2022 BAS Annual Case Competition

Team 12:

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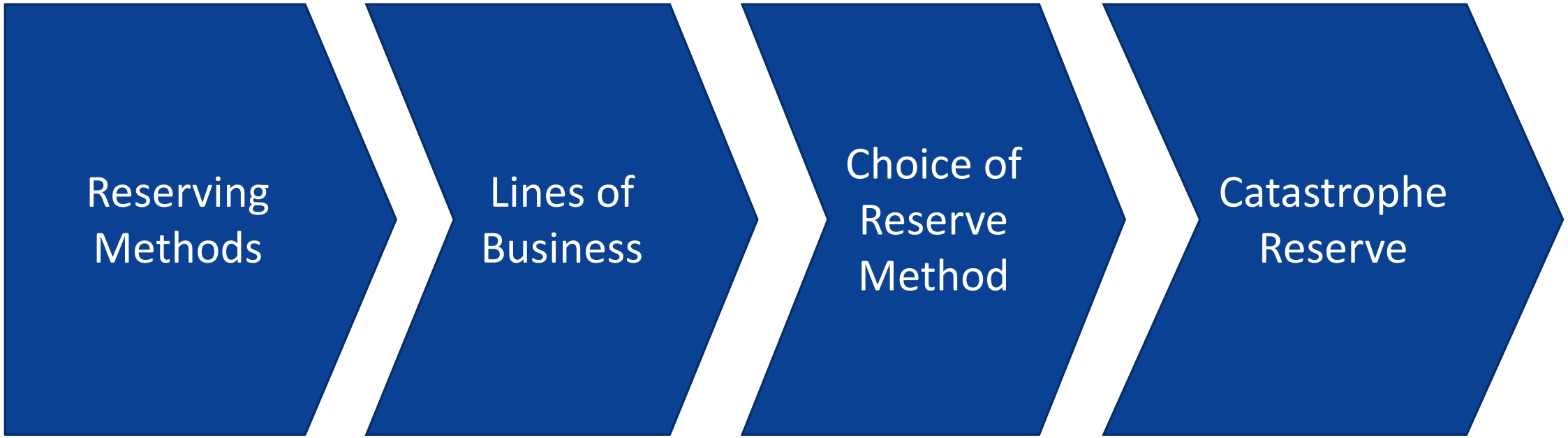
Agenda


Reserving Methods
Lines of Business
Choice of Reserve Method
Catastrophe Reserve

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Reserving Methods

- Paid Chain Ladder
- Reported Chain Ladder
- Expected Loss Ratio
- Bornheutter-Ferguson
- Cape Cod

AY \ DY	0	1	2	3	4	5	6	7	8	9
2011	14.39 (mil $)	24.01	29.02	31.96	34.60	35.71	36.40	36.58	36.62	36.62
2012	15.01	24.20	29.74	32.34	34.94	35.80	36.41	36.72	36.73	
2013	15.38	23.32	28.13	29.67	31.98	32.46	32.77	32.87		
2014	13.77	23.20	28.04	31.28	32.57	34.96	35.43			
2015	20.04	28.96	35.42	39.11	41.14	42.11				
2016	16.39	27.25	32.69	35.09	35.89					
2017	21.86	35.48	42.36	43.97						
2018	16.46	26.78	29.80							
2019	18.27	26.73								
2020	9.55									

Annual Cumulative Paid Chain Ladder Triangle

DY	0_1	1_2	2_3	3_4	4_5	5_6	6_7	7_8	8_9	9_10
Dev factors	1.583	1.197	1.080	1.059	1.033	1.015	1.006	1.001	1.000	1.000

AY \ DY	0	1	2	3	4	5	6	7	8	9
2011	14.39 (mil $)	24.01	29.02	31.96	34.60	35.71	36.40	36.58	36.62	36.62
2012	15.01	24.20	29.74	32.34	34.94	35.80	36.41	36.72	36.73	36.73
2013	15.38	23.32	28.13	29.67	31.98	32.46	32.77	32.87	32.90	32.90
2014	13.77	23.20	28.04	31.28	32.57	34.96	35.43	35.63	35.66	35.66
2015	20.04	28.96	35.42	39.11	41.14	42.11	42.74	42.98	43.01	43.01
2016	16.39	27.25	32.69	35.09	35.89	37.08	37.64	37.85	37.88	37.88
2017	21.86	35.48	42.36	43.97	46.55	48.09	48.81	49.08	49.12	49.12
2018	16.46	26.78	29.80	32.18	34.06	35.19	35.72	35.92	35.95	35.95
2019	18.27	26.73	31.99	34.55	36.58	37.79	38.35	38.57	38.60	38.60
2020	9.55	15.11	18.09	19.54	20.68	21.36	21.69	21.81	21.82	21.82

Annual Cumulative Paid Chain Ladder Triangle

Annual Cumulative Reported Chain Ladder Triangle

AY \ DY	0	1	2	3	4	5	6	7	8	9
2011	29.25 (mil $)	32.68	32.97	33.12	33.28	33.29	33.33	33.33	33.33	33.33
2012	28.64	31.88	32.52	32.54	32.57	32.61	32.61	32.61	32.61	
2013	25.69	29.33	29.69	29.78	30.64	30.65	30.66	30.66		
2014	29.17	32.37	33.48	34.21	34.24	34.29	34.29			
2015	33.70	37.75	38.65	38.84	38.94	38.94				
2016	19.21	21.45	21.76	22.06	22.06					
2017	23.03	26.80	27.15	27.26						
2018	18.96	22.23	22.34							
2019	22.42	24.35								
2020	15.63									

Expected Loss Ratio

$$\text{Loss Ratio} = \frac{\text{Paid Loss}}{\text{Premium}}$$

$$\text{Loss Ratio (2011)} = \frac{36.6 \text{ mil}}{49.3 \text{ mil}} = 0.74$$

Bornheutter-Ferguson

	0_1	1_2	2_3	3_4	4_5	5_6	6_7	7_8	8_9
Dev factors	1.583	1.197	1.080	1.059	1.033	1.015	1.006	1.001	1.000
CDF	2.286	1.444	1.206	1.117	1.055	1.021	1.006	1.001	1.000

Apply ultimate losses from expected method

$$\text{IBNR} = \text{UL} \times (1 - \frac{1}{\text{CDF}})$$

B-F UL = Paid losses + IBNR

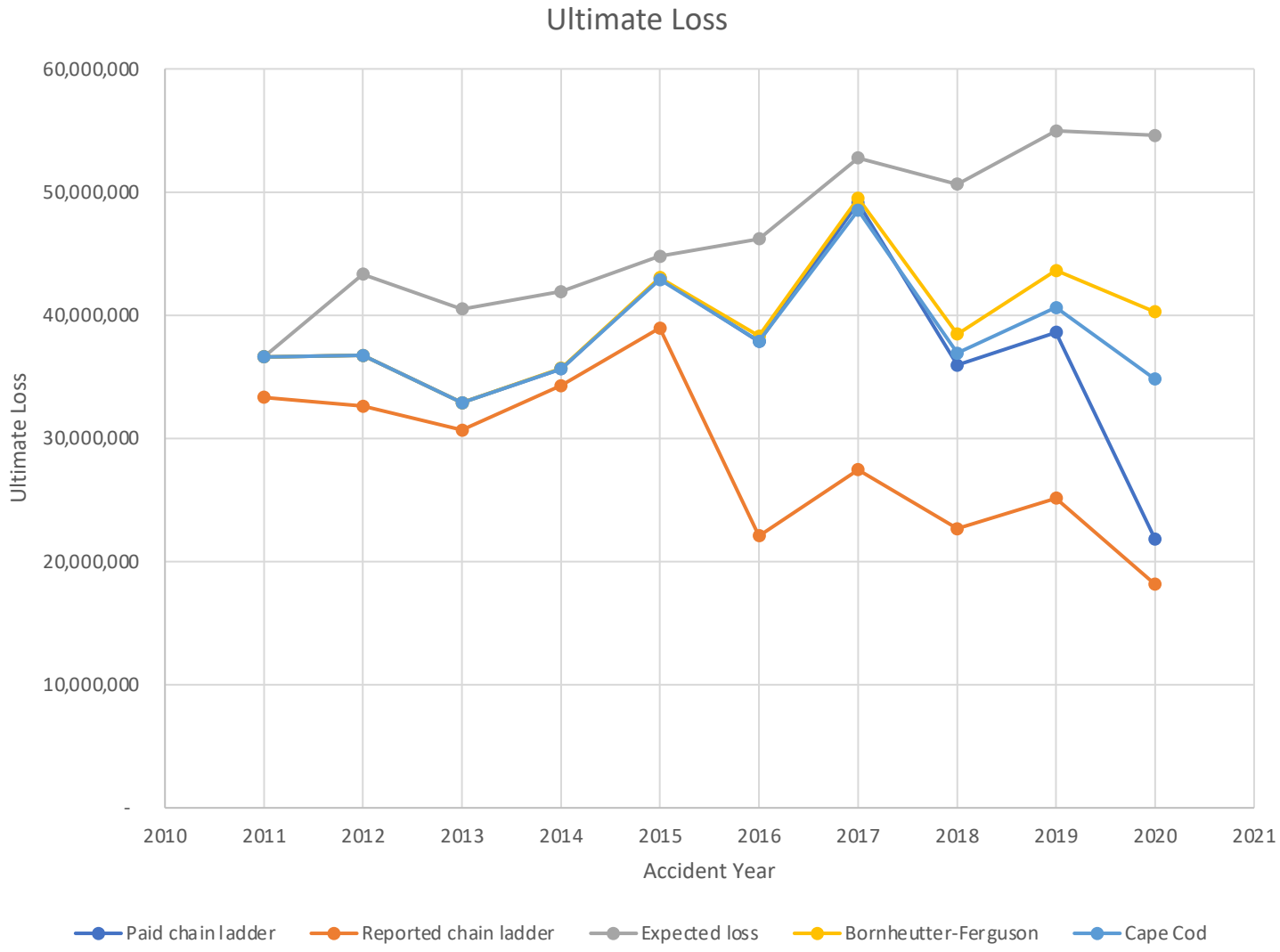
Cape-Cod

1. An extension of B-F method
2. Obtain Cape Cod paid losses using premium
3. Predict Cape Cod ultimate losses and IBNR

Ultimate Loss Summary Table (in mil $)

	Paid chain ladder	Reported chain ladder	Expected loss	Bornheutter-Ferguson	Cape Cod
2011	36.62	33.33	36.62	36.62	36.62
2012	36.73	32.61	43.33	36.73	36.73
2013	32.90	30.66	40.50	32.90	32.90
2014	35.66	34.29	41.91	35.70	35.65
2015	43.01	38.96	44.80	43.05	42.89
2016	37.88	22.09	46.20	38.31	37.88
2017	49.12	27.45	52.77	49.50	48.52
2018	35.95	22.67	50.64	38.46	36.92
2019	38.60	25.13	54.97	43.63	40.63
2020	21.82	18.15	54.60	40.26	34.81
Total	368.29	285.34	466.35	395.18	383.56

Summary Graph



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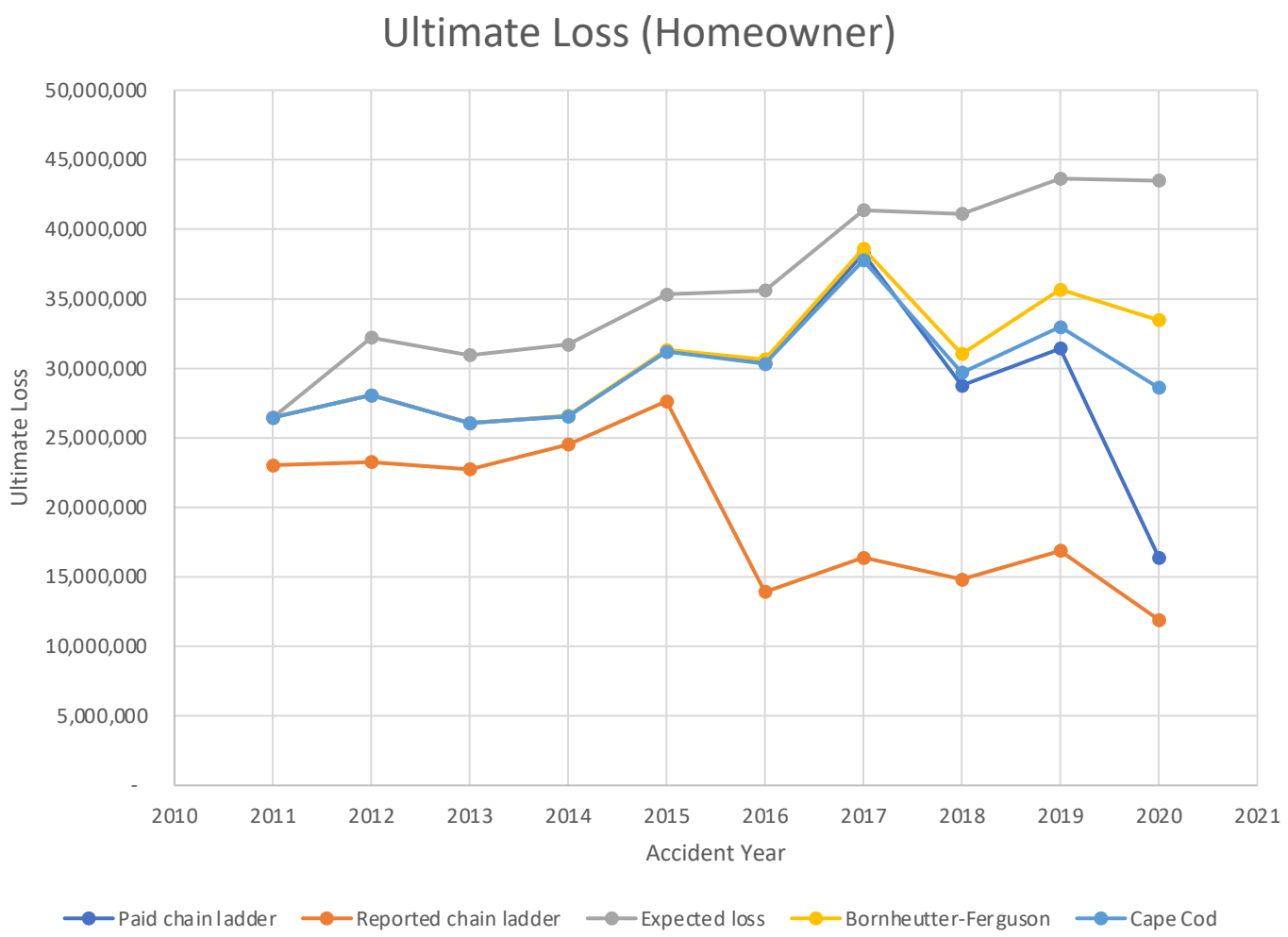
Lines of Business

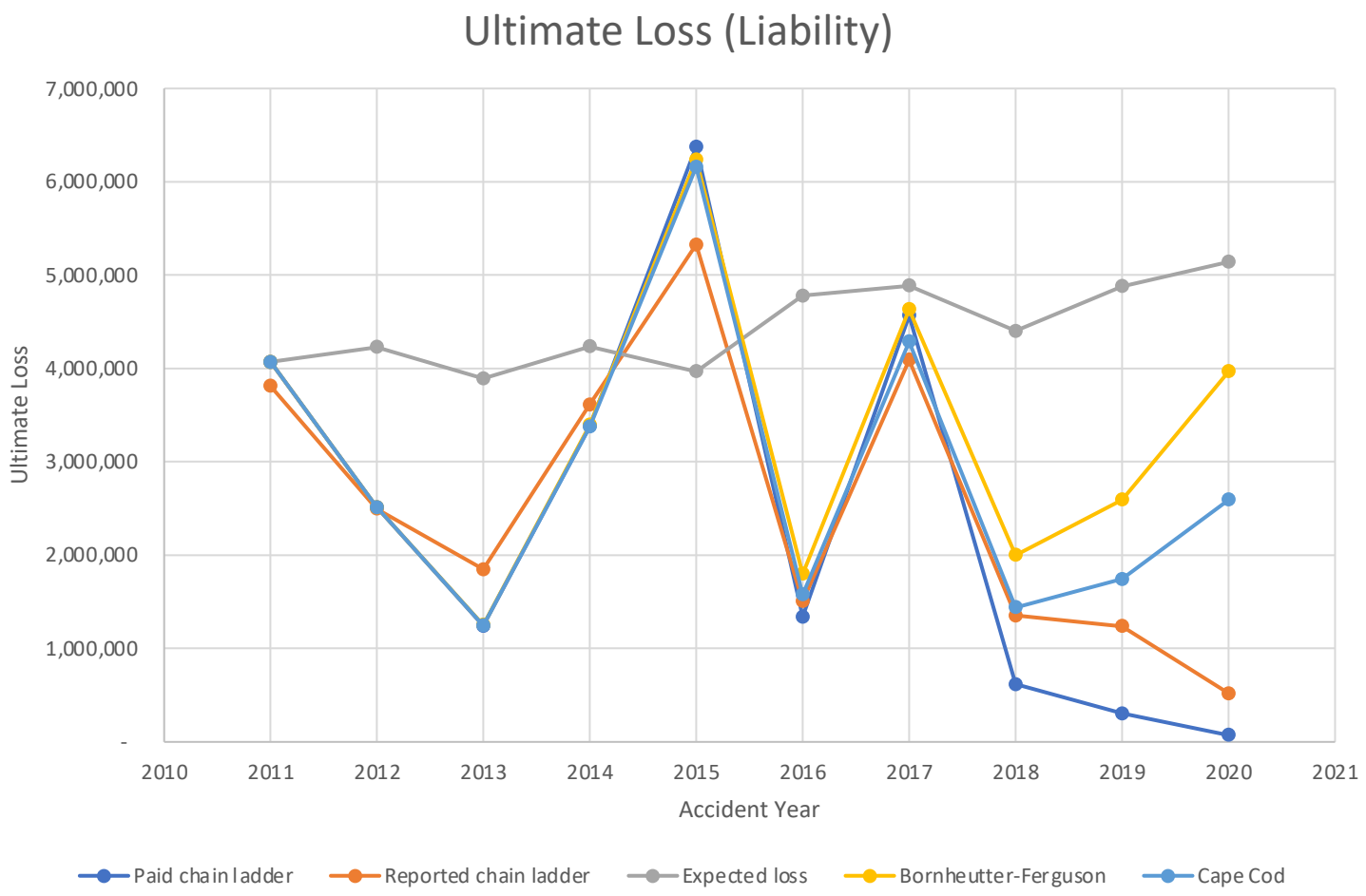
- Homeowner
- Personal Auto Liability
- Personal Auto Physical Damage (Physdam)


Ultimate Loss (Homeowner)
50,000,000
45,000,000
40,000,000
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
-
Ultimate Loss
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Accident Year
Paid chain ladder
Reported chain ladder
Expected loss
Bornheutter-Ferguson
Cape Cod

Homeowner

Accident Year	Selected Ultimate Loss (mil $)
2011	26.46
2012	28.05
2013	26.06
2014	26.56
2015	31.25
2016	30.45
2017	38.21
2018	29.82
2019	33.35
2020	31.04
Total	301.24

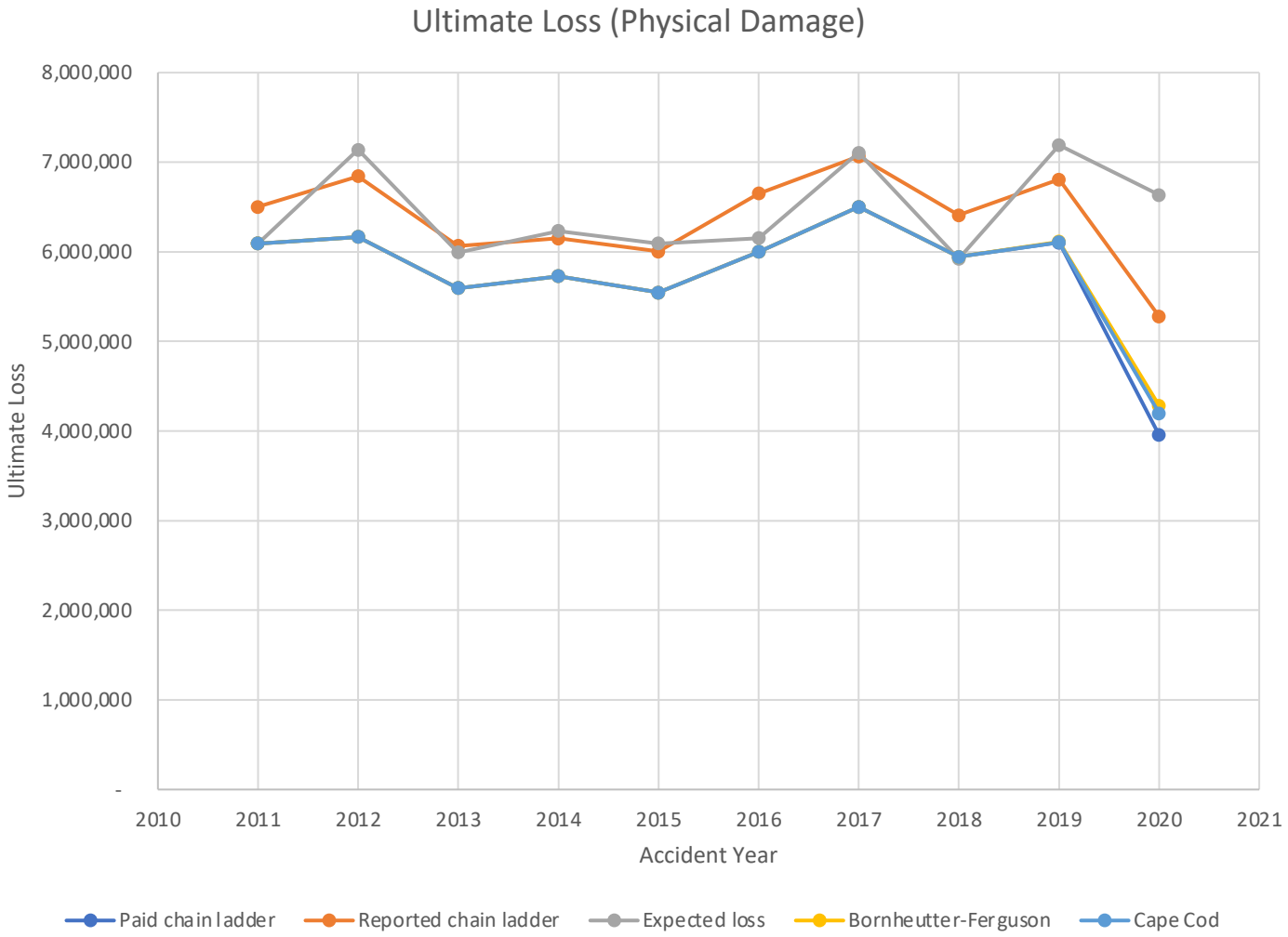
Homeowner



Personal Auto Liability

Accident Year	Selected Ultimate Loss (mil $)
2011	4.07
2012	2.51
2013	1.25
2014	3.39
2015	6.26
2016	1.56
2017	4.40
2018	2.00
2019	2.60
2020	3.97
Total	31.99

Personal Auto Liability



Personal Auto Physical Damage

Accident Year	Selected Ultimate Loss (mil $)
2011	6.17
2012	6.50
2013	5.77
2014	6.23
2015	6.09
2016	6.15
2017	7.11
2018	5.92
2019	7.19
2020	6.63
Total	63.77

Personal Auto Physical Damage

Homeowner

- Highest profit
- Personal auto liability has fluctuating paid loss
- Present reasonable development pattern

Choice for Line of Business

3

Choice of Reserve Method

- Pros & Cons
- Our choice

Pros & Cons (PCL)

Pros:

- Applicable to all lines of insurance
- Good predictor

Cons:

- Requires precise past data

Pros & Cons (RCL)

Pros:

- Evaluate the accuracy of initial reserves

Cons:

- Requires precise past data

Pros & Cons (Expected)

Pros:

- Functions well with limited historical data
- Not affected by volatile data

Cons:

- Overlooks economic events

Pros & Cons (Bornheutter-Ferguson)

Pros:

- Functionable with immature data
- Responsive to big data

Cons:

- Requires precise past loss ratio & development factors

Pros & Cons (Cape-Cod)

Pros:

- Indifferent to random fluctuations in early stages

Cons:

- Requires big data size

Choice of Method

Bornheutter-Ferguson

- Higher level of reserve
- Compatible development factors

4

Catastrophe Reserve

- Infrequent
- Volatile

Unique Challenges

- Restricted access to location
- Interruption in communication
- Complication of foreign exchange rate
- Hurdles in financial reporting

Thank you!

Appendix

1. https://www.actuary.org/sites/default/files/files/catmonograph_june01.4.pdf/catmonograph_june01.4.pdf
2. https://www.casact.org/sites/default/files/presentation/clrs_2012_handouts_session_5174_handout_604_0.pdf
3. http://elib.mi.sanu.ac.rs/files/journals/yjor/71/yujorn71p553-561.pdf