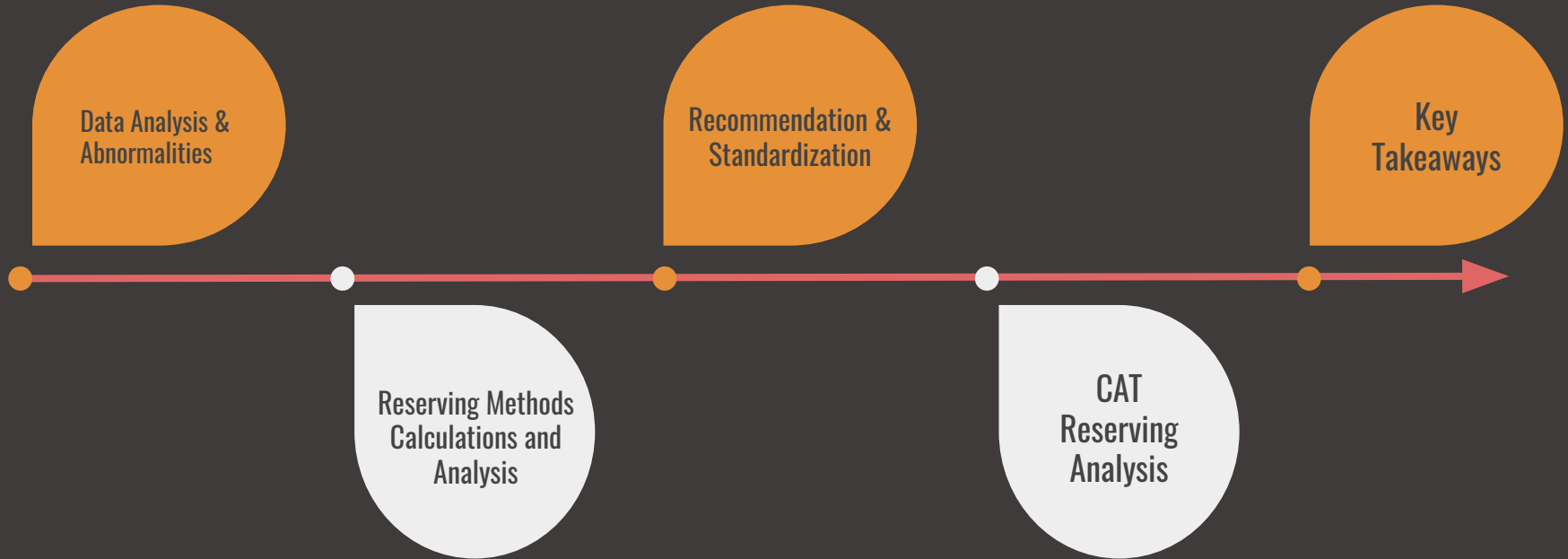


# 2022 Case Competition: Bruin Mutual

Team 11 - Tracy C., Minju K., Shannon L., Susanna T.

# Agenda

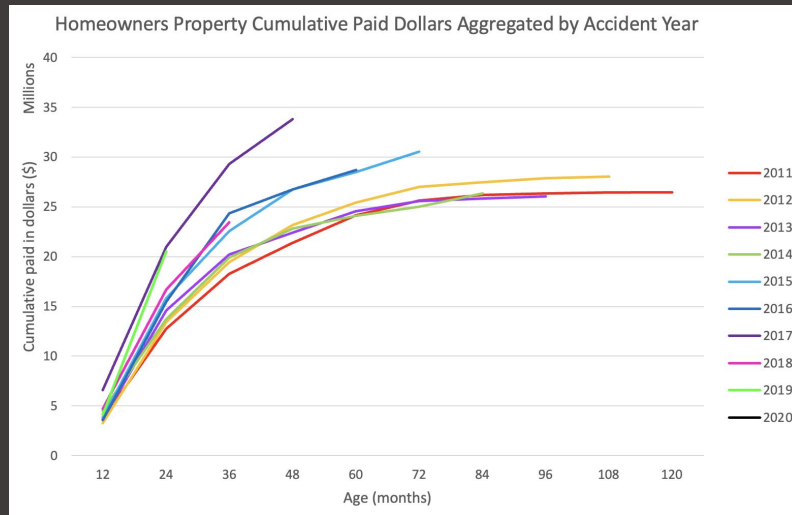
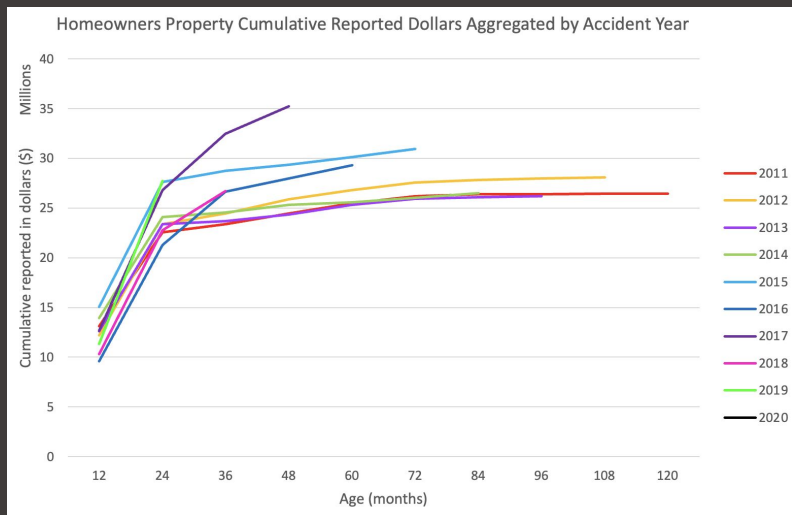


# Data Analysis & Abnormalities

# Data Analysis & Abnormalities

## Homeowners Property

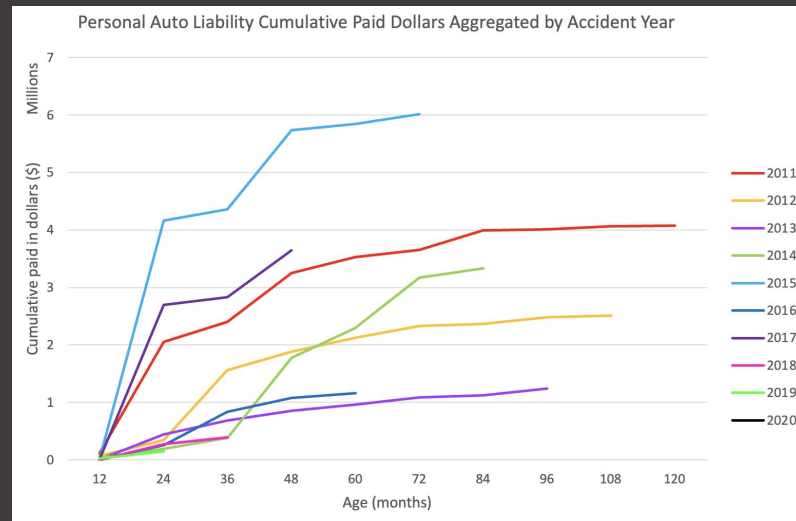
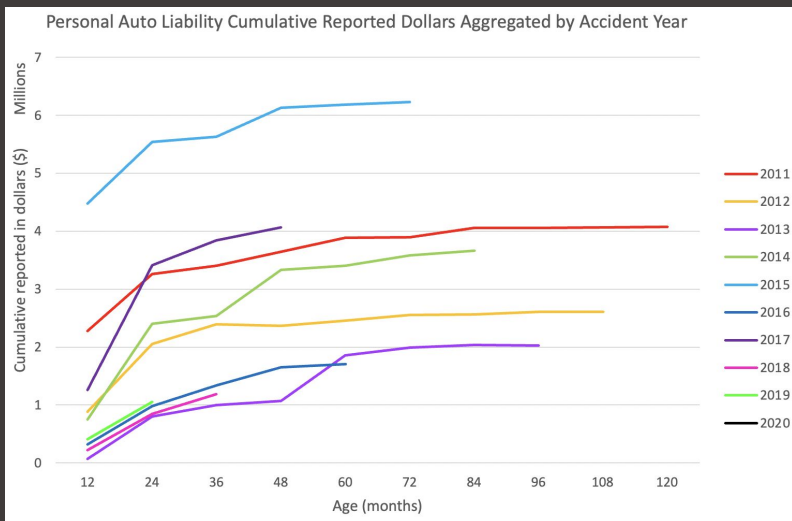
- Similar trends across different AYs
  - Rapid increase in the loss with the first year
  - Continuous gradual increase after the first year
- Abnormalities in 2017



# Data Analysis & Abnormalities

## Personal Auto Liability

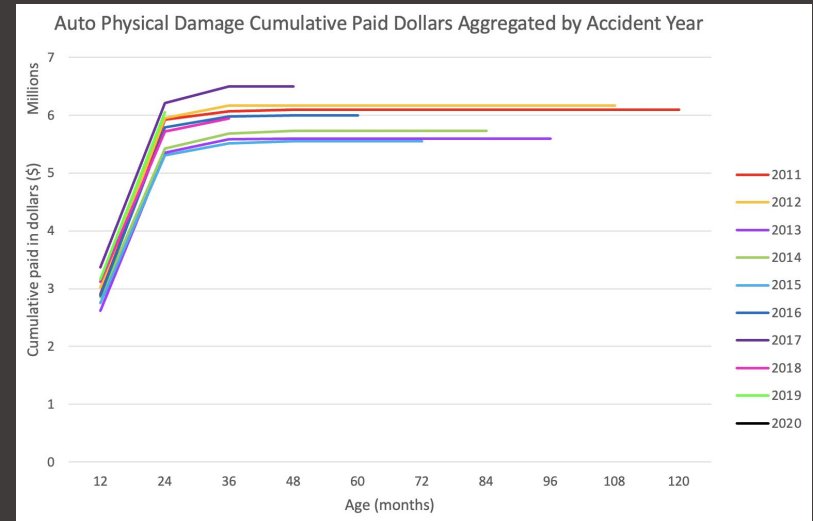
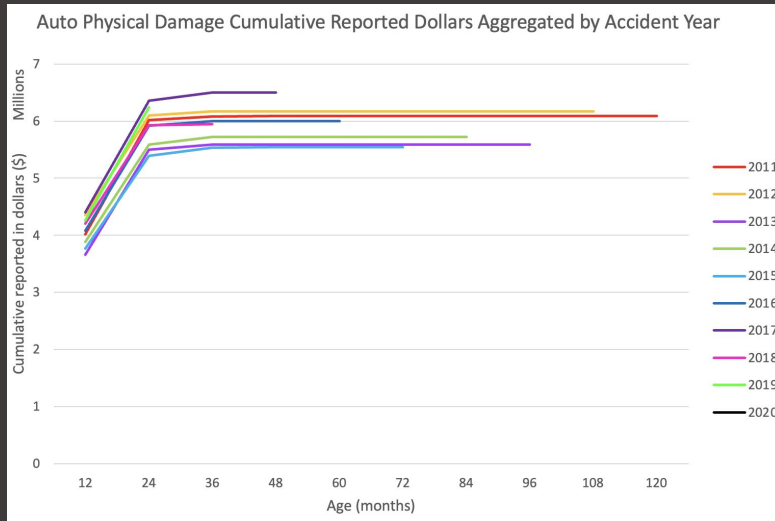
- Inconsistent and fluctuating across different AYs
  - Rapid increase in the loss with the first year
- Abnormalities in 2015



# Data Analysis & Abnormalities

## Personal Auto Physical Damage

- Similar trends across different AYs
  - Rapid increase in the loss with the first year
  - Gradually levels off after the first year



# Reserving Method Calculations & Analysis

# Assumptions



Changing environment

Average										
Simple Average										
Latest 3	2.256	1.212	1.053	1.027	1.023	1.010	1.003	1.003	1.000	
Selected	2.256	1.212	1.053	1.027	1.023	1.010	1.003	1.003	1.000	1.000

Selected averages for the  
age-to-age factors and tail  
factors

$$\text{Selected Loss Ratio} = \frac{\text{Total Initial Selected Ultimate Claims}}{\text{Total Earned Premium}}$$

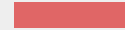
Selected Loss Ratio Formula



# Chain Ladder Method



- **Simple & reliable with stable environment and consistent historical data**



- **Heavily reliant on historical data with no consideration of risk theory**

Accident Year	Projected Ultimate Losses (\$000)					
	Auto Physdam		Auto Liability		Homeowners Prop	
	<i>Reported</i>	<i>Paid</i>	<i>Reported</i>	<i>Paid</i>	<i>Reported</i>	<i>Paid</i>
2011	6,093	6,093	4,075	4,077	26,466	26,458
2012	6,167	6,167	2,614	2,518	28,102	28,051
2013	5,594	5,594	2,029	1,258	26,281	26,038
2014	5,728	5,728	3,692	3,564	26,693	26,372
2015	5,537	5,547	6,375	6,639	31,472	30,549
2016	6,001	6,001	1,823	1,515	30,497	28,730
2017	6,502	6,502	4,437	5,358	37,703	33,913
2018	5,947	5,962	1,463	749	30,061	23,726
2019	6,325	6,308	1,678	564	37,815	22,084
2020	6,727	6,742	1,660	7,658	40,890	11,049
<b>Total</b>	<b>60,631</b>	<b>60,643</b>	<b>29,847</b>	<b>33,899</b>	<b>315,980</b>	<b>256,971</b>

## Chain Ladder Method

# Expected Method



- **Maintains stability over time, as actual claim data is not used**



- **Requires priori estimate with accurate ELR**

Accident Year	Projected Ultimate Losses (\$000)		
	Auto Physdam	Auto Liability	Homeowners Prop
2011	5,723	2,916	20,944
2012	6,704	3,029	25,504
2013	5,630	2,789	24,503
2014	5,854	3,035	25,100
2015	5,723	2,843	27,960
2016	5,780	3,425	28,175
2017	6,674	3,502	32,759
2018	5,562	3,153	32,549
2019	6,754	2,497	34,548
2020	6,231	3,684	34,433
<b>Total</b>	<b>60,637</b>	<b>31,873</b>	<b>286,475</b>

Expected Method

# Bornhuetter-Ferguson Method



- **Weighted combination of Chain Ladder and Expected methods**



- **Requires reasonable development patterns and accurate priori estimates**

Accident Year	Projected Ultimate Losses (\$000)					
	Auto Physdam		Auto Liability		Homeowners Prop	
	<i>Reported</i>	<i>Paid</i>	<i>Reported</i>	<i>Paid</i>	<i>Reported</i>	<i>Paid</i>
2011	6,093	6,093	4,074	4,075	26,465	26,458
2012	6,167	6,167	2,615	2,519	28,100	28,051
2013	5,594	5,594	2,031	1,281	26,274	26,039
2014	5,728	5,728	3,688	3,530	26,682	26,372
2015	5,547	5,547	6,297	6,282	31,412	30,549
2016	6,001	6,001	1,927	1,960	30,407	28,730
2017	6,501	6,502	4,358	4,764	37,383	33,910
2018	5,947	5,943	1,779	1,895	30,338	23,823
2019	6,331	6,051	2,359	2,704	36,943	22,962
2020	6,571	3,472	3,269	3,692	36,532	21,610
<b>Total</b>	<b>60,480</b>	<b>57,097</b>	<b>32,398</b>	<b>32,702</b>	<b>310,537</b>	<b>268,505</b>

## Bornhuetter-Ferguson Method

# Cape Cod Method



- **Variability in losses at early maturities do not significantly skew estimates**



- **Highly dependent on a constant loss exposure and an accurate ELR**

Accident Year	Projected Ultimate Losses (\$000)		
	Auto Physdam	Auto Liability	Homeowners Prop
2011	6,093	4,075	26,465
2012	6,167	2,615	28,102
2013	5,594	2,031	26,283
2014	5,728	3,688	26,699
2015	5,547	6,298	31,458
2016	6,001	1,931	30,514
2017	6,502	4,364	37,590
2018	5,947	1,790	30,692
2019	6,331	2,385	37,843
2020	6,566	3,328	38,801
<b>Total</b>	<b>60,475</b>	<b>32,506</b>	<b>314,448</b>

## Cape Cod Method



# Recommendations & Standardization

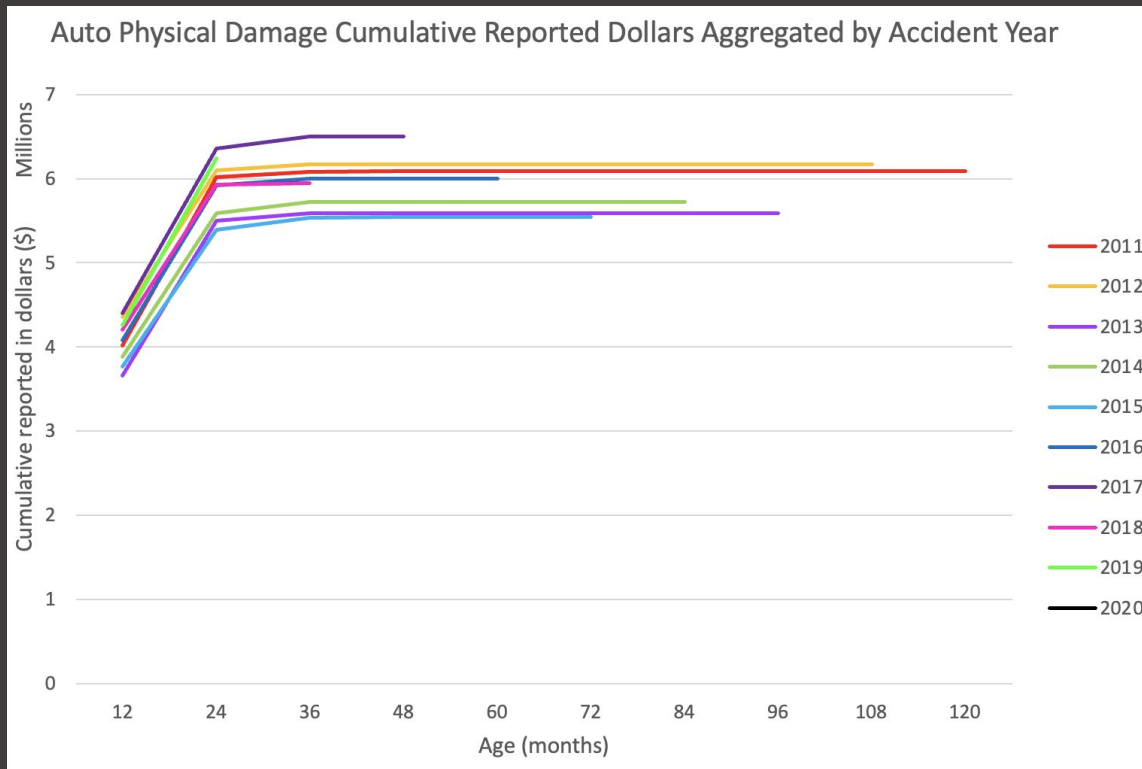
# Recommendation

Accident Year	Ultimate Loss Selection (\$) for		
	Auto Physical Damage	Auto Liability	Homeowners Property
2011	\$6,093,005.04	\$4,075,202.45	\$26,467,240.97
2012	\$6,167,101.82	\$2,576,402.25	\$28,091,633.06
2013	\$5,594,091.84	\$1,726,270.90	\$26,251,736.2
2014	\$5,727,696.43	\$3,632,517.81	\$31,623,721.67
2015	\$5,547,188.08	\$6,378,235.02	\$30,904,648.57
2016	\$6,000,913.12	\$1,831,354.14	\$38,301,891.37
2017	\$6,501,639.72	\$4,656,282.02	\$38,301,891.37
2018	\$5,952,411.08	\$1,535,039.31	\$31,128,096.7
2019	\$6,324,123.81	\$1,937,772.81	\$38,658,010.38
2020	\$6,620,224.861	\$3,921,467.68	\$40,591,136.83
<b>Total</b>	<b>\$60,528,395.79</b>	<b>\$32,270,544.40</b>	<b>\$319,132,706.06</b>

## Ultimate loss selection

Average of the three reserving methods (excluding Expected method)

# Standardization

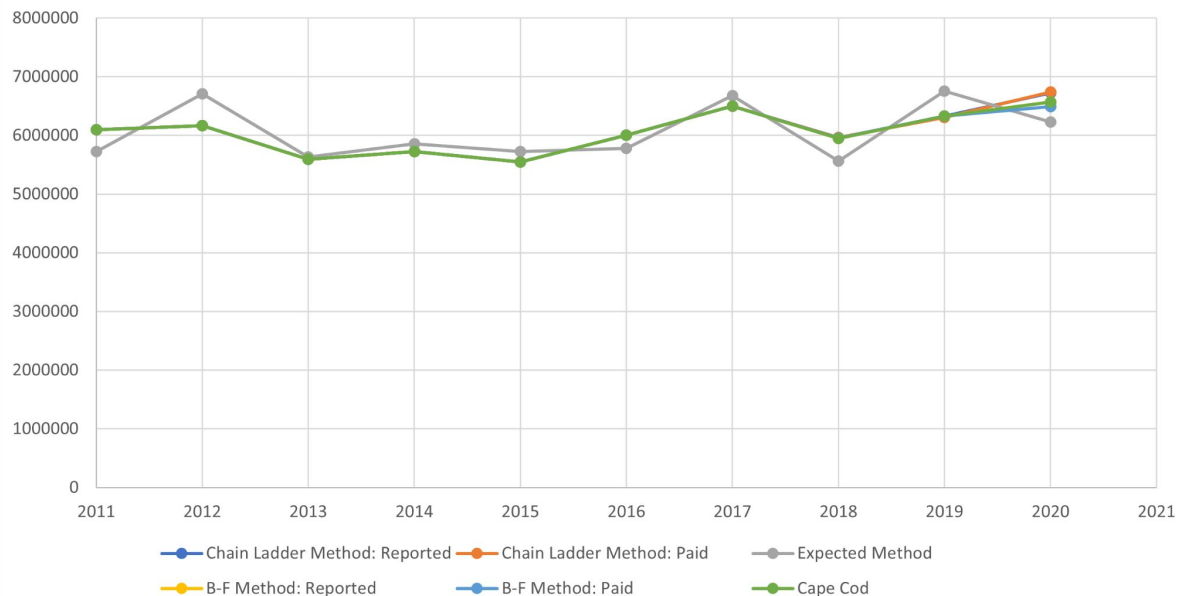


## LoB: Auto Physical Damage

1) Similar trends  
for all accident  
years

# Standardization

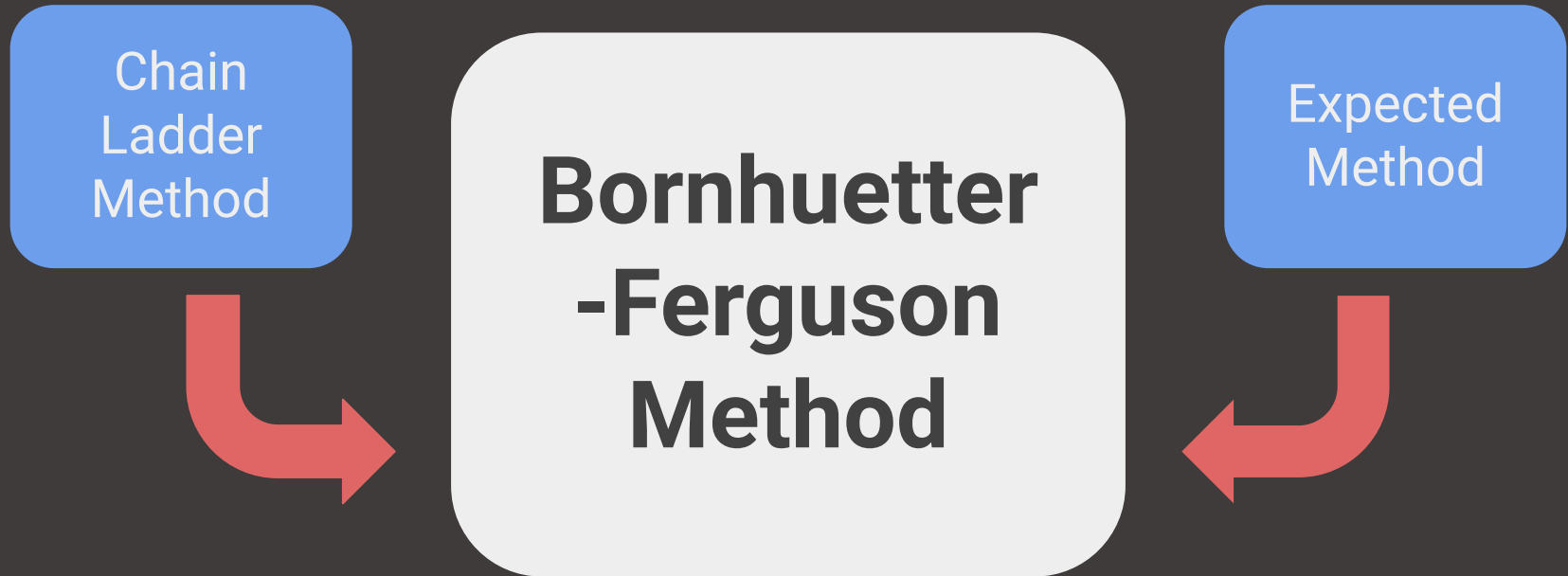
Projected Ultimate Claims of Auto Physical Damage Line



**LoB: Auto  
Physical Damage**

2) Least variability  
across methods

# Standardization

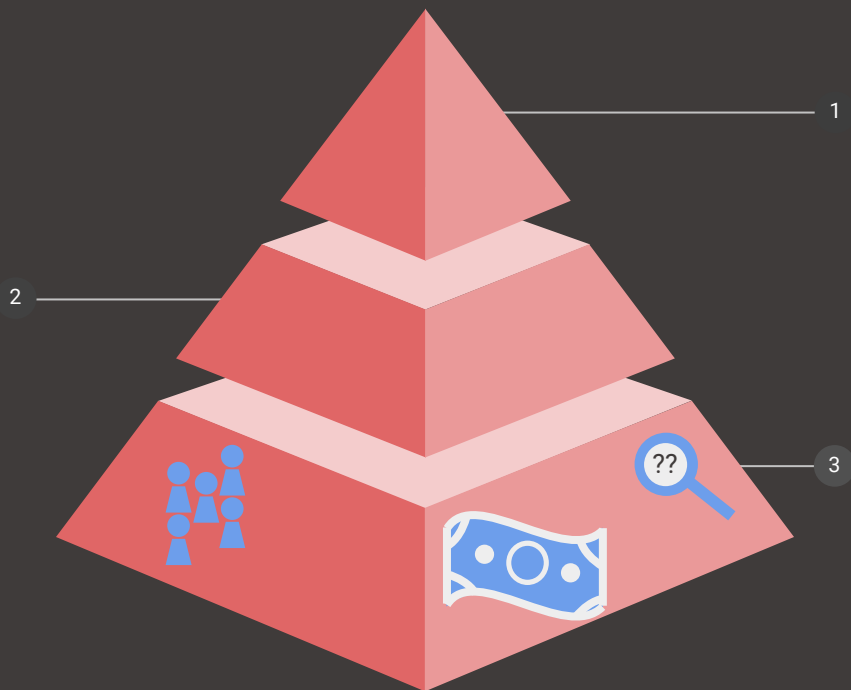


# CAT Reserving Analysis

# CAT Reserving Analysis: A Separate Process

## Distinction from xCAT

Why do we need to separate?



## CAT Reserves

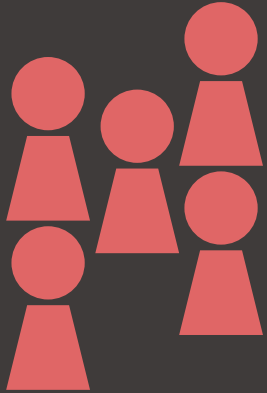
Catastrophe Reserve Methods

## Disadvantages

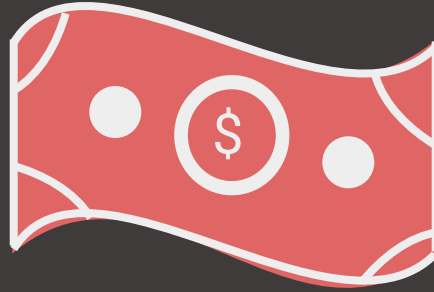
Brings on many challenges

- Intrinsically tied to why its seperated

# CAT Reserving Analysis: Challenges



**Influx of Claims**



**Expensive**

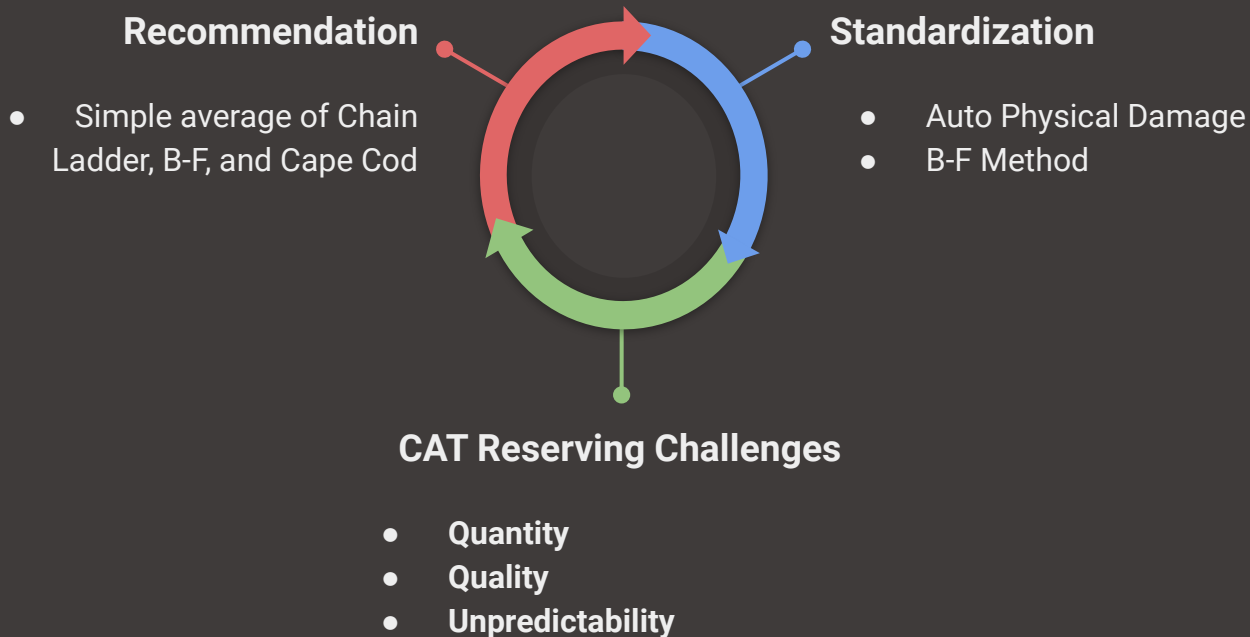


**Unpredictable**



# Key Takeaways

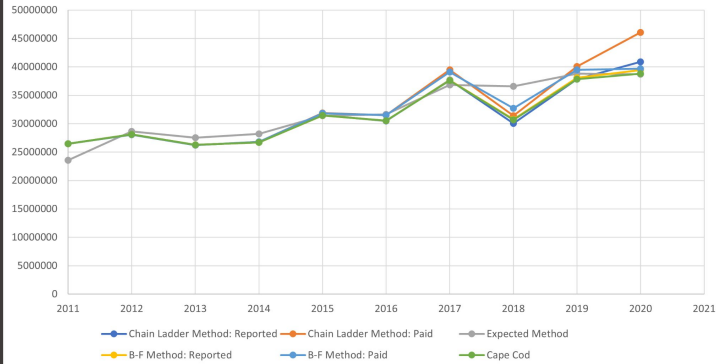
# Key Takeaways



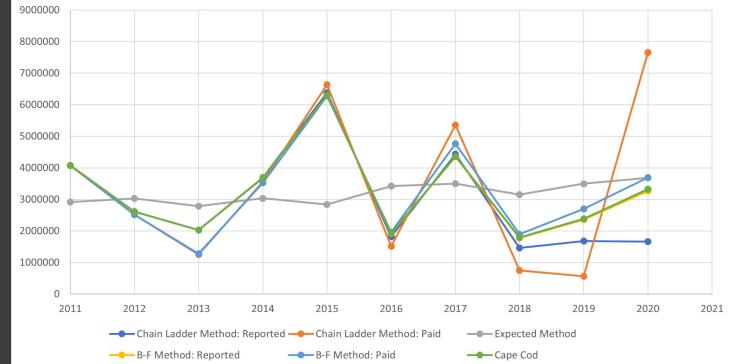
Thank you!

# Appendix

Projected Ultimate Claims of Homeowners Property Line



Projected Ultimate Claims of Auto Liability Line



Projected Ultimate Claims of Auto Physical Damage Line

