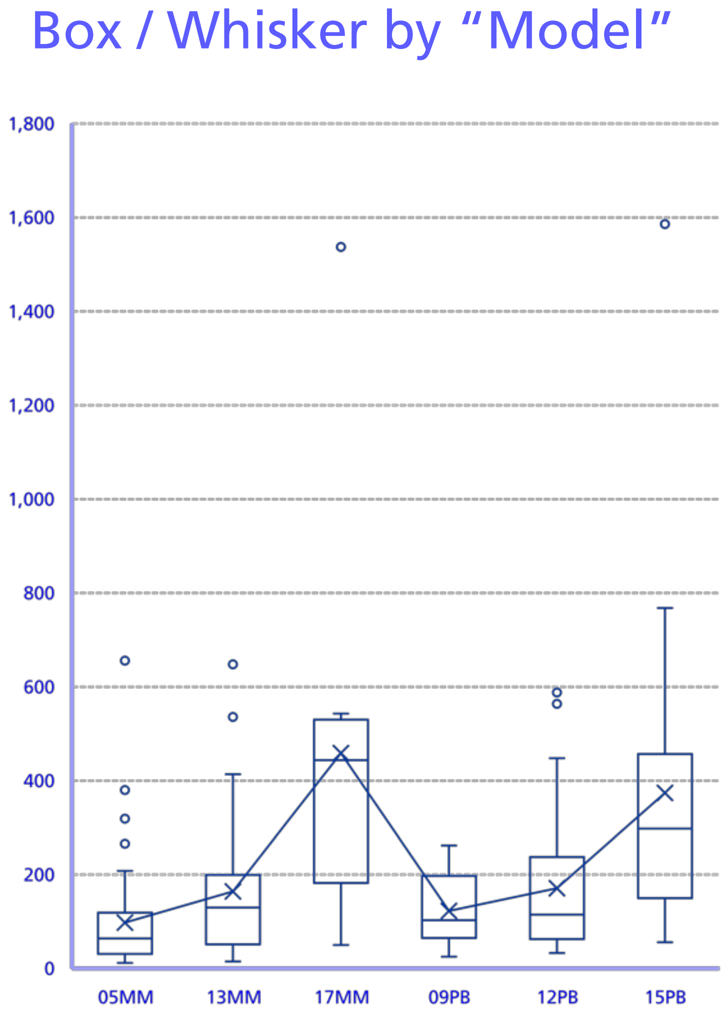
Large Losses are sad … so lets talk about the lottery

Mega Millions and Power Ball





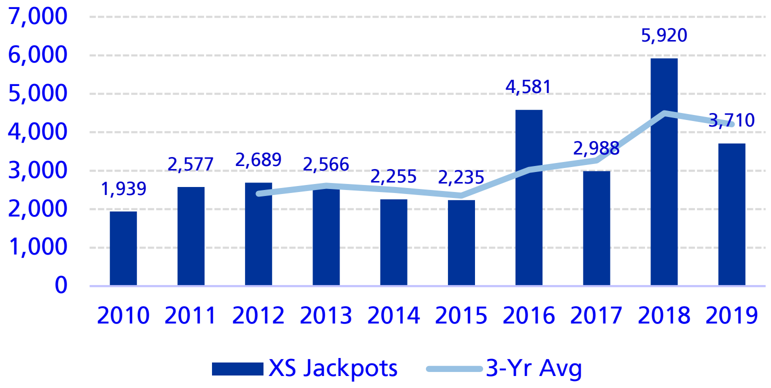




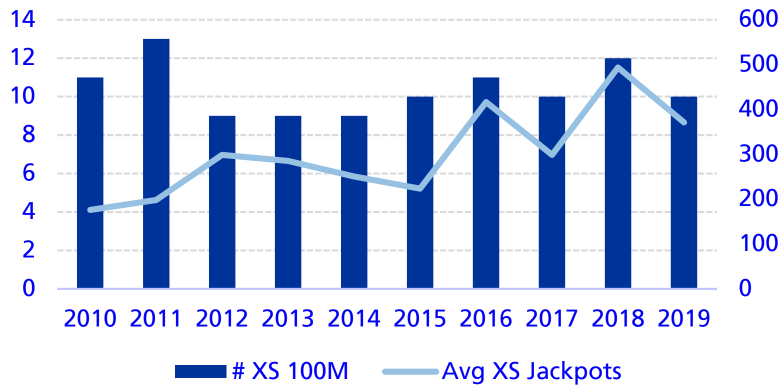
What if we focus on Jackpots in Excess of 100M?

ZURICH

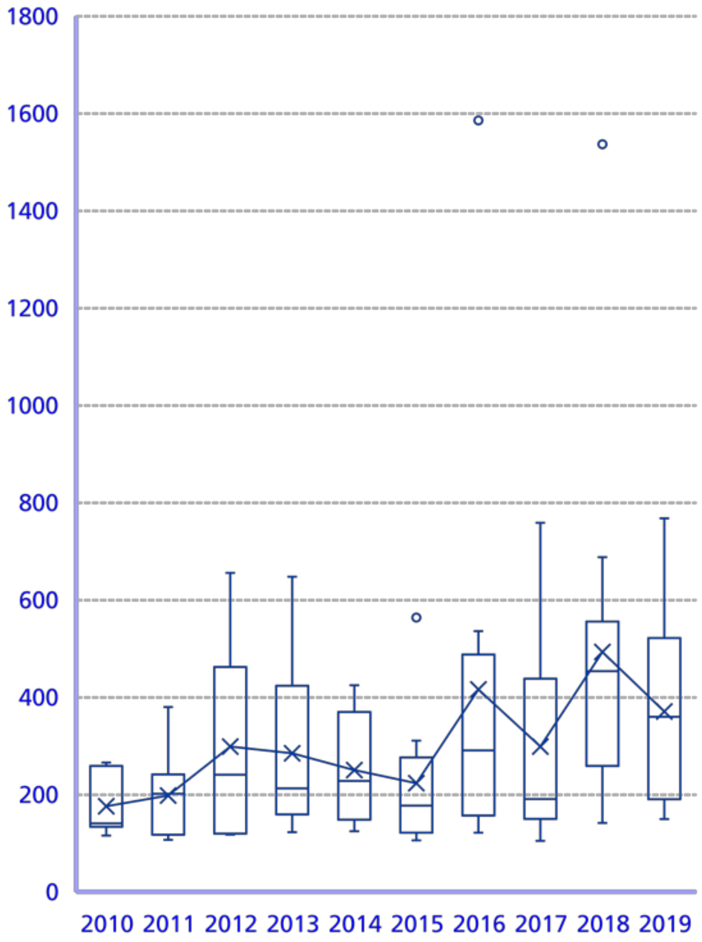
Total XS Jackpots



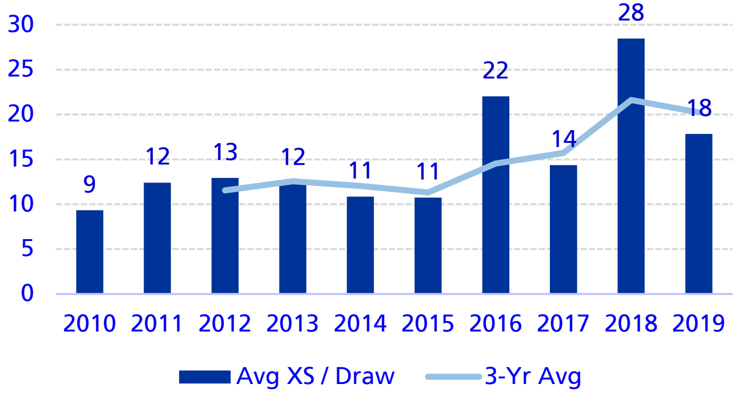
XS Frequency / Severity



Box / Whisker by Year

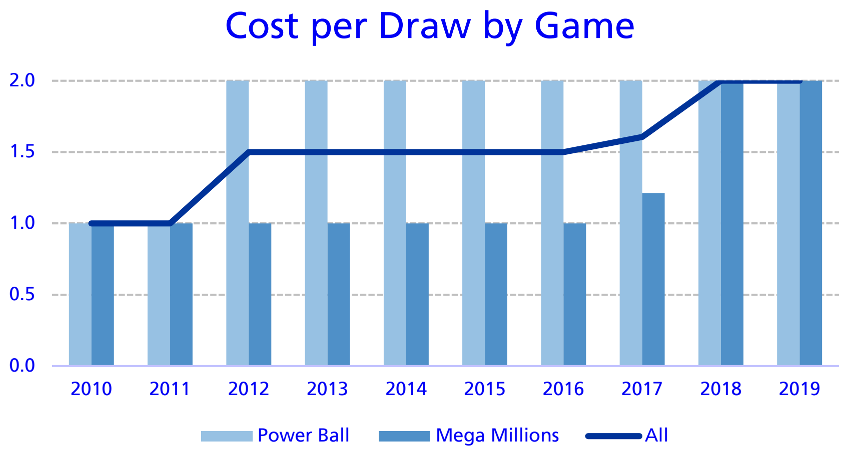


XS Pure Premium



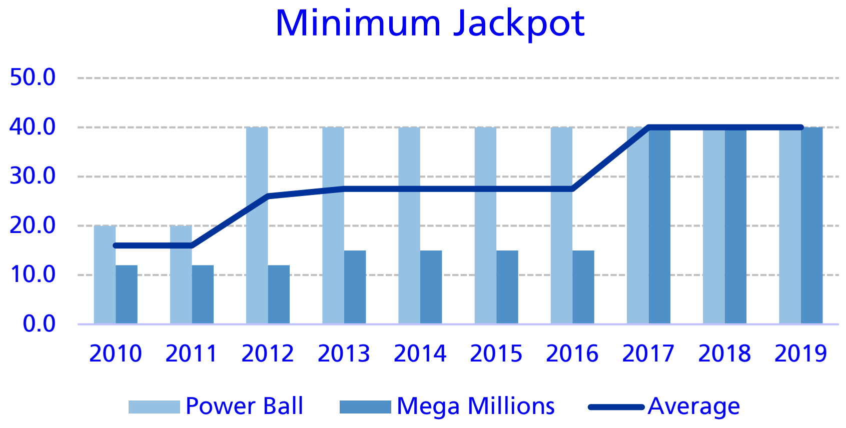
Lottery	Insurance
Jackpot	Loss
Draws	Exposure
Game	Model
Jackpot / Draw	Pure Premium

A few more thoughts about the lottery



		XS 100M			
Game Model	Draws Exposure	Jackpots Frequency	Winnings Loss	Avg Severity	Win / Draw Pure Prem
05MM	197	15	3,228	215	16
13MM	209	19	4,693	247	22
17MM	113	11	5,455	496	48
09PB	106	14	2,569	184	24
12PB	193	21	5,633	268	29
15PB	221	24	9,882	412	45

Format	Cost	Odds
05MM	1.00	1:175M
13MM	1.00	1:259M
17MM	2.00	1:302M
09PB	1.00	1:195M
12PB	2.00	1:175M
15PB	2.00	1:292M



Comments: In the last 10 years,

- the cost to win a lot of money has doubled.
- The minimum jackpot has grown from approximately 15M to 40M
- Clearly, there is no trend because of inflation BUT there has been MODEL changes
- How long would it take to recognize a change?
- **COVID Game Change: Early April, the minimum jackpot was reset to $20M**

Back to Actuarial Considerations…

How well do we know our large loss model?

Confidence Intervals for the Pareto Parameter

Level of Tolerance (+ / -)	Level of Confidence				
	97.5%	95.0%	90.0%	85.0%	80.0%
5%	2160	1655	1165	890	710
10%	580	445	310	240	190
15%	275	210	150	115	90
25%	115	85	60	45	40
50%	40	30	20	15	10

Classic Credibility Approach
From Single Parameter Pareto Distribution
Discussion by K. Reichle and J. Yonkunas

Model Risk / Parameter Risk: if our underlying distribution comes with material uncertainty, can we easily relate 1 time period to the next?

Parameter Surface: instead of solving for the correct parameter (and resulting trends) of that distribution maybe consider a grid of possible parameters

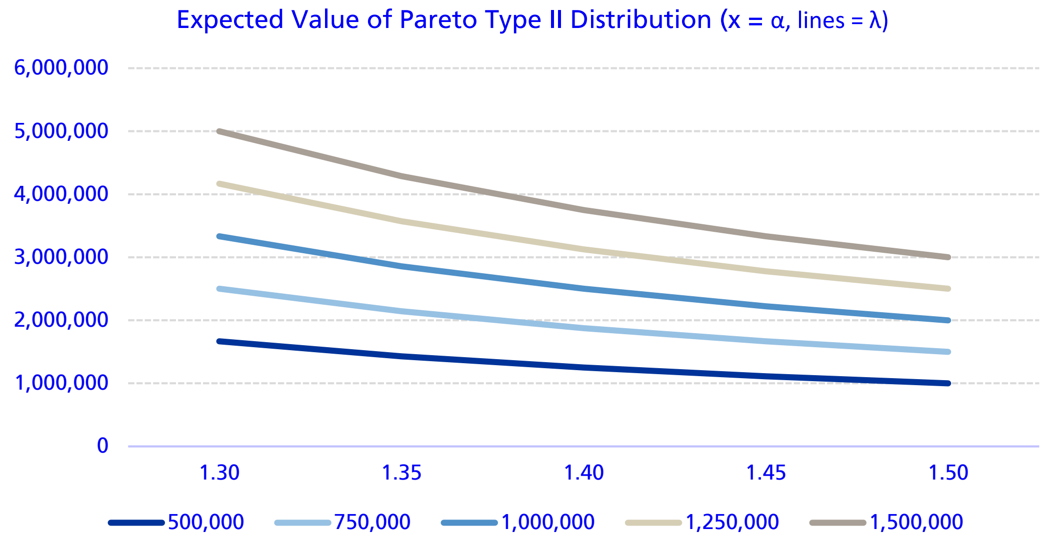
Expected Loss Trend: Approach analysis with a range of possible trend factors and rely on multiple indications – not just 1 estimate

Parameter Surface?

Pareto Type II Distribution (Lomax)

Exp Value	Shape: α				
Scale: λ	1.30	1.35	1.40	1.45	1.50
500,000	1,666,667	1,428,571	1,250,000	1,111,111	1,000,000
750,000	2,500,000	2,142,857	1,875,000	1,666,667	1,500,000
1,000,000	3,333,333	2,857,143	2,500,000	2,222,222	2,000,000
1,250,000	4,166,667	3,571,429	3,125,000	2,777,778	2,500,000
1,500,000	5,000,000	4,285,714	3,750,000	3,333,333	3,000,000

$$E[X] = \lambda / (\alpha - 1)$$



Balance:

- How robust is the data?
- How good is the parameter estimate?
- How good is the model?
- Actuarial judgement
- Intuition

Consider:

- Likelihood an AY of claims data "belongs" to a parameter pair
- How does the "likelihood" shift over time?

Conclusions / Final Thoughts

- When the perception of a “lot of money” changes, do we experience a “shock trend” in on-leveling large losses?

- Given the lack of large loss data, what other indicators would point to a change in “large loss inflation” or what might actually be a model change or “new normal”? Can we use economic trends or price changes to supplement our view?

- Should we expand our analysis to account for what we cannot observe? Parameter surface, loss trend ranges …

- Explicit “trend margin” for model risk, parameter risk, etc…

- How do we blend Art with the limitations of actuarial science?

Thank you

Reference Materials

Amstislavskiy, V. “Trend in Excess Layers” CLRS, September 2016

http://www.casact.org/education/clrs/2016/presentations/ST-8.pdf

Reichle, K. and Yonkunas, J. “Discussion of: A Practical Guide Single Parameter Pareto Distribution”

https://www.casact.org/pubs/proceed/proceed85/85085.pdf

MacroTrends.net; Various Charts

https://www.macrotrends.net/

Contact Information

Peter Magliaro, FCAS, MAAA
Vice President & Actuarial Director
Standard Lines Pricing Manager
Zurich North America
peter.magliaro@zurichna.com

Estimating Casualty Large Loss Trend

CAS Ratemaking and Predictive Modeling (RPM)
July 29, 2020

SERVE | ADD VALUE | INNOVATE

Agenda

- General Liability Segment Results
- Trend Estimation Observations
- Using Excess Loss Data Directly

General Liability Segment Results

Primary Annual Statement LOBs Including General Liability

- Commercial Multi-Peril Liability (052)
- Other Liability (170)
- Products Liability (180)

Types of Insurance included in Annual Statement LOB “Other Liability”

- Premises/Operations
- Liquor Liability
- Directors and Officers
- Cyber Liability
- Professional E&O
  - Excluding Medical Professional
- Commercial Umbrella/Excess
- Personal Umbrella
- Personal Liability
- Plus More……

Source: https://www.naic.org/documents/industry_pcm_p_c_2017.pdf

General Liability – Selected Segment Totals

Year Ending Calendar Year	Loss and ALAE ($)	Earned Premium ($)	Loss Ratio
2009	7,698,966,405	14,069,789,261	0.547
2010	7,653,936,084	13,674,957,128	0.560
2011	7,830,612,863	13,166,767,611	0.595
2012	7,996,979,584	14,076,184,176	0.568
2013	8,238,896,176	15,376,161,880	0.536
2014	8,819,997,060	16,306,792,209	0.541
2015	8,961,445,352	17,417,984,609	0.514
2016	9,738,725,840	17,783,142,092	0.548
2017	10,529,676,012	17,970,583,432	0.586
2018	11,516,817,755	18,586,238,416	0.620

Bulk reserves are not included and a consistent number of accident years are included in each calendar year. This includes Premises/Operations, Products/Completed Operations, Composite Rated Risks, and Commercial Umbrella/Excess

Source: ISO/Verisk

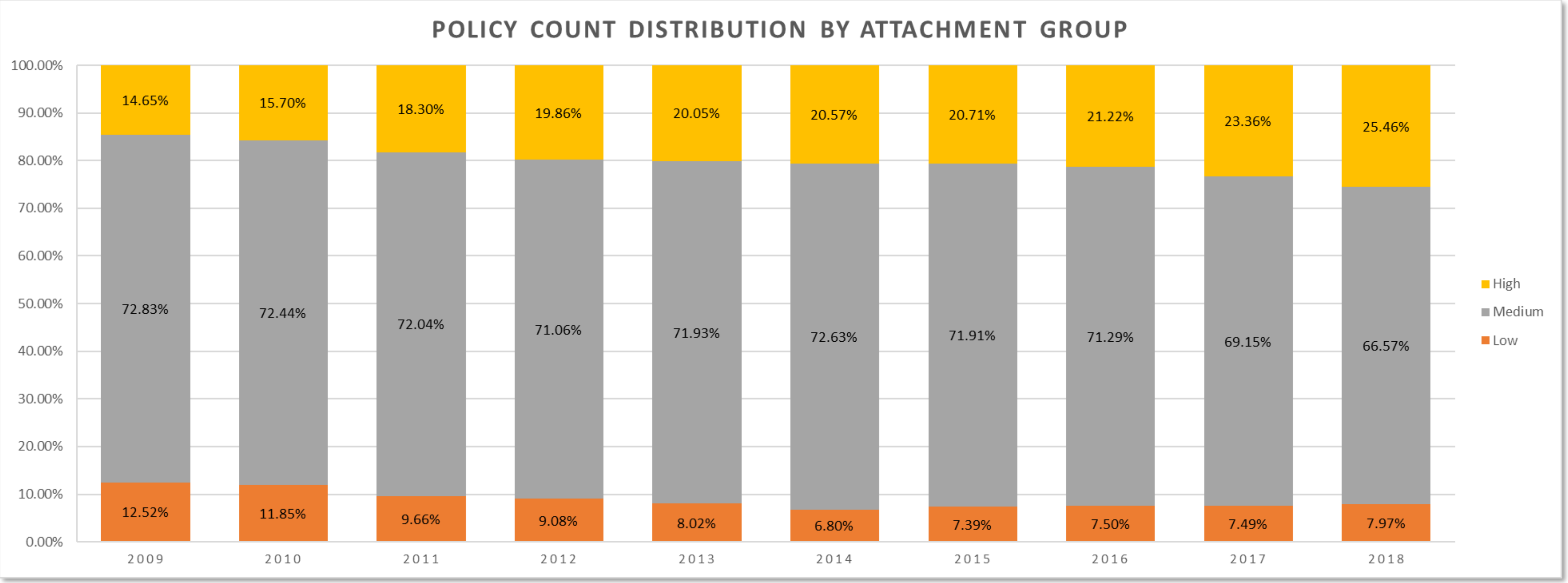
General Liability – Commercial Umbrella & Excess

Year Ending Calendar Year	Loss and ALAE ($)	Earned Premium ($)	Loss Ratio
2009	1,993,193,901	5,140,000,000	0.388
2010	1,929,553,640	5,380,000,000	0.359
2011	2,212,645,848	4,980,000,000	0.444
2012	2,145,615,722	5,470,000,000	0.392
2013	2,295,176,919	6,020,000,000	0.381
2014	2,509,747,885	6,320,000,000	0.397
2015	2,736,762,214	6,920,000,000	0.395
2016	3,227,006,709	6,910,000,000	0.467
2017	3,544,973,614	6,810,000,000	0.521
2018	4,445,962,627	7,140,000,000	0.623

Bulk reserves are not included and a consistent number of accident years are included in each calendar year

Source: ISO/Verisk

Commercial Umbrella & Excess Liability – Attachment Point Distribution (Pol Yr)



Attachment Point Size Groups - High, Medium, and Low

High: Attachment Point > $1.5M

Medium: $500k < Attachment Point <=$1.5M

Low: Attachment Point <= $500k

Trend Estimation Observations

Hypothesized Causes for Different/Changing Trends by Layer

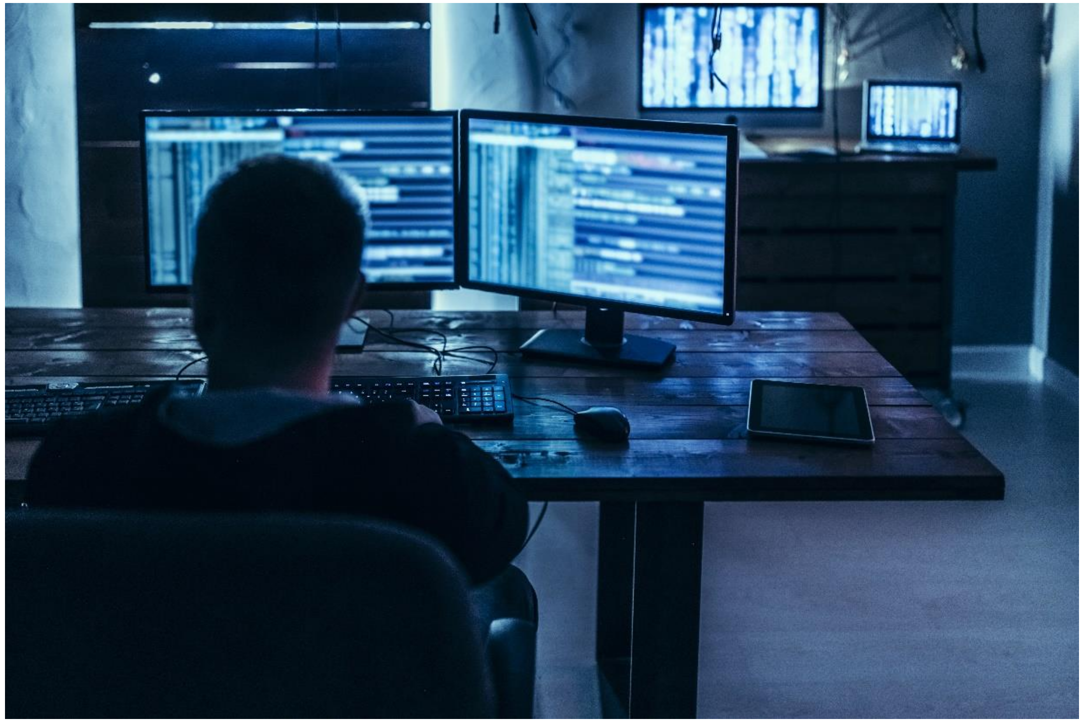
- "Social Inflation"
  - Larger Jury Verdicts
  - Changing Judicial Decisions
  - Greater Propensity to Sue

- Law Changes
  - Tort Reform

- Litigation Funding/Greater Use of Analytics by Plaintiffs

- Evolving Loss Types
  - Traumatic Brain Injuries for example

- Economic Shocks
  - 2008 Economic Recession



2008/2009 Economic Recession – Deeper Dive

- Potential Impact on Insurance Trend
  - Relationship to General Inflation Levels

- Slowing of Increases in Severity During/Around The Recession
  - Example: Primary General Liability Premises/Operations

- Claim Frequency

External Variables to Evaluate Trend

- Leading Indicators
  - Identification
  - Differ by Line of Insurance

- Potential Examples
  - Legal Cost Inflation
  - Medical Inflation
  - Public Perception of Corporations

- Data Quality/Changing Methods

Methodologies and Aggregations

- Depending on aggregation method, value of most recent data may be limited
  - Accentuated for long tail lines
- Segment Data vs. Limited Volume
- Primary Policy Loss Data
- Conclusion => Multiple methods and/or aggregations could be analyzed

Using Excess Loss Data Directly

Using Excess Loss Amounts to Determine Trend

- Potential Challenges
  - Data Volume
  - Not having Excess and Primary
  - Higher Layers
  - Lack of Detail
  - Policy Limits/Attachment Points

Size of Loss Trend Hypothesis Testing (Unadjusted) - Illustrative Example

Trend Test - Base Case (no exposure growth or freq trend)

Tot	426	460	497	546	601	
#	35	35	35	35	35	
Avg	12.2	13.1	14.2	15.6	17.2	
check sev chg		1.080	1.080	1.100	1.100	1.090
"feeder" trend sel		1.000	1.000	1.000	1.000	1.000
Threshold	25.0	25.0	25.0	25.0	25.0	
Tot xs	290	313	338	398	438	
#	6	6	6	7	7	
Avg	48.3	52.2	56.3	56.9	62.6	
indic sev chg		1.080	1.080	1.010	1.100	1.067
On-level SP	1000	1000	1000	1000	1000	
GU Freq	0.0350	0.0350	0.0350	0.0350	0.0350	
XS Freq	0.0060	0.0060	0.0060	0.0070	0.0070	
indic freq chg		1.000	1.000	1.167	1.000	1.039
GU Burn	0.4258	0.4598	0.4966	0.5463	0.6009	
XS Burn	0.2897	0.3129	0.3379	0.3982	0.4380	
indic pure prem chg		1.080	1.080	1.178	1.100	1.109

	"true" trend->	1.080	1.080	1.100	1.100
Clm #	Y1	Y2	Y3	Y4	Y5
35	**80.45**	**86.89**	**93.84**	**103.22**	**113.55**
34	**63.02**	**68.07**	**73.51**	**80.86**	**88.95**
33	**49.72**	**53.69**	**57.99**	**63.79**	**70.17**
32	**39.49**	**42.65**	**46.07**	**50.67**	**55.74**
31	**31.59**	**34.12**	**36.85**	**40.53**	**44.59**
30	**25.45**	**27.49**	**29.68**	**32.65**	**35.92**
29	20.64	22.30	24.08	**26.49**	**29.14**
28	16.86	18.21	19.67	21.64	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	11.18	12.30	13.53
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	7.02
20	4.30	4.64	5.01	5.51	6.06
19	3.74	4.04	4.36	4.80	5.27
18	3.27	3.54	3.82	4.20	4.62
17	2.89	3.12	3.37	3.70	4.07
16	2.56	2.77	2.99	3.29	3.62
15	2.29	2.48	2.68	2.94	3.24
14	2.07	2.23	2.41	2.65	2.92
13	1.87	2.02	2.19	2.40	2.64
12	1.71	1.85	2.00	2.20	2.41
11	1.57	1.70	1.84	2.02	2.22
10	1.46	1.57	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	1.80
7	1.21	1.30	1.41	1.55	1.70
6	1.15	1.24	1.34	1.48	1.62
5	1.10	1.19	1.29	1.41	1.56
4	1.06	1.15	1.24	1.37	1.50
3	1.04	1.12	1.21	1.33	1.46
2	1.01	1.10	1.18	1.30	1.43
1	1.00	1.08	1.17	1.28	1.41

Source: CARe 6/2012 – IT1 - JBuchanan

Size of Loss Trend Hypothesis Testing – Assuming 6% (Illustrative)

Trend Test - Base Case (no exposure growth or freq trend)

Tot	426	460	497	546	601	
#	35	35	35	35	35	
Avg	12.2	13.1	14.2	15.6	17.2	
check sev chg		1.080	1.080	1.100	1.100	1.090
"feeder" trend sel		1.060	1.060	1.060	1.060	1.060
Threshold	25.0	26.5	28.1	29.8	31.6	
Tot xs	290	313	338	372	409	
#	6	6	6	6	6	
Avg	48.3	52.2	56.3	62.0	68.2	
indic sev chg		1.080	1.080	1.100	1.100	1.090
On-level SP	1000	1000	1000	1000	1000	
GU Freq	0.0350	0.0350	0.0350	0.0350	0.0350	
XS Freq	0.0060	0.0060	0.0060	0.0060	0.0060	
indic freq chg		1.000	1.000	1.000	1.000	1.000
GU Burn	0.4258	0.4598	0.4966	0.5463	0.6009	
XS Burn	0.2897	0.3129	0.3379	0.3717	0.4089	
indic pure prem chg		1.080	1.080	1.100	1.100	1.090

	"true" trend->	1.080	1.080	1.100	1.100
Clm #	Y1	Y2	Y3	Y4	Y5
35	**80.45**	**86.89**	**93.84**	**103.22**	**113.55**
34	**63.02**	**68.07**	**73.51**	**80.86**	**88.95**
33	**49.72**	**53.69**	**57.99**	**63.79**	**70.17**
32	**39.49**	**42.65**	**46.07**	**50.67**	**55.74**
31	**31.59**	**34.12**	**36.85**	**40.53**	**44.59**
30	**25.45**	**27.49**	**29.68**	**32.65**	**35.92**
29	20.64	22.30	24.08	26.49	29.14
28	16.86	18.21	19.67	21.64	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	11.18	12.30	13.53
24	8.05	8.69	9.39	10.33	11.36
23	6.81	7.35	7.94	8.74	9.61

Size of Loss Trend Hypothesis Testing – Assuming 12% (Illustrative)

Trend Test - Base Case **(no exposure growth or freq trend)**

Tot	426	460	497	546	601	
#	35	35	35	35	35	
Avg	12.2	13.1	14.2	15.6	17.2	
check sev chg		1.080	1.080	1.100	1.100	1.090
"feeder" trend sel		1.120	1.120	1.120	1.120	1.120
Threshold	25.0	28.0	31.4	35.1	39.3	
Tot xs	290	285	308	339	373	
#	6	5	5	5	5	
Avg	48.3	57.1	61.7	67.8	74.6	
indic sev chg		1.182	1.080	1.100	1.100	1.115
On-level SP	1000	1000	1000	1000	1000	
GU Freq	0.0350	0.0350	0.0350	0.0350	0.0350	
XS Freq	0.0060	0.0050	0.0050	0.0050	0.0050	
indic freq chg		0.833	1.000	1.000	1.000	0.955
GU Burn	0.4258	0.4598	0.4966	0.5463	0.6009	
XS Burn	0.2897	0.2854	0.3083	0.3391	0.3730	
indic pure prem chg		0.985	1.080	1.100	1.100	1.065

	"true" trend->	1.080	1.080	1.100	1.100
Clm #	Y1	Y2	Y3	Y4	Y5
35	**80.45**	**86.89**	**93.84**	**103.22**	**113.55**
34	**63.02**	**68.07**	**73.51**	**80.86**	**88.95**
33	**49.72**	**53.69**	**57.99**	**63.79**	**70.17**
32	**39.49**	**42.65**	**46.07**	**50.67**	**55.74**
31	**31.59**	**34.12**	**36.85**	**40.53**	**44.59**
30	**25.45**	27.49	29.68	32.65	35.92
29	20.64	22.30	24.08	26.49	29.14
28	16.86	18.21	19.67	21.64	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	11.18	12.30	13.53
24	8.05	8.69	9.39	10.33	11.36
23	6.81	7.35	7.94	8.74	9.61

Summary

- Divergence between overall GL and Excess/Umbrella Results
- Multiple Methods and/or Aggregations
- Using Excess Loss Data Directly
  - Consider Limitations

Contact Information

Tim McCarthy, ACAS, MAAA
Actuarial Director – Commercial Liability
ISO/Verisk
(201) 469-2743
timothy.mccarthy@verisk.com

ISO®