



# Actuarial 101 for Self-Insured Entities

*Commitment Beyond Numbers*



Ken Hawkins, ACAS, MAAA  
Trenton Lipka, ACAS, MAAA

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# About the Presenters

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**Ken Hawkins, ACAS, MAAA**

- Consulting Actuary
- Pinnacle Actuarial Resources, Inc.
- Bloomington, Illinois



**Trenton Lipka, ACAS, MAAA**

- Associate Actuary
- Pinnacle Actuarial Resources, Inc.
- Bloomington, Illinois

# Agenda

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- IBNR for Self-Insurance Programs
- Actuarial Estimates
- Considerations Before Beginning an Analysis
- Claim Payment and Reporting Patterns
- Estimating Ultimate Losses

# IBNR for Self-Insurance Programs

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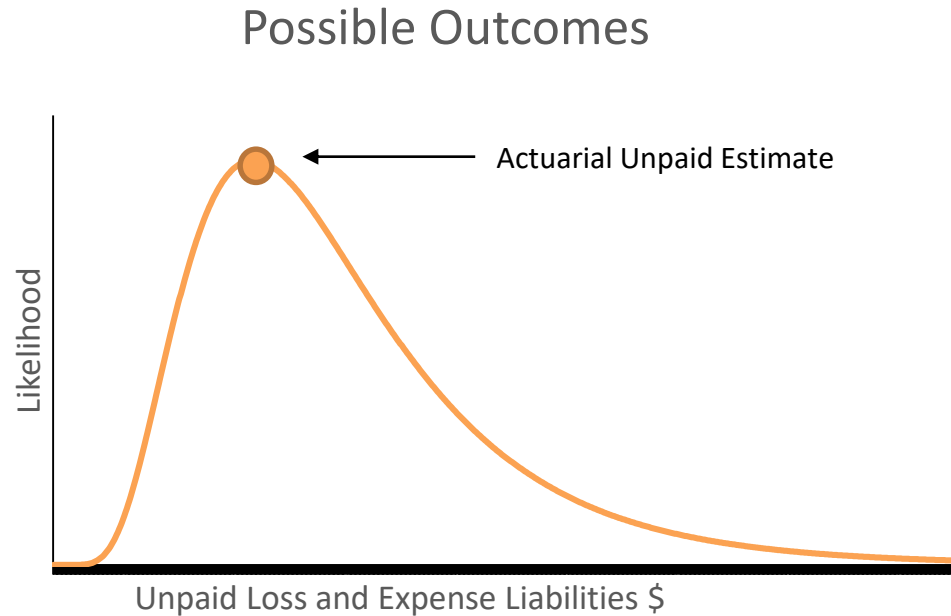
- What is incurred but not reported (IBNR)?
  - Component of financial statement liabilities
  - Recognizes accounting expenses incurred but not recorded
  - Two components of IBNR reserves:
    - True IBNR, or reserves occurring in a period but not reported as of evaluation date
    - Development on known claims or incurred but not enough reported
- Why is IBNR necessary?
- Why is there generally development in case reserves?
  - The ultimate value of a claim can range from \$0 to the retention



# Actuarial Estimates

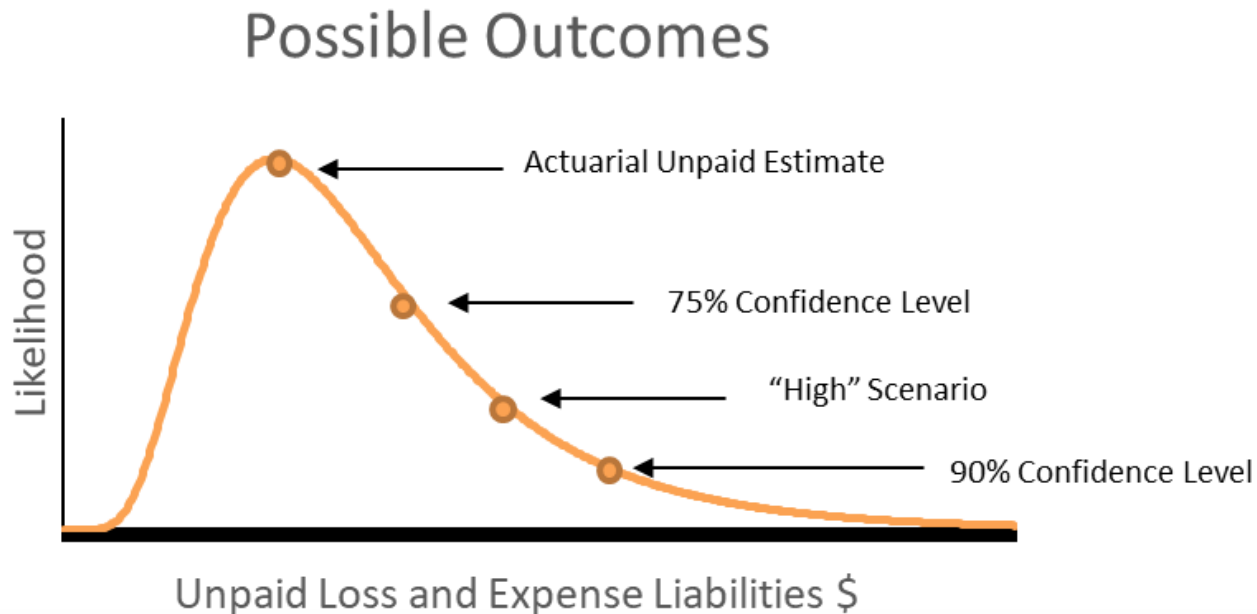
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- Actuarial unpaid estimate - Estimate of future claim liabilities “that represents an expected value over the range of reasonably possible outcomes”
- The actuarial unpaid estimate directly effects the funding for the following policy period. A too-small estimate could lead to underfunding



# Actuarial Estimates

- Risk margin - Difference between actuarial unpaid estimate and estimate of unpaid liabilities at a higher statistical confidence level or scenario
  - Confidence level of x% means there is a x% chance that losses will ultimately be less than the estimate of unpaid losses at that level
  - Scenarios can include assumptions representing favorable or adverse outcomes of future events



# Relevant Information

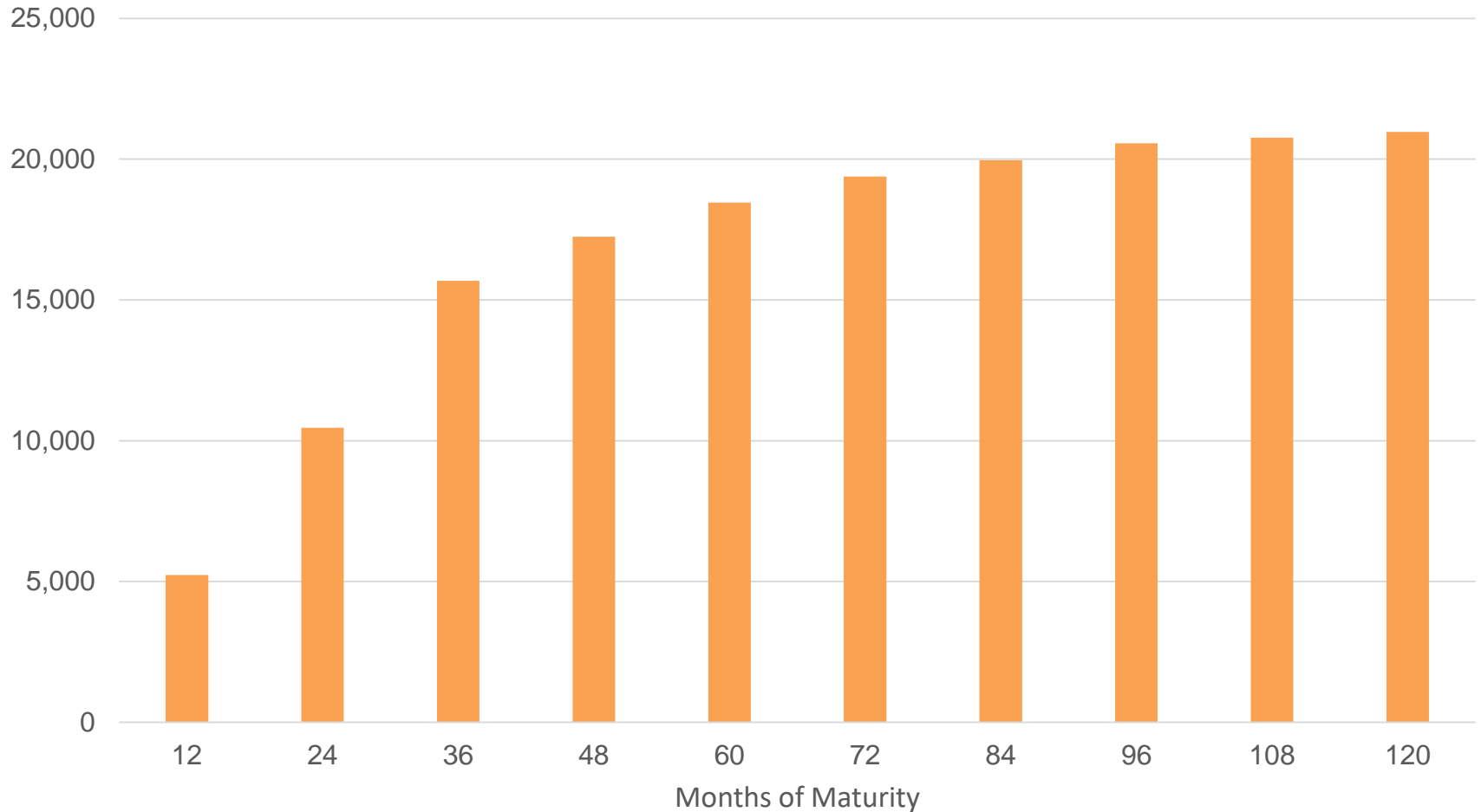
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- Losses
  - Cumulative paid and reported (paid plus case) by policy period at current and historical evaluation dates
  - Individual large losses
  - Claim listing with details can provide more insights
- Exposures (sales, payroll, mileage, number of units)
- Self-insured retention by policy period
- Recent changes:
  - Loss prevention/safety
  - Underlying business
  - Legal environment
  - Claims handling
  - Self-insurance/funding program

# Payment Patterns

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Cumulative Loss Payments for Policy Period 2010

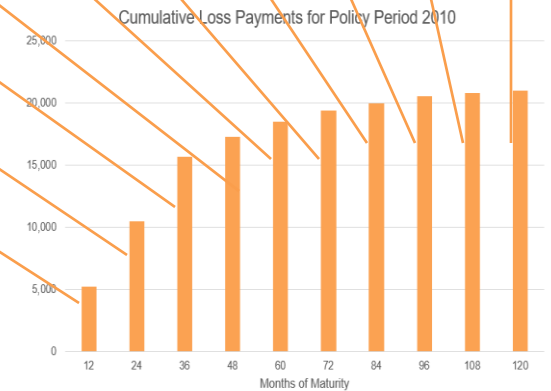




# Cumulative Paid Loss Triangles

Cumulative Paid Losses  
By Policy Period  
At Annual Evaluations

Policy Period	<u>12</u>	<u>24</u>	<u>36</u>	<u>48</u>	<u>60</u>	<u>72</u>	<u>84</u>	<u>96</u>	<u>108</u>	<u>120</u>
2010	5,228	10,455	15,682	17,250	18,458	19,380	19,962	20,561	20,766	20,974



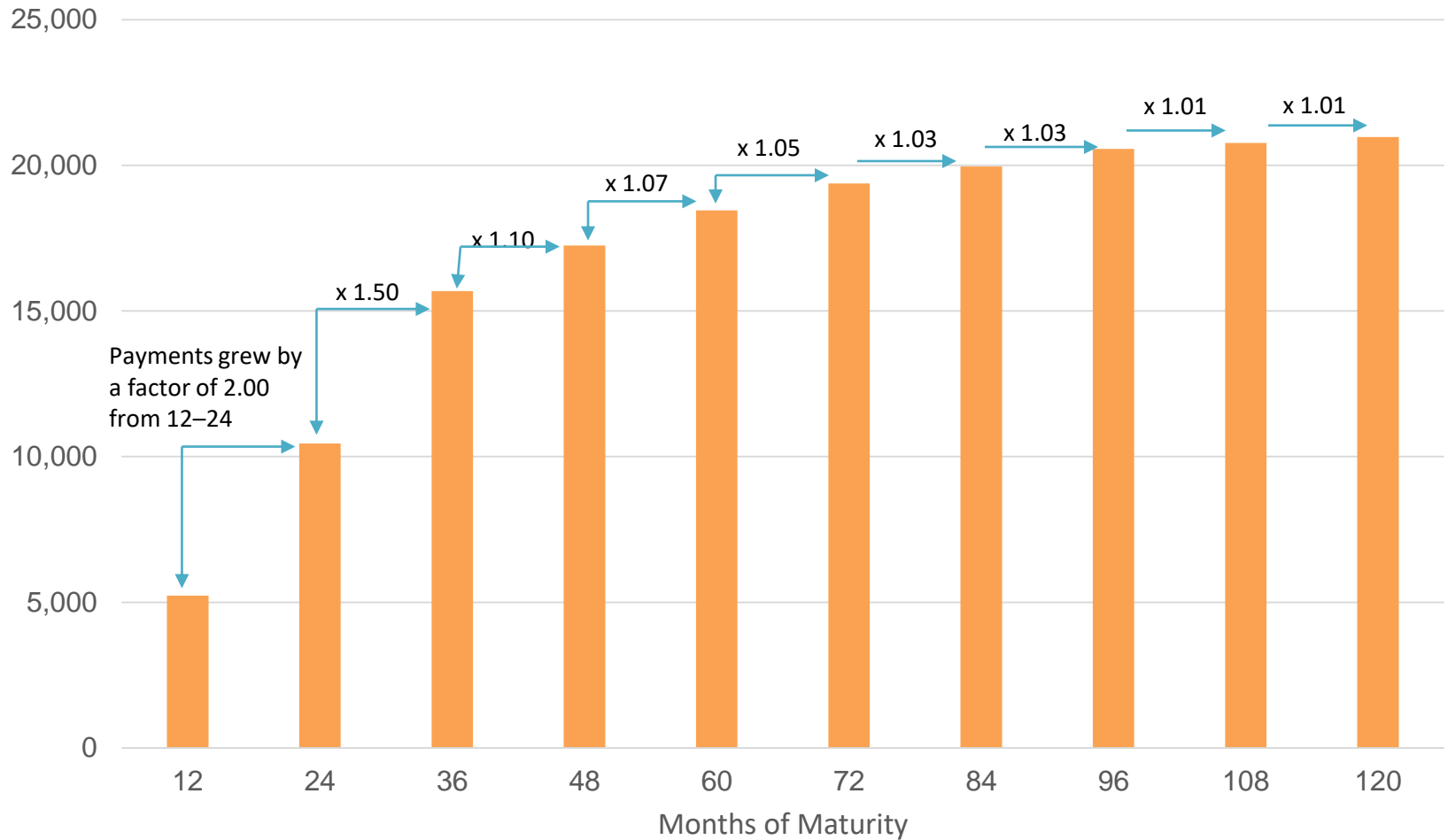
# Cumulative Paid Loss Triangles

Cumulative Paid Losses  
By Policy Period  
At Annual Evaluations

<u>Policy Period</u>	<u>12</u>	<u>24</u>	<u>36</u>	<u>48</u>	<u>60</u>	<u>72</u>	<u>84</u>	<u>96</u>	<u>108</u>	<u>120</u>
2010	5,228	10,455	15,682	17,250	18,458	19,380	19,962	20,561	20,766	20,974
2011	5,932	12,101	17,546	19,301	20,266	21,482	21,912	22,788	23,016	
2012	8,196	15,983	24,454	27,389	29,853	31,048	31,669	32,619		
2013	8,968	18,115	26,991	29,150	30,899	32,444	33,417			
2014	8,018	16,116	24,335	27,498	29,698	31,183				
2015	7,010	14,019	21,028	22,500	24,075					
2016	6,864	14,002	21,143	23,257						
2017	5,552	10,716	15,753							
2018	4,935	10,117								
2019	6,347									

# Growth In Cumulative Loss Payments

Cumulative Loss Payments for Policy Period 2010



# Age-to-Age Factors

Cumulative Paid Losses  
By Policy Period  
At Annual Evaluations

Policy Period	<u>12</u>	<u>24</u>	<u>36</u>
2010	5,228	10,455	15,682
2011	5,932	12,101	17,546
2012	8,196	15,983	24,454
2013	8,968	18,115	26,991
2014	8,018	16,116	24,335
2015	7,010	14,019	21,028
2016	6,864	14,002	21,143
2017	5,552	10,716	15,753
2018	4,935	10,117	
2019	6,347		

Paid Loss Age-to-Age Factors  
By Policy Period

Policy Period	<u>12 - 24</u>	<u>24 - 36</u>	<u>36 - 48</u>
2010	2.00	1.50	1.10
2011	2.04	1.45	1.10
2012	1.95	1.53	1.12
2013	2.02	1.49	1.08
2014	2.01	1.51	1.13
2015	2.00	1.50	1.07
2016	2.04	1.51	1.10
2017	1.93	1.47	
2018	2.05		

# Paid Loss Age-to-Age Triangle

## Paid Loss Age-to-Age Factors By Policy Period

<u>Policy Period</u>	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>48-60</u>	<u>60-72</u>	<u>72-84</u>	<u>84-96</u>	<u>96-108</u>	<u>108-120</u>	<u>120+</u>
2010	2.00	1.50	1.10	1.07	1.05	1.03	1.03	1.01	1.01	
2011	2.04	1.45	1.10	1.05	1.06	1.02	1.04	1.01		
2012	1.95	1.53	1.12	1.09	1.04	1.02	1.03			
2013	2.02	1.49	1.08	1.06	1.05	1.03				
2014	2.01	1.51	1.13	1.08	1.05					
2015	2.00	1.50	1.07	1.07						
2016	2.04	1.51	1.10							
2017	1.93	1.47								
2018	2.05									

# Paid Loss Age-to-Age Triangle

Paid Loss Age-to-Age Factors  
By Policy Period

Policy Period	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>48-60</u>	<u>60-72</u>	<u>72-84</u>	<u>84-96</u>	<u>96-108</u>	<u>108-120</u>	<u>120+</u>
2010	2.00	1.50	1.10	1.07	1.05	1.03	1.03	1.01	1.01	
2011	2.04	1.45	1.10	1.05	1.06	1.02	1.04	1.01		
2012	1.95	1.53	1.12	1.09	1.04	1.02	1.03			
2013	2.02	1.49	1.08	1.06	1.05	1.03				
2014	2.01	1.51	1.13	1.08	1.05					
2015	2.00	1.50	1.07	1.07						
2016	2.04	1.51	1.10							
2017	1.93	1.47								
2018	2.05									
Selected	2.00	1.50	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00

# Paid Loss Age-to-Age Triangle

Paid Loss Age-to-Age Factors  
By Policy Period

Policy Period	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>48-60</u>	<u>60-72</u>	<u>72-84</u>	<u>84-96</u>	<u>96-108</u>	<u>108-120</u>	<u>120+</u>
2010	2.00	1.50	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00
2011	2.04	1.45	1.10	1.05	1.06	1.02	1.04	1.01	1.01	1.00
2012	1.95	1.53	1.12	1.09	1.04	1.02	1.03	1.01	1.01	1.00
2013	2.02	1.49	1.08	1.06	1.05	1.03	1.03	1.01	1.01	1.00
2014	2.01	1.51	1.13	1.08	1.05	1.03	1.03	1.01	1.01	1.00
2015	2.00	1.50	1.07	1.07	1.05	1.03	1.03	1.01	1.01	1.00
2016	2.04	1.51	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00
2017	1.93	1.47	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00
2018	2.05	1.50	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00
Selected	2.00	1.50	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00

# Paid Loss Age-to-Ultimate Factors

Paid Loss Age-to-Age Factors  
By Policy Period

Policy Period	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>48-60</u>	<u>60-72</u>	<u>72-84</u>	<u>84-96</u>	<u>96-108</u>	<u>108-120</u>	<u>120+</u>
2010	2.00	1.50	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00
2011	2.04	1.45	1.10	1.05	1.06	1.02	1.04	1.01	1.01	1.00
2012	1.95	1.53	1.12	1.09	1.04	1.02	1.03	1.01	1.01	1.00
2013	2.02	1.49	1.08	1.06	1.05	1.03	1.03	1.01	1.01	1.00
2014	2.01	1.51	1.13	1.08	1.05	1.03	1.03	1.01	1.01	1.00
2015	2.00	1.50	1.07	1.07	1.05	1.03	1.03	1.01	1.01	1.00
2016	2.04	1.51	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00
2017	1.93	1.47	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00
2018	2.05	1.50	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00
Selected	2.00	1.50	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00
Age to Ultimate Factor							1.05	1.02	1.01	1.00



# Paid Loss Age-to-Ultimate Factors

Paid Loss Age-to-Age Factors  
By Policy Period

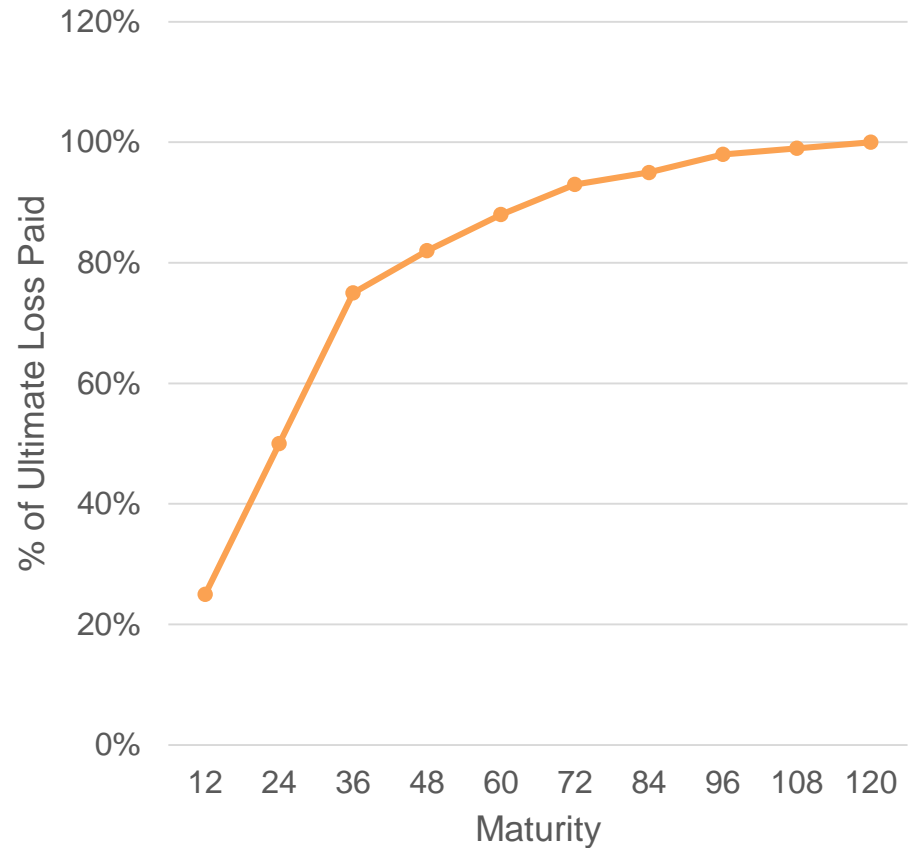
Policy Period	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>48-60</u>	<u>60-72</u>	<u>72-84</u>	<u>84-96</u>	<u>96-108</u>	<u>108-120</u>	<u>120+</u>
2010	2.00	1.50	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00
2011	2.04	1.45	1.10	1.05	1.06	1.02	1.04	1.01	1.01	1.00
2012	1.95	1.53	1.12	1.09	1.04	1.02	1.03	1.01	1.01	1.00
2013	2.02	1.49	1.08	1.06	1.05	1.03	1.03	1.01	1.01	1.00
2014	2.01	1.51	1.13	1.08	1.05	1.03	1.03	1.01	1.01	1.00
2015	2.00	1.50	1.07	1.07	1.05	1.03	1.03	1.01	1.01	1.00
2016	2.04	1.51	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00
2017	1.93	1.47	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00
2018	2.05	1.50	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00
Selected	2.00	1.50	1.10	1.07	1.05	1.03	1.03	1.01	1.01	1.00
Age to Ultimate Factor	4.00	2.00	1.34	1.21	1.13	1.08	1.05	1.02	1.01	1.00

# Loss Payment Pattern

Age to Ultimate Factors  
By Policy Period

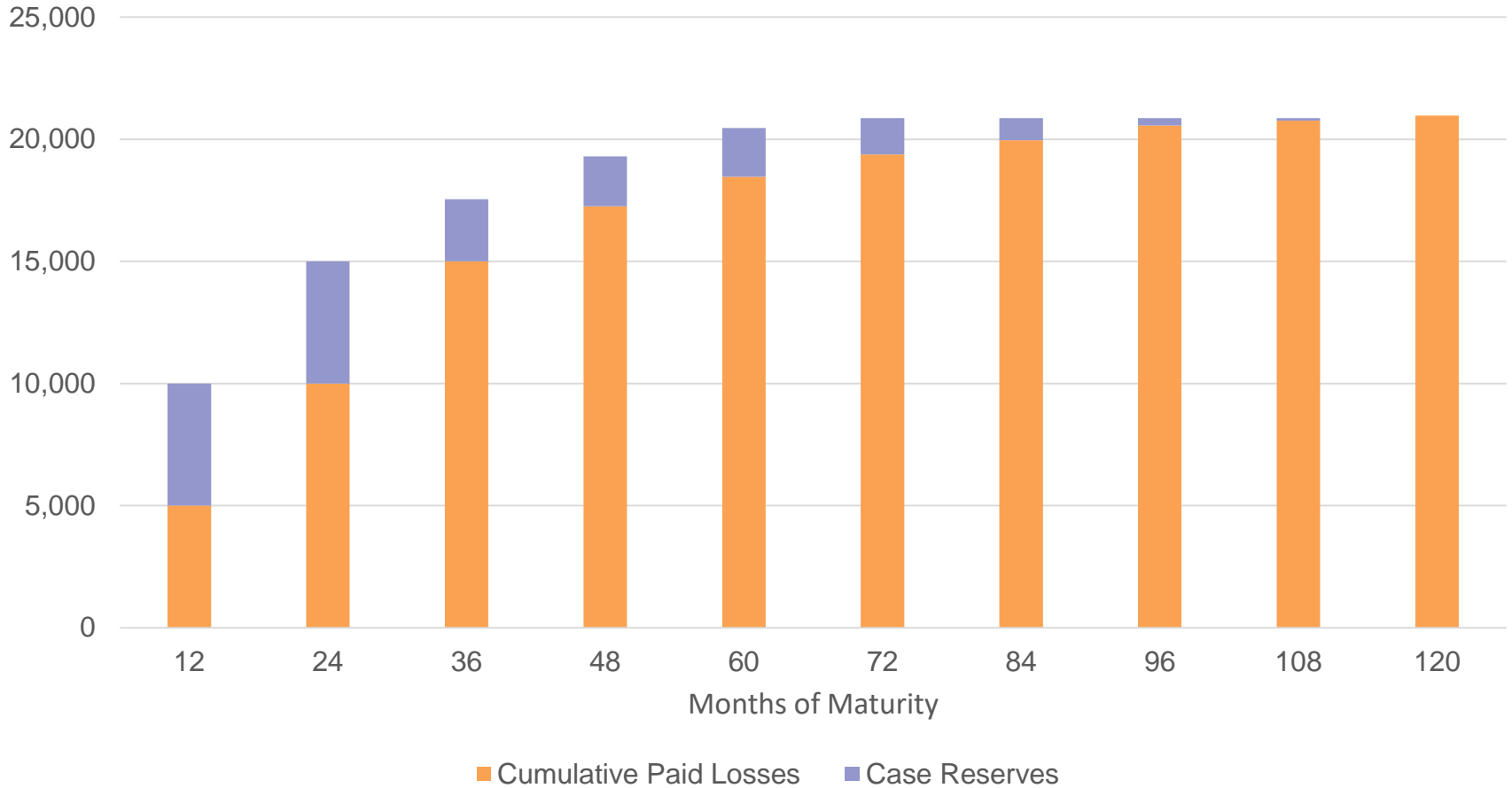
Policy Period	Maturity @ 12/31/19	Age to Ultimate Factor	% of Ultimate Paid
2010	120	1.00	100%
2011	108	1.01	99%
2012	96	1.02	98%
2013	84	1.05	95%
2014	72	1.08	93%
2015	60	1.13	88%
2016	48	1.21	82%
2017	36	1.34	75%
2018	24	2.00	50%
2019	12	4.00	25%

Loss Payment Pattern



# Reporting Patterns

Reported Losses (Cumulative Payments + Case Reserves) for Policy Period 2010



# Reported Loss Triangles

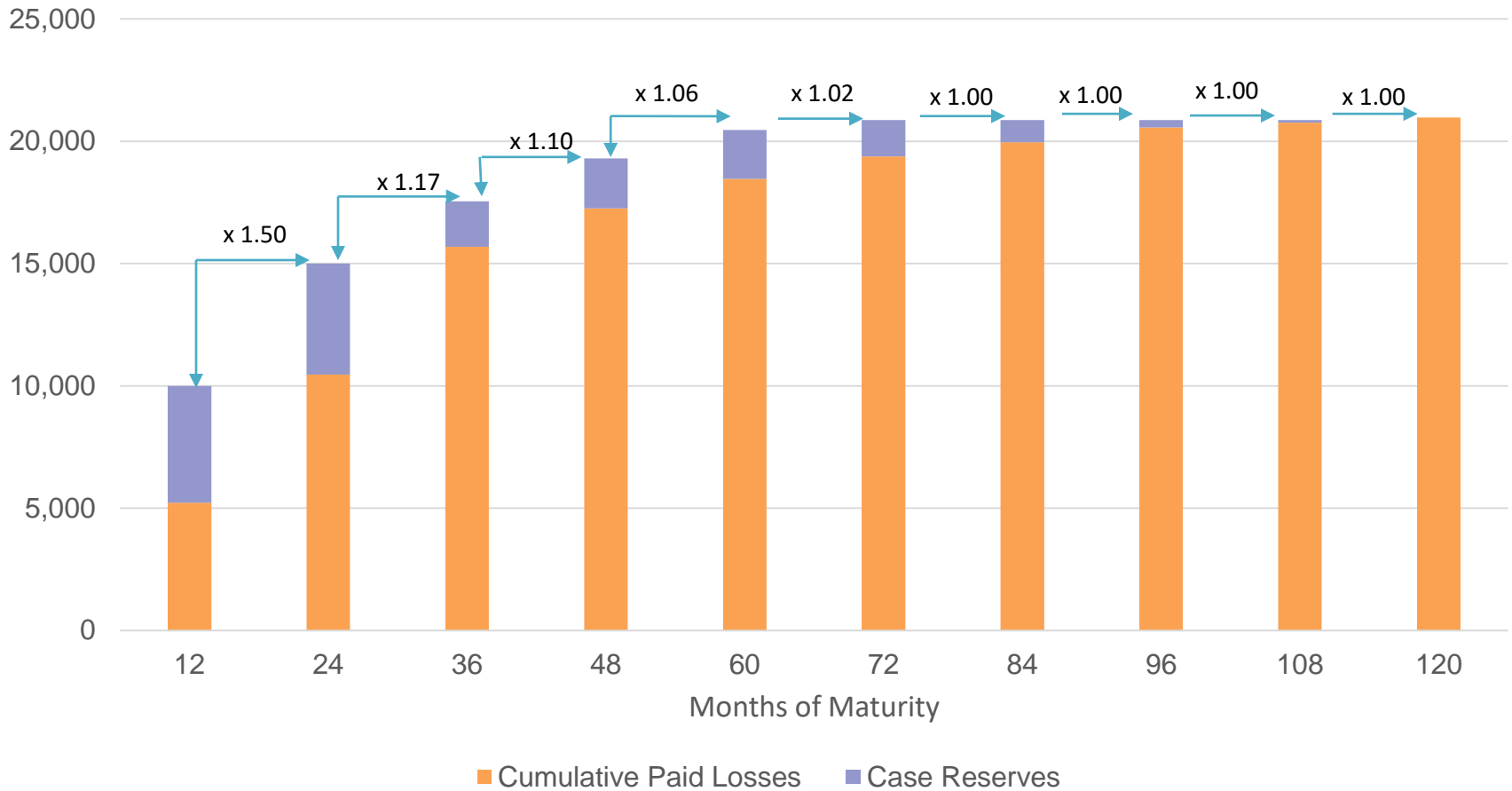
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Reported Losses  
By Policy Period  
At Annual Evaluations

<u>Policy Period</u>	<u>12</u>	<u>24</u>	<u>36</u>	<u>48</u>	<u>60</u>	<u>72</u>	<u>84</u>	<u>96</u>	<u>108</u>	<u>120</u>
2010	10,000	15,000	17,550	19,305	20,463	20,873	20,873	20,873	20,873	20,974
2011	11,500	17,020	19,403	20,955	22,003	22,223	22,667	22,894	23,123	
2012	16,200	24,138	28,000	30,240	31,450	32,079	32,399	32,723		
2013	17,500	26,775	30,256	32,071	33,995	33,995	33,995			
2014	16,000	24,000	28,080	29,765	31,253	31,566				
2015	14,000	20,860	23,989	25,668	26,952					
2016	14,500	21,895	24,960	26,708						
2017	14,500	22,040	25,566							
2018	15,000	22,200								
2019	20,000									

# Reporting Patterns

Reported Losses (Cumulative Payments + Case Reserves) for Policy Period 2010



# Reported Loss Age-to-Age Factors

Reported Losses  
By Policy Period  
At Annual Evaluations

Policy Period	<u>12</u>	<u>24</u>	<u>36</u>
2010	10,000	15,000	17,550
2011	11,500	17,020	19,403
2012	16,200	24,138	28,000
2013	17,500	26,775	30,256
2014	16,000	24,000	28,080
2015	14,000	20,860	23,989
2016	14,500	21,895	24,960
2017	14,500	22,040	25,566
2018	15,000	22,200	
2019	20,000		

Reported Loss Age-to-Age Factors  
By Policy Period

Policy Period	<u>12 - 24</u>	<u>24 - 36</u>	<u>36 - 48</u>
2010	1.50	1.17	1.10
2011	1.48	1.14	1.08
2012	1.49	1.16	1.08
2013	1.53	1.13	1.06
2014	1.50	1.17	1.06
2015	1.49	1.15	1.07
2016	1.51	1.14	1.07
2017	1.52	1.16	
2018	1.48		

# Reported Loss Age-to-Age Triangle

## Reported Loss Age-to-Age Factors By Policy Period

Policy Period	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>48-60</u>	<u>60-72</u>	<u>72-84</u>	<u>84-96</u>	<u>96-108</u>	<u>108-120</u>	<u>120+</u>
2010	1.50	1.17	1.10	1.06	1.02	1.00	1.00	1.00	1.00	
2011	1.48	1.14	1.08	1.05	1.01	1.02	1.01	1.01		
2012	1.49	1.16	1.08	1.04	1.02	1.01	1.01			
2013	1.53	1.13	1.06	1.06	1.00	1.00				
2014	1.50	1.17	1.06	1.05	1.01					
2015	1.49	1.15	1.07	1.05						
2016	1.51	1.14	1.07							
2017	1.52	1.16								
2018	1.48									

# Reported Loss Age-to-Age Triangle

Reported Loss Age-to-Age Factors  
By Policy Period

Policy Period	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>48-60</u>	<u>60-72</u>	<u>72-84</u>	<u>84-96</u>	<u>96-108</u>	<u>108-120</u>	<u>120+</u>
2010	1.50	1.17	1.10	1.06	1.02	1.00	1.00	1.00	1.00	
2011	1.48	1.14	1.08	1.05	1.01	1.02	1.01	1.01		
2012	1.49	1.16	1.08	1.04	1.02	1.01	1.01			
2013	1.53	1.13	1.06	1.06	1.00	1.00				
2014	1.50	1.17	1.06	1.05	1.01					
2015	1.49	1.15	1.07	1.05						
2016	1.51	1.14	1.07							
2017	1.52	1.16								
2018	1.48									
Selected	1.50	1.15	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00



# Reported Loss Age-to-Age Triangle

Reported Loss Age-to-Age Factors  
By Policy Period

Policy Period	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>48-60</u>	<u>60-72</u>	<u>72-84</u>	<u>84-96</u>	<u>96-108</u>	<u>108-120</u>	<u>120+</u>
2010	1.50	1.17	1.10	1.06	1.02	1.00	1.00	1.00	1.00	1.00
2011	1.48	1.14	1.08	1.05	1.01	1.02	1.01	1.01	1.00	1.00
2012	1.49	1.16	1.08	1.04	1.02	1.01	1.01	1.00	1.00	1.00
2013	1.53	1.13	1.06	1.06	1.00	1.00	1.01	1.00	1.00	1.00
2014	1.50	1.17	1.06	1.05	1.01	1.01	1.01	1.00	1.00	1.00
2015	1.49	1.15	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00
2016	1.51	1.14	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00
2017	1.52	1.16	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00
2018	1.48	1.15	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00
Selected	1.50	1.15	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00

# Reported Loss Age-to-Ultimate Factors

Reported Loss Age-to-Age Factors  
By Policy Period

Policy Period	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>48-60</u>	<u>60-72</u>	<u>72-84</u>	<u>84-96</u>	<u>96-108</u>	<u>108-120</u>	<u>120+</u>
2010	1.50	1.17	1.10	1.06	1.02	1.00	1.00	1.00	1.00	1.00
2011	1.48	1.14	1.08	1.05	1.01	1.02	1.01	1.01	1.00	1.00
2012	1.49	1.16	1.08	1.04	1.02	1.01	1.01	1.00	1.00	1.00
2013	1.53	1.13	1.06	1.06	1.00	1.00	1.01	1.00	1.00	1.00
2014	1.50	1.17	1.06	1.05	1.01	1.01	1.01	1.00	1.00	1.00
2015	1.49	1.15	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00
2016	1.51	1.14	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00
2017	1.52	1.16	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00
2018	1.48	1.15	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00
Selected	1.50	1.15	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00
Age to Ultimate Factor						1.02	1.01	1.00	1.00	1.00

# Reported Loss Age-to-Ultimate Factors

Reported Loss Age-to-Age Factors  
By Policy Period

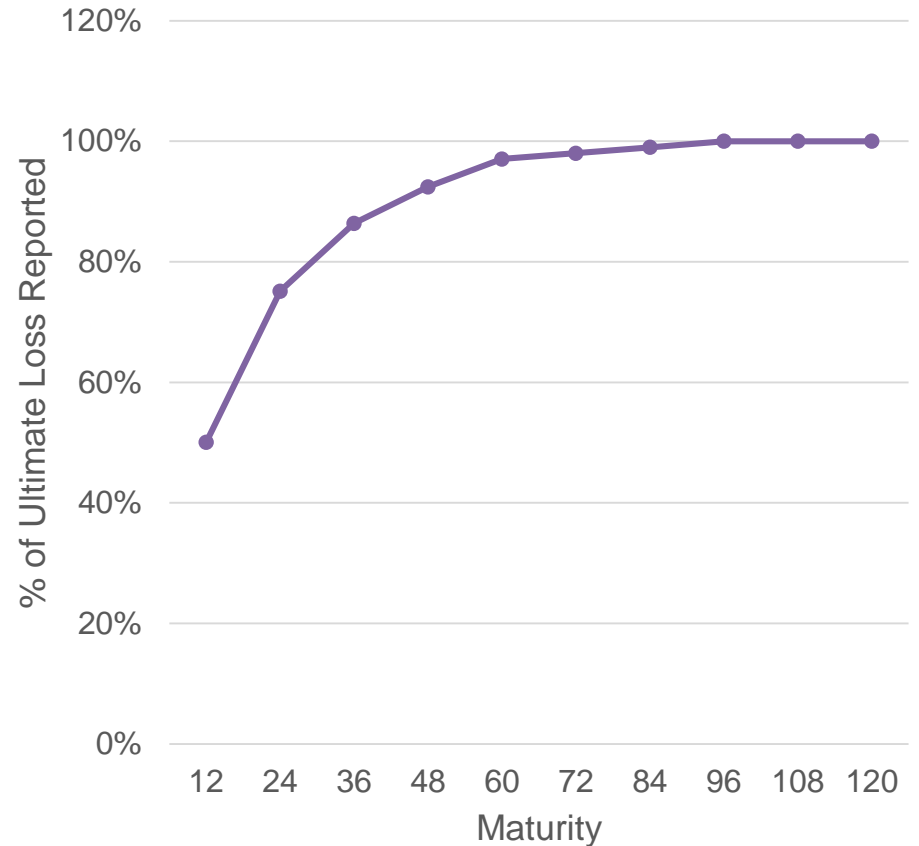
Policy Period	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>48-60</u>	<u>60-72</u>	<u>72-84</u>	<u>84-96</u>	<u>96-108</u>	<u>108-120</u>	<u>120+</u>
2010	1.50	1.17	1.10	1.06	1.02	1.00	1.00	1.00	1.00	1.00
2011	1.48	1.14	1.08	1.05	1.01	1.02	1.01	1.01	1.00	1.00
2012	1.49	1.16	1.08	1.04	1.02	1.01	1.01	1.00	1.00	1.00
2013	1.53	1.13	1.06	1.06	1.00	1.00	1.01	1.00	1.00	1.00
2014	1.50	1.17	1.06	1.05	1.01	1.01	1.01	1.00	1.00	1.00
2015	1.49	1.15	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00
2016	1.51	1.14	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00
2017	1.52	1.16	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00
2018	1.48	1.15	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00
Selected	1.50	1.15	1.07	1.05	1.01	1.01	1.01	1.00	1.00	1.00
Age to Ultimate Factor	2.00	1.33	1.16	1.08	1.03	1.02	1.01	1.00	1.00	1.00

# Reported Loss Pattern

## Age to Ultimate Factors By Policy Period

<u>Policy Period</u>	<u>Maturity @ 12/31/19</u>	<u>Age to Ultimate Factor</u>	<u>% of Ultimate Reported</u>
2010	120	1.00	100%
2011	108	1.00	100%
2012	96	1.00	100%
2013	84	1.01	99%
2014	72	1.02	98%
2015	60	1.03	97%
2016	48	1.08	92%
2017	36	1.16	86%
2018	24	1.33	75%
2019	12	2.00	50%

## Reported Loss Pattern

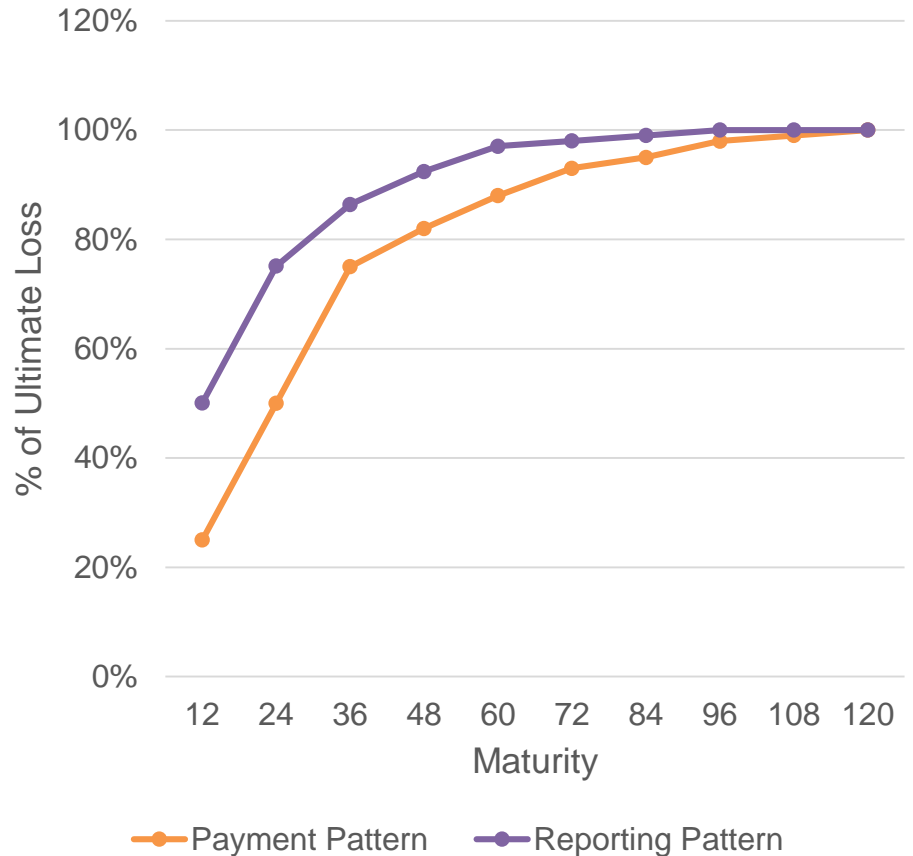


# Payment Pattern vs. Reporting Pattern

Age to Ultimate Factors  
By Policy Period

<u>Policy Period</u>	<u>Maturity @ 12/31/19</u>	<u>% of Ultimate Paid</u>	<u>% of Ultimate Reported</u>
2010	120	100%	100%
2011	108	99%	100%
2012	96	98%	100%
2013	84	95%	99%
2014	72	93%	98%
2015	60	88%	97%
2016	48	82%	92%
2017	36	75%	86%
2018	24	50%	75%
2019	12	25%	50%

Development Patterns



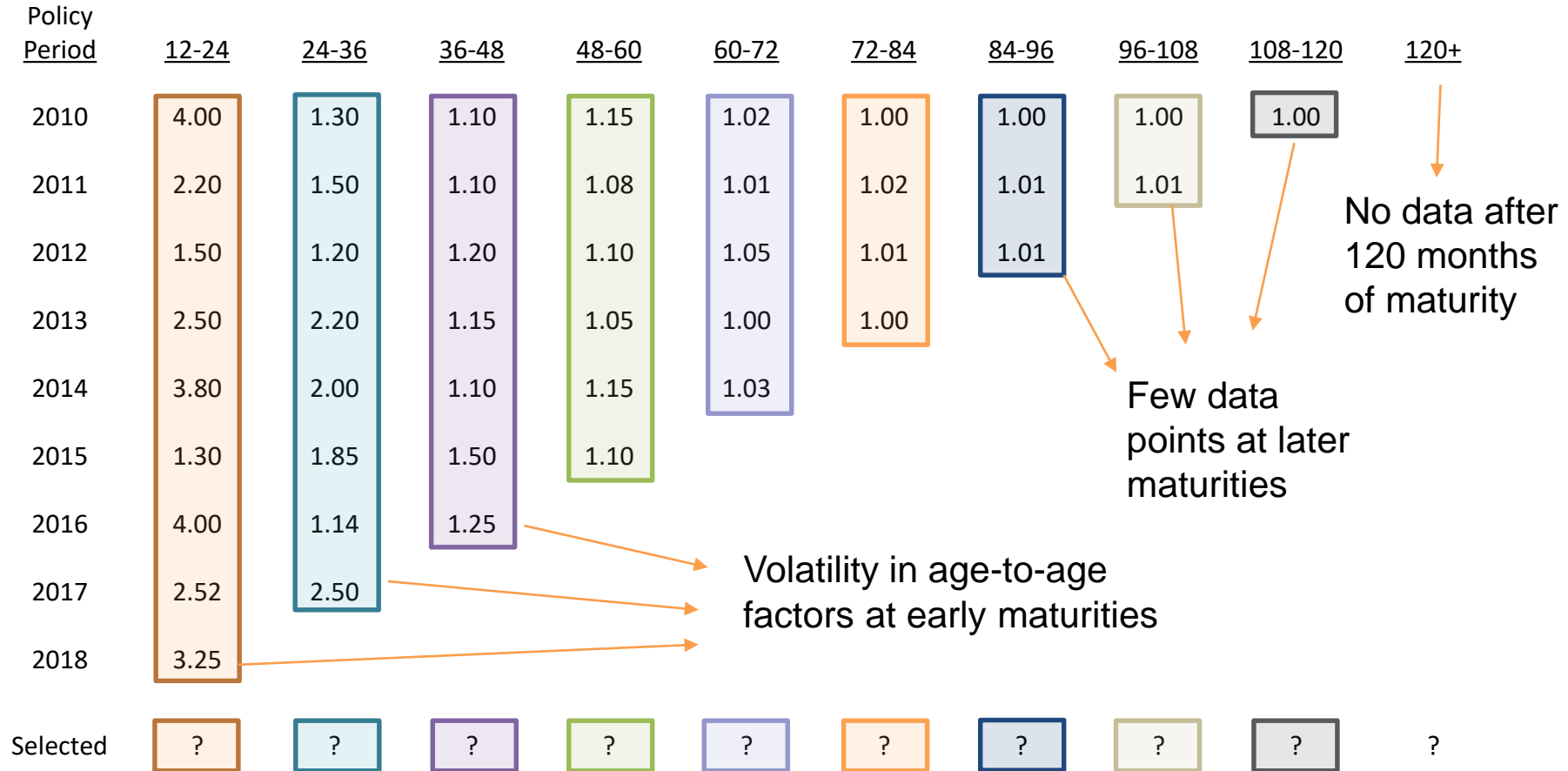
# Common Situations for Self-Insureds

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- Limited data
  - Large self-insured/funding programs typically have sufficient data
  - Smaller self-insured/funding programs may have limited data that can be supplemented with relevant external benchmark data
  - Some programs don't have sufficient data for analysis and require external benchmarks to produce an actuarial unpaid estimate

# Incorporating Industry Information

Reported Loss Age-to-Age Factors  
By Policy Period



# Incorporating Industry Information

## Reported Loss Age-to-Age Factors By Policy Period

Policy Period	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>48-60</u>	<u>60-72</u>	<u>72-84</u>	<u>84-96</u>	<u>96-108</u>	<u>108-120</u>	<u>120+</u>
2010	4.00	1.30	1.10	1.15	1.02	1.00	1.00	1.00	1.00	
2011	2.20	1.50	1.10	1.08	1.01	1.02	1.01	1.01		
2012	1.50	1.20	1.20	1.10	1.05	1.01	1.01			
2013	2.50	2.20	1.15	1.05	1.00	1.00				
2014	3.80	2.00	1.10	1.15	1.03					
2015	1.30	1.85	1.50	1.10						
2016	4.00	1.14	1.25							
2017	2.52	2.50								
2018	3.25									
Industry Benchmark	1.80	1.50	1.30	1.15	1.05	1.01	1.01	1.01	1.01	1.02
Selected	?	?	?	?	?	?	?	?	?	?



# Common Situations for Self-Insureds

---

- Recent changes
  - Changes to the self-insurance program, claims handling, underlying business, etc..., can distort historical patterns
- Examples of changes impacting development patterns
  - Loss prevention/safety
  - Underlying business
  - Legal environment
  - Claims handling
  - Self-insurance program

# Polling Question

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Which of the following would cause a 'policy year' effect to loss development factors?

- A** Case reserves strengthening
- B** Additional loss prevention/safety initiatives
- C** Change in closure rates

Polling Question #1

# Recent Changes – Policy Period Effects

Reported Loss Age-to-Age Factors  
By Policy Period

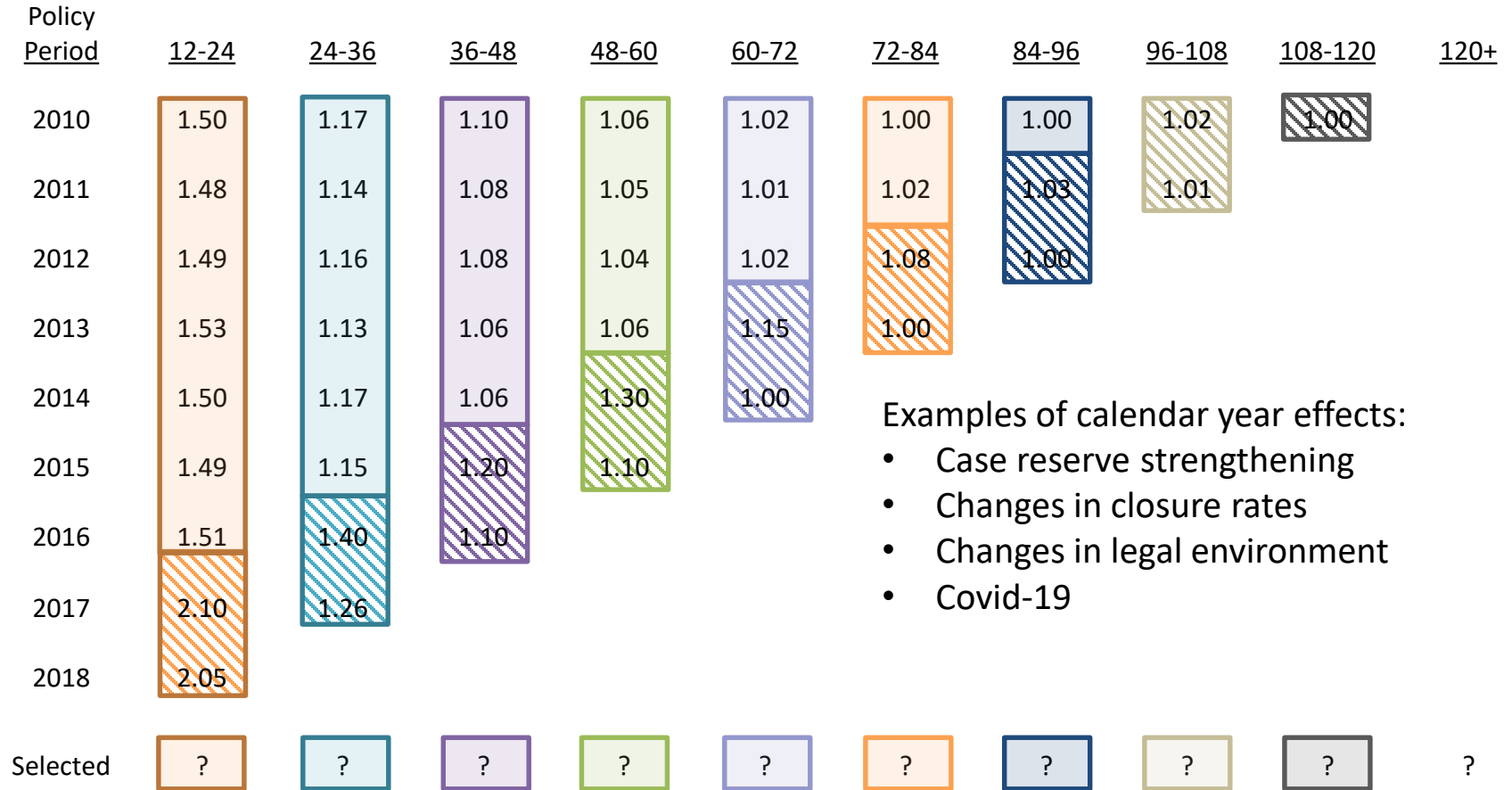
Policy Period	12-24	24-36	36-48	48-60	60-72	72-84	84-96	96-108	108-120	120+
2010	1.50	1.17	1.10	1.06	1.02	1.00	1.00	1.00	1.00	
2011	1.48	1.14	1.08	1.05	1.01	1.02	1.01	1.01		
2012	1.49	1.16	1.08	1.04	1.02	1.01	1.01			
2013	1.53	1.13	1.06	1.06	1.00	1.00				
2014	1.50	1.17	1.06	1.05	1.01					
2015	1.49	1.15	1.07	1.05						
2016	2.00	1.25	1.1							
2017	2.10	1.26								
2018	2.05									
Selected	?	?	?	?	?	?	?	?	?	?

Examples of policy period effects:

- Loss prevention/safety initiatives
- Changes in underlying business
- Changes in legal environment
- Changes in self-insurance program

# Recent Changes – Calendar Year Effects

Reported Loss Age-to-Age Factors  
By Policy Period



Examples of calendar year effects:

- Case reserve strengthening
- Changes in closure rates
- Changes in legal environment
- Covid-19

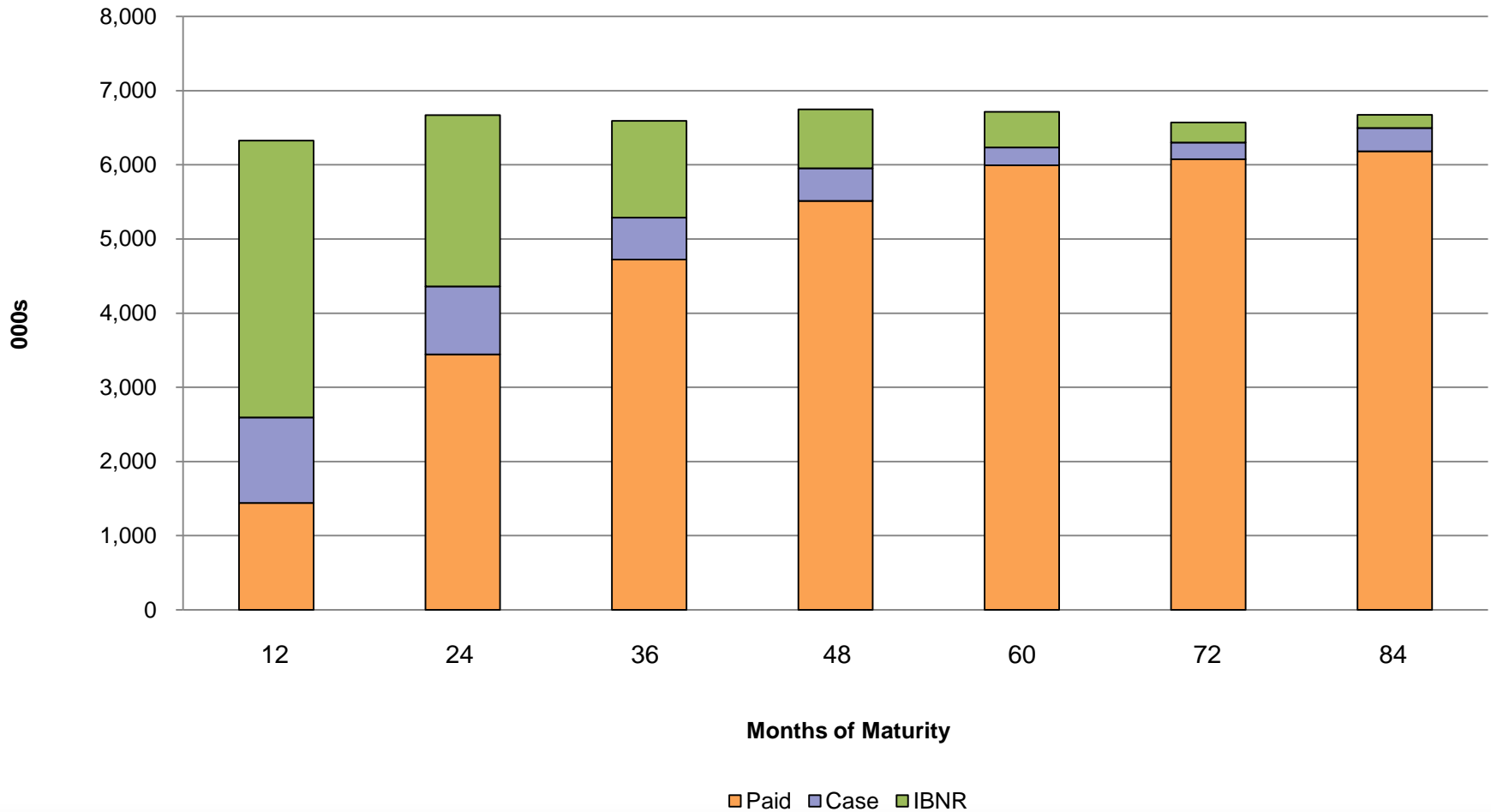
# Estimating Ultimate Loss

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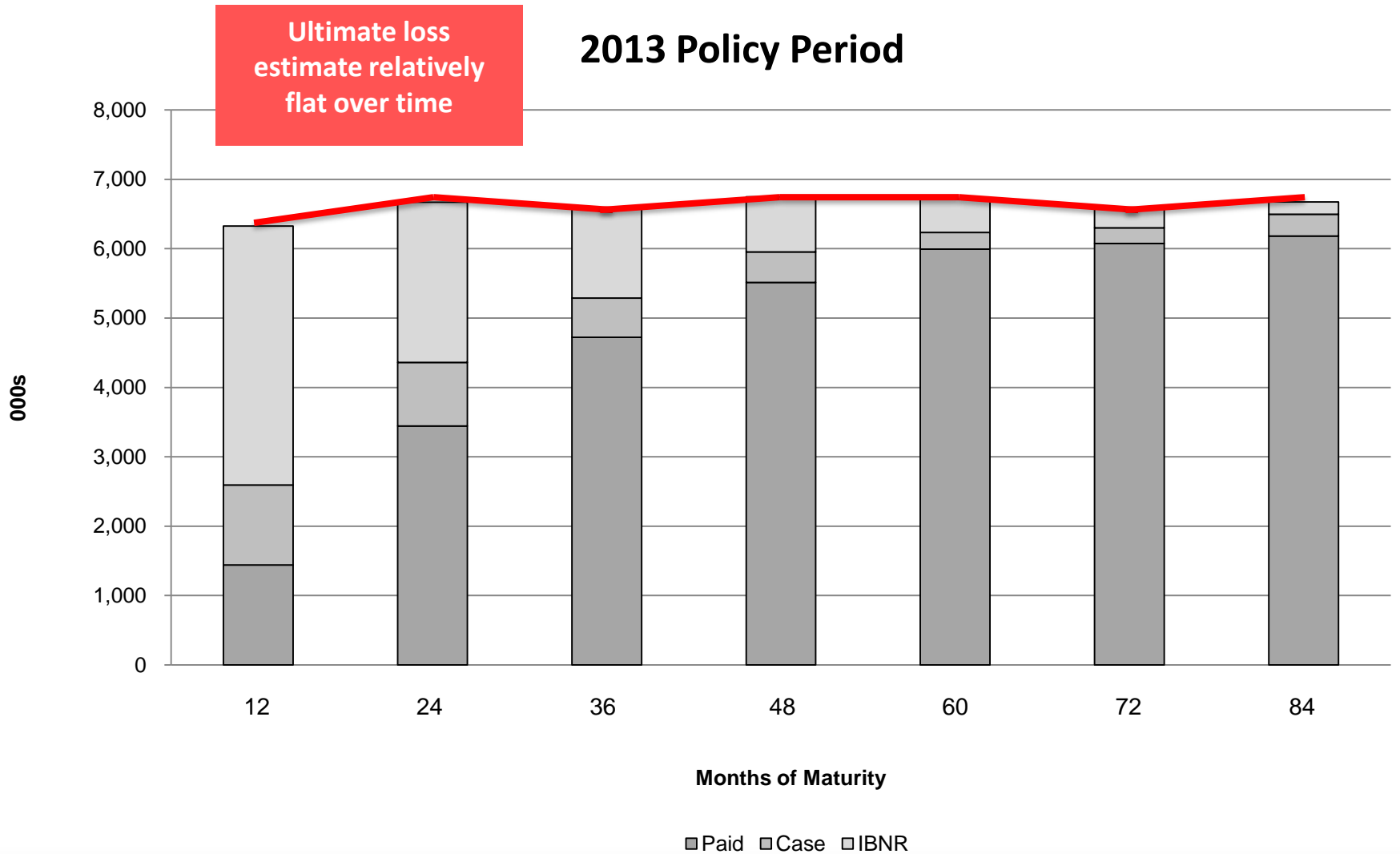
- Ultimate loss – total claim payments after all claims have been reported and settled.
- Components of ultimate loss
  - Paid loss
  - Case reserves
  - IBNR reserves
- Case and IBNR components will be 0 after all claims are reported and settled
- Ultimate loss estimate changes over time as claims develop

# Components of Ultimate Loss

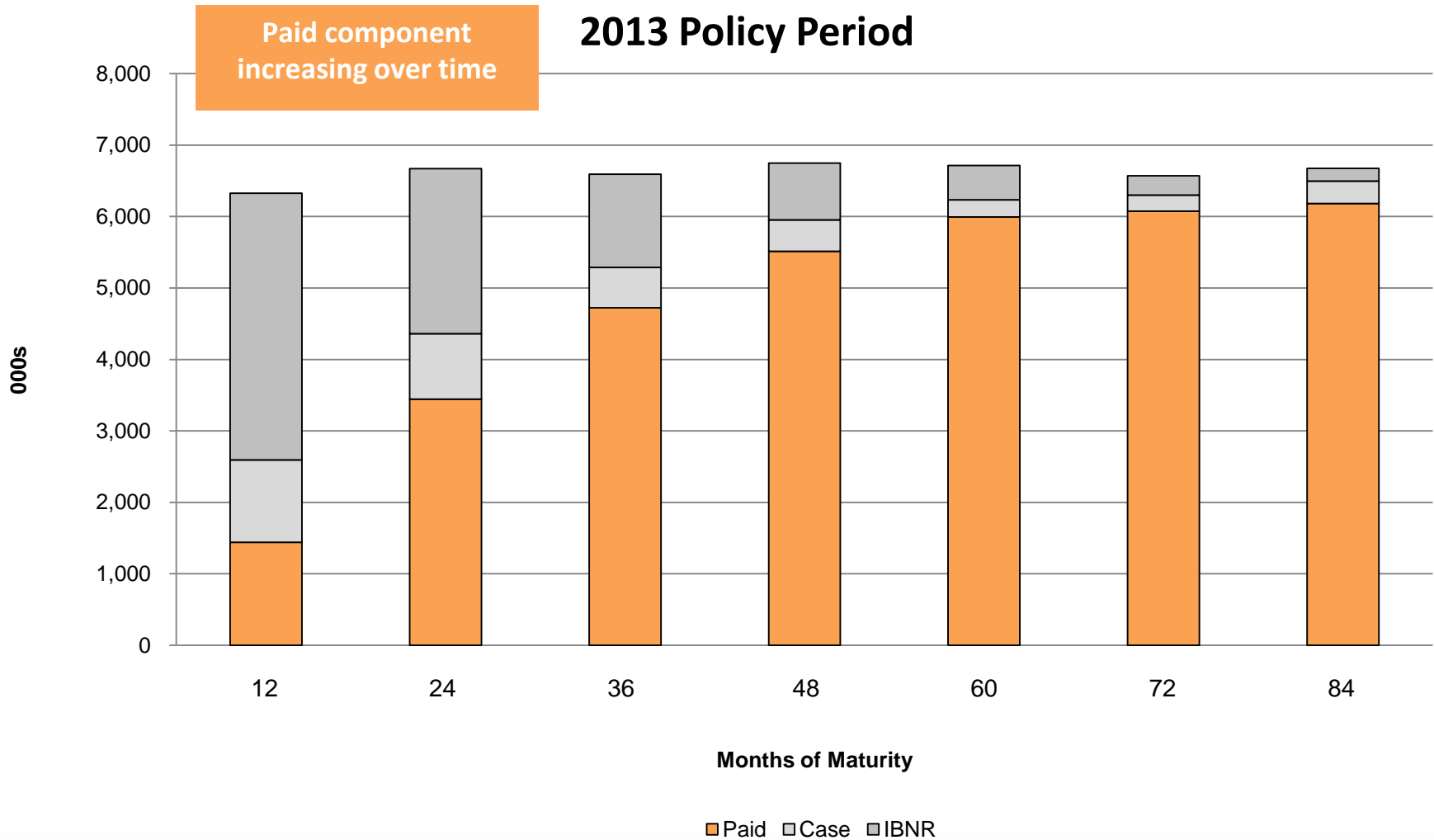
## 2013 Policy Period



# Components of Ultimate Loss

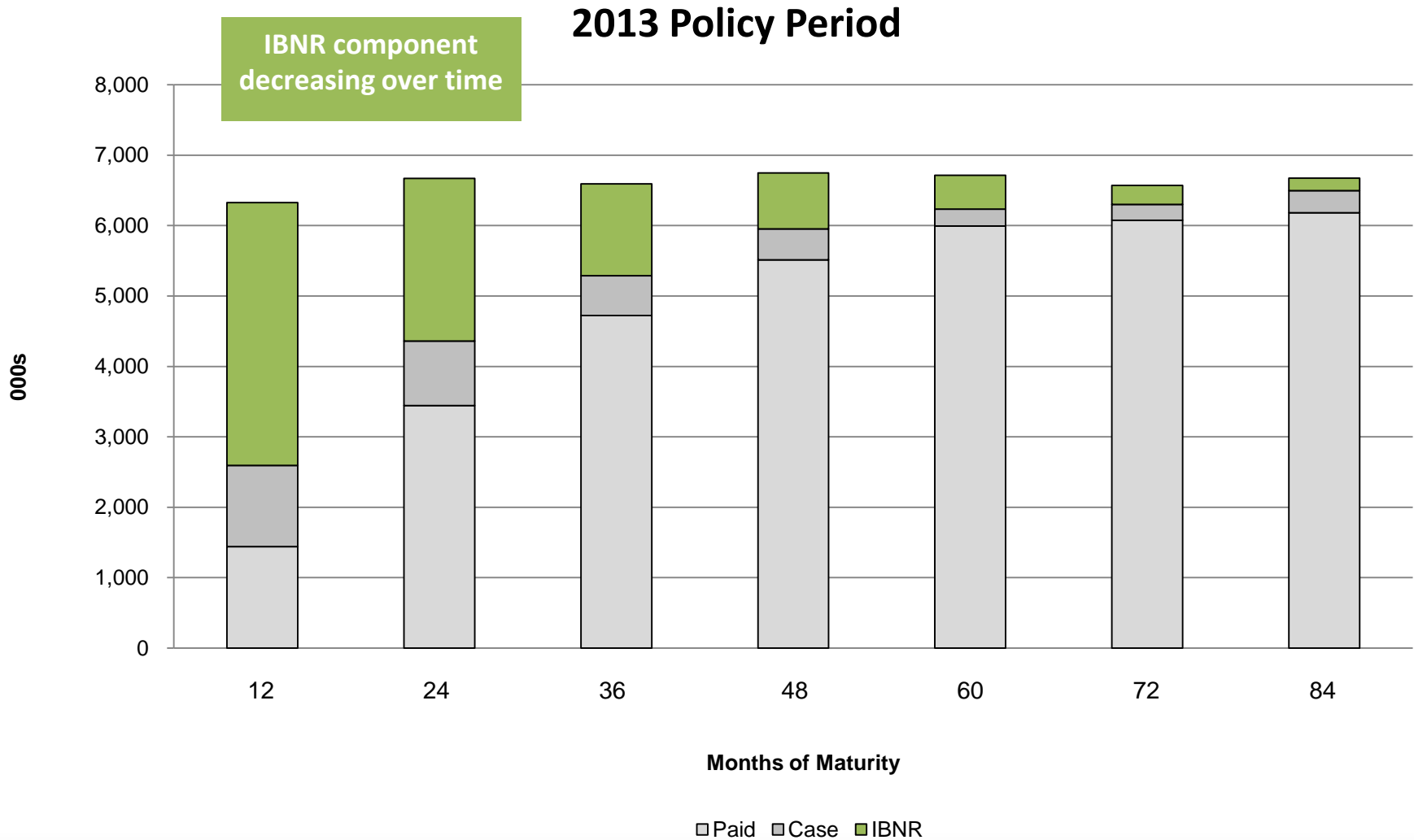


# Components of Ultimate Loss





# Components of Ultimate Loss



# Estimating Ultimate Loss: Methods

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- Common ultimate loss estimation methods
  - Loss development method
  - Expected loss method
  - Bornhuetter-Ferguson (BF) method
- Other ultimate loss estimation methods
  - Case reserve development method
  - Benktander method
    - Also referred to as Iterated BF method
  - Counts and averages methods
  - Stochastic loss reserving

# Loss Development Method

---

- Ultimate loss =
  - (Reported loss to date) x (Reported age to ultimate factor)
  - (Paid loss to date) x (Paid age to ultimate factor)
- Assumptions
  - Claims will develop similarly to past experience
- Considerations
  - Relies fully on claims experience to date
  - Requires reliable development patterns
  - Can be distorted by changing claims environment
  - Sensitive to loss experience for immature policy periods

# Loss Development Method

<u>Policy Period</u>	<u>Maturity @ 12/31/19</u>	<u>% of Ultimate Reported</u>	<u>Age to Ultimate Factor</u>	<u>Reported Loss to Date</u>	<u>Development Method Estimate</u>
2010	120	100%	1.00	20,974	20,974
2011	108	100%	1.00	23,123	23,123
2012	96	100%	1.00	32,723	32,723
2013	84	99%	1.01	33,995	34,335
2014	72	98%	1.02	31,566	32,197
2015	60	97%	1.03	26,952	27,761
2016	48	92%	1.08	26,708	28,845
2017	36	86%	1.16	25,566	29,657
2018	24	75%	1.33	22,200	29,526
2019	12	50%	2.00	20,000	40,000

Equal to reported loss to date when age to ultimate factor is 1.00

Sensitive to loss experience in most recent policy periods.

# Case Reserve Development Method

---

- Ultimate loss =
  - (Paid loss to date) + (Case reserves to date) x (Case age to ultimate factor)
- Case age to ultimate factor =
  - $1 + (\text{Reported age to ultimate factor} - 1) \times (\text{Paid age to ultimate factor}) / (\text{Paid age to ultimate factor} - \text{Reported age to ultimate factor})$
- Assumptions
  - Claims will develop similarly to past experience
  - Case reserves to date provide useful information
- Considerations
  - Relies fully on claims experience to date
  - Requires reliable development patterns
  - Can be distorted by changing claims environment
  - Can be distorted by case reserves for large losses

# Case Reserve Development Method

<u>Policy Period</u>	<u>Maturity @ 12/31/19</u>	<u>Reported Age to Ultimate Factor</u>	<u>Paid Age to Ultimate Factor</u>	<u>Paid Loss to Date</u>	<u>Case Reserve to Date</u>	<u>Case Age to Ultimate Factor</u>	<u>Case Reserve Method Estimate</u>
2010	120	1.00	1.00	20,974	0	1.00	20,974
2011	108	1.00	1.01	23,016	107	1.00	23,124
2012	96	1.00	1.02	32,619	104	1.00	32,725
2013	84	1.01	1.05	33,417	578	1.26	34,024
2014	72	1.02	1.08	31,183	383	1.36	31,597
2015	60	1.03	1.13	24,075	2,877	1.34	27,326
2016	48	1.08	1.21	23,257	3,451	1.74	27,433
2017	36	1.16	1.34	15,753	9,813	2.19	28,902
2018	24	1.33	2.00	10,117	12,083	2.00	34,283
2019	12	2.00	4.00	6,347	13,653	3.00	60,959

$$= 33,417 + 578 * 1.26$$

$$= 1 + [(1.08 - 1) * (1.21)] / (1.21 - 1.08)$$

May be distorted by case reserves for large losses.

# Expected Loss Method

---

- Initial estimate of ultimate loss
- Considerations
  - May be more reliable for immature policy periods
  - Can be used to reflect changing claims environment
  - Does not reflect claims experience to date

# Initial Expected Loss Estimate

Commonly based on historical experience adjusted for trend and/or other changes

Calculation of Initial Expected Loss Estimate

<u>Policy Period</u>	<u>Prior Ultimate Loss</u>	<u>Exposure</u>	<u>Loss Cost</u>	<u>Trend Factor</u>	<u>Trended Loss Cost</u>	
2010	21,000	42,000	500	1.30	652	More mature experience suggests a higher expected loss cost
2011	23,000	42,000	548	1.27	694	
2012	33,000	42,000	786	1.23	966	
2013	34,000	42,000	810	1.19	967	
2014	35,000	42,000	833	1.16	966	
2015	28,000	42,000	667	1.13	750	
2016	22,000	42,000	524	1.09	572	Recent data may suggest improved loss costs
2017	21,000	42,000	500	1.06	530	
2018	20,500	42,000	488	1.03	503	

2019 Initial Expected Losses = 2019 Initial Expected Loss Cost x 2019 Exposure



# Expected Loss Method

<u>Policy Period</u>	<u>Maturity @ 12/31/19</u>	<u>Age to Ultimate Factor</u>	<u>% of Ultimate Reported</u>	<u>Reported Loss to Date</u>	<u>Development Method Estimate</u>	<u>Initial Expected Loss</u>
2010	120	1.00	100%	20,974	20,974	30,000
2011	108	1.00	100%	23,123	23,123	30,000
2012	96	1.00	100%	32,723	32,723	30,000
2013	84	1.01	99%	33,995	34,335	30,000
2014	72	1.02	98%	31,566	32,197	30,000
2015	60	1.03	97%	26,952	27,761	30,000
2016	48	1.08	92%	26,708	28,845	30,000
2017	36	1.16	86%	25,566	29,657	29,000
2018	24	1.33	75%	22,200	29,526	29,000
2019	12	2.00	50%	20,000	40,000	28,000

Does not reflect claims experience to date.

May be more reliable for immature policy periods.

# BF Method

---

- Ultimate loss =
  - (Reported loss to date) + (Initial expected loss) x (% of loss unreported)
  - (Paid loss to date) + (Initial expected loss) x (% of loss unpaid)
- Assumptions
  - Use development patterns to determine % of ultimate loss unreported
  - Unreported ultimate loss (IBNR) will develop based on initial expected loss
- Considerations
  - Credibility weighted average of expected loss method and development method
  - Provides stability while still responding to claims experience

# BF Method

<u>Policy Period</u>	<u>Reported Loss to Date</u>	<u>% of Ultimate Unreported</u>	<u>Initial Expected Loss</u>	<u>Expected Unreported Loss</u>	<u>BF Method Estimate</u>
2010	20,974	0%	30,000	0	20,974
2011	23,123	0%	30,000	0	23,123
2012	32,723	0%	30,000	0	32,723
2013	33,995	1%	30,000	300	34,295
2014	31,566	2%	30,000	600	32,166
2015	26,952	3%	30,000	900	27,852
2016	26,708	8%	30,000	2,400	29,108
2017	25,566	14%	29,000	4,060	29,626
2018	22,200	25%	29,000	7,250	29,450
2019	20,000	50%	28,000	14,000	34,000

Development patterns determine % of ultimate loss unreported. Unreported ultimate loss will develop according to initial expected loss

Expected unreported loss = Initial expected loss x % of ultimate unreported

BF method estimate = Reported loss to date + Expected unreported loss

# Polling Question

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Given the following output for 2019, what method would you give the most weight?

<u>Policy Period</u>	<u>Reported Loss to Date</u>	<u>% of Ultimate Reported</u>	<u>Development Method Estimate</u>	<u>Case Reserve Method Estimate</u>	<u>Expected Loss Method Estimate</u>	<u>BF Method Estimate</u>
2019	20,000	50%	40,000	60,959	28,000	34,000

- A** Development Method
- B** Case Reserve Method
- C** Expected Loss Method
- D** BF Method

Polling Question #2

# Selecting Ultimate Loss

<u>Policy Period</u>	<u>Reported Loss to Date</u>	<u>% of Ultimate Reported</u>	<u>Development Method Estimate</u>	<u>Case Reserve Method Estimate</u>	<u>Expected Loss Method Estimate</u>	<u>BF Method Estimate</u>	<u>Selected Ultimate Loss</u>
2010	20,974	100%	20,974	20,974	30,000	20,974	20,974
2011	23,123	100%	23,123	23,124	30,000	23,123	23,123
2012	32,723	100%	32,723	32,725	30,000	32,723	32,973
2013	33,995	99%	34,335	34,024	30,000	34,295	34,300
2014	31,566	98%	32,197	31,597	30,000	32,166	32,175
2015	26,952	97%	27,761	27,326	30,000	27,852	27,800
2016	26,708	92%	28,845	27,433	30,000	29,108	29,000
2017	25,566	86%	29,657	28,902	29,000	29,626	29,650
2018	22,200	75%	29,526	34,283	29,000	29,450	29,500
2019	20,000	50%	40,000	60,959	28,000	34,000	35,000

# IBNR = Selected Ultimate Loss - Paid - Case

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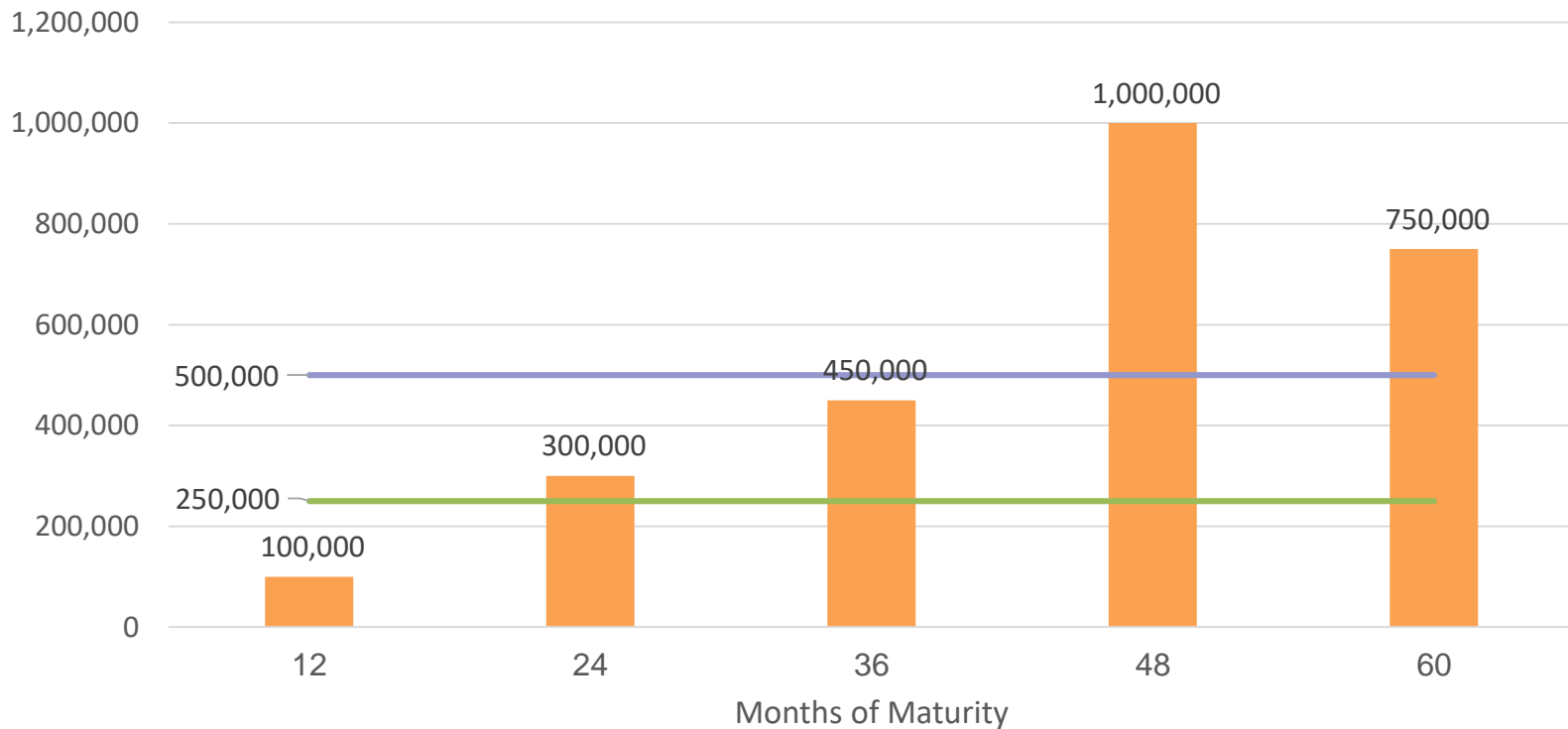
<u>Policy Period</u>	<u>Selected Ultimate Loss</u>	<u>Cumulative Paid Loss</u>	<u>Case Reserve</u>	<u>IBNR</u>
2010	20,974	20,974	0	0
2011	23,123	23,016	107	0
2012	32,973	32,619	104	250
2013	34,300	33,417	578	305
2014	32,175	31,183	383	609
2015	27,800	24,075	2,877	848
2016	29,000	23,257	3,451	2,292
2017	29,650	15,753	9,813	4,084
2018	29,500	10,117	12,083	7,300
2019	35,000	6,347	13,653	15,000

# Additional Considerations

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Development patterns will be affected by changes in retention

Cumulative Gross Reported Loss for Sample Claim



# Additional Considerations

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- Changes in claims handling procedures
  - How initial case reserves are set up
  - Relative adequacy of case reserves
  - Emphasis on speed of closing claims
  - Desire to fight claims
  - Staffing, number of claims per adjuster
  - Different third party administrator (TPA)
- Growing or shrinking book of business
  - Compare long-term and short-term averages of age-to-age factors
  - Stability vs responsiveness



# Communication

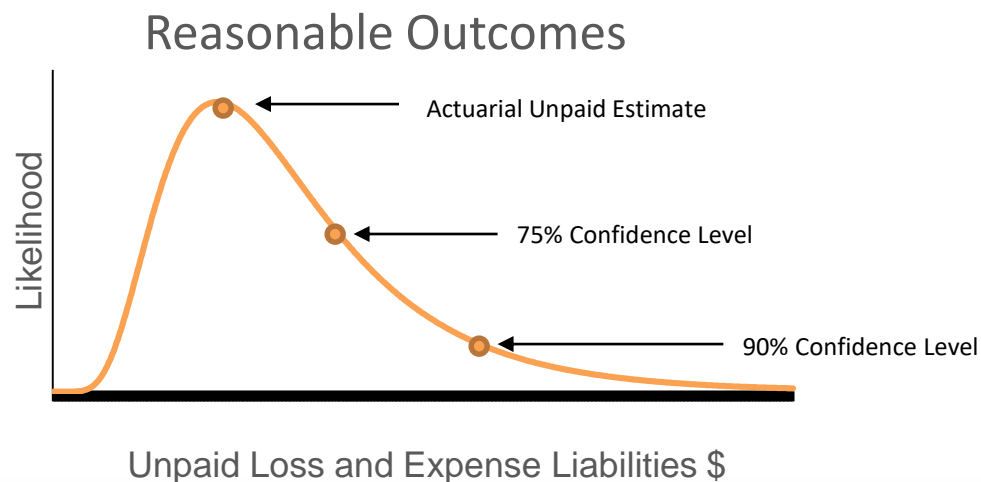
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- Discuss changes with your actuary
- Evaluate any report for reasonableness

# Conclusion

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- An estimate of IBNR requires actuarial judgment and assumptions in addition to empirical data
- The Actuarial Unpaid Estimate is the projected expected value over a range of reasonable outcome
- The ultimate losses will effect funding for the following policy year
- Communication of changes and other relevant information is important to understanding the story behind the numbers
- The results of any analysis should be evaluated for reasonableness



# Questions

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# Join Us for the Next Pinnacle APEX Webinar

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## PINNACLE APEX WEBINAR

Thursday, May 28

2:00 p.m. ET

Registration is Open



Greg Frankowiak



Radost Wenman

## The Importance of Data Management and Data Quality

# Final Notes

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- We'd like your feedback and suggestions
  - Please complete our [survey](#)
- For copies of this APEX presentation
  - Visit the [Resource Knowledge Center](#) at [Pinnacleactuaries.com](http://Pinnacleactuaries.com)



# Thank You for Your Attention

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