

GUY CARPENTER




Reserve Risk Models: Grey, White and Black Swans

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Lead Casualty Specialty Actuary

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“We are seeing things that were 25-standard deviation moves, several days in a row”

- David Viniar (2007), Goldman Sachs



“UBS’s specialists ...placed too much trust in statistical models.

In retrospect, models ...were far too optimistic and ultimately led to an underestimation of the risks.

By the end of 2009 ...UBS’s write-downs exceeded 50 billion francs.” (USD\$60 billion)

– UBS in transparency report to shareholders (2010)



“NASA seriously underestimated the dangers astronauts faced ...in the early 1980s...

At the time, managers thought there was only a 1-in-100,000 chance of losing a shuttle and its crew.

Engineers thought the probability was closer to 1 in 100.

But in reality, ...the odds were 1 in 10.”

– USA Today (2010)









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Can we get it right??

1. Reserve risk model
2. Reserve best estimate model

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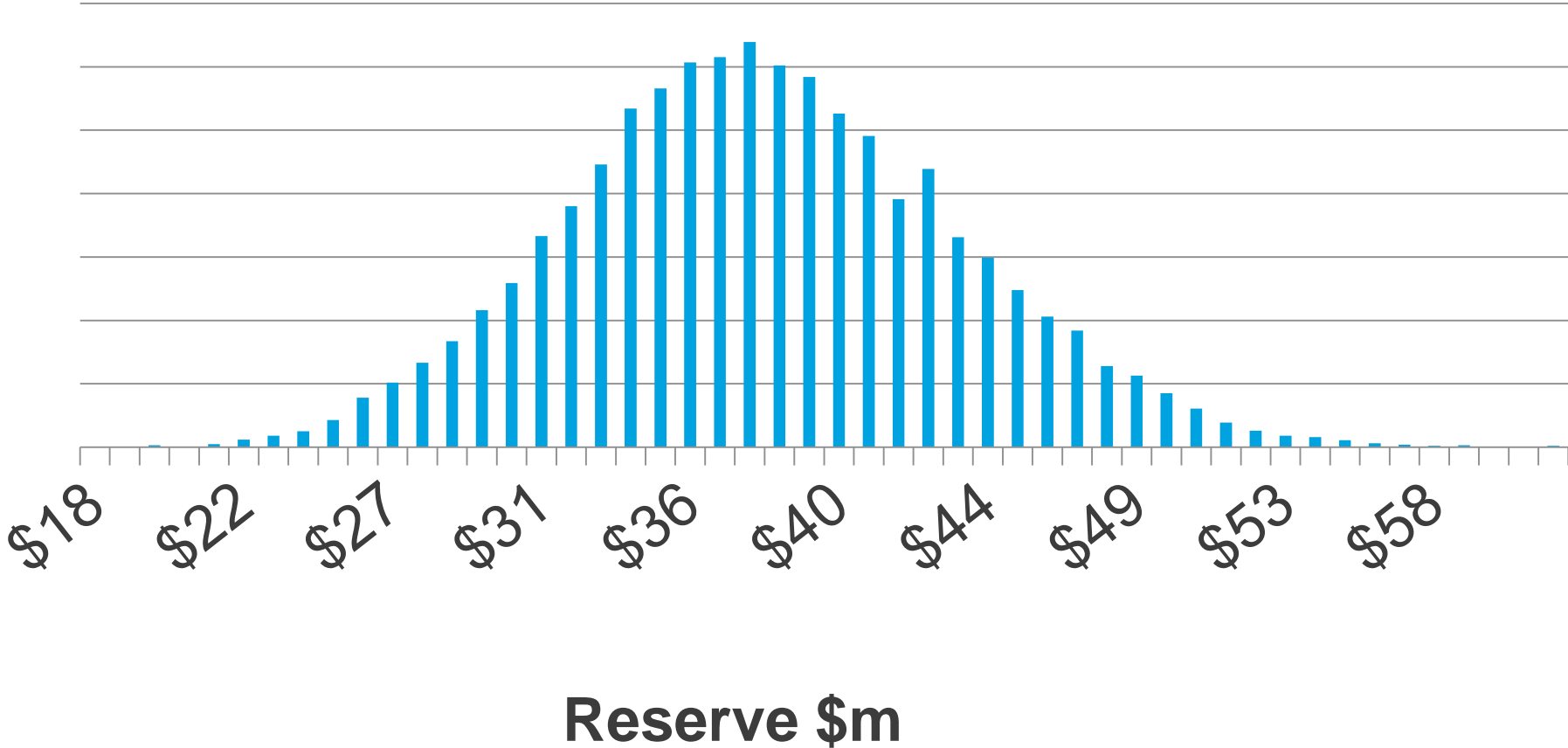
Reserve Risk Model – can we get it right?

1. Are we under-estimating capital?
2. Are we mis-allocating capital?

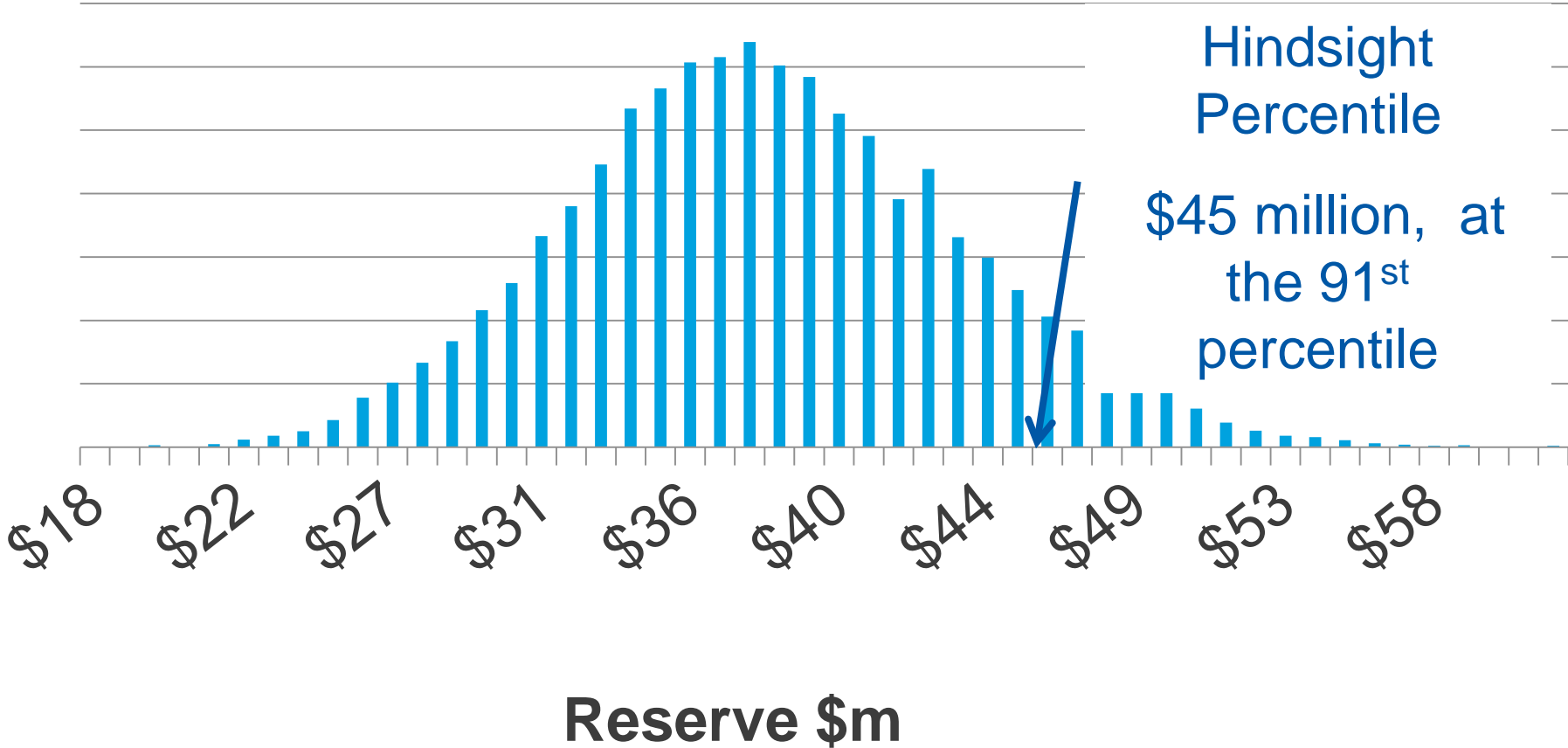
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Company A Distribution of Homeowners Unpaid as of 12/2000



Company A Distribution of Homeowners Unpaid as of 12/2000



51 Companies

Hindsight Percentile

Company A

91%

Company B

51%

Company C

6%

.....

.....

.....

.....

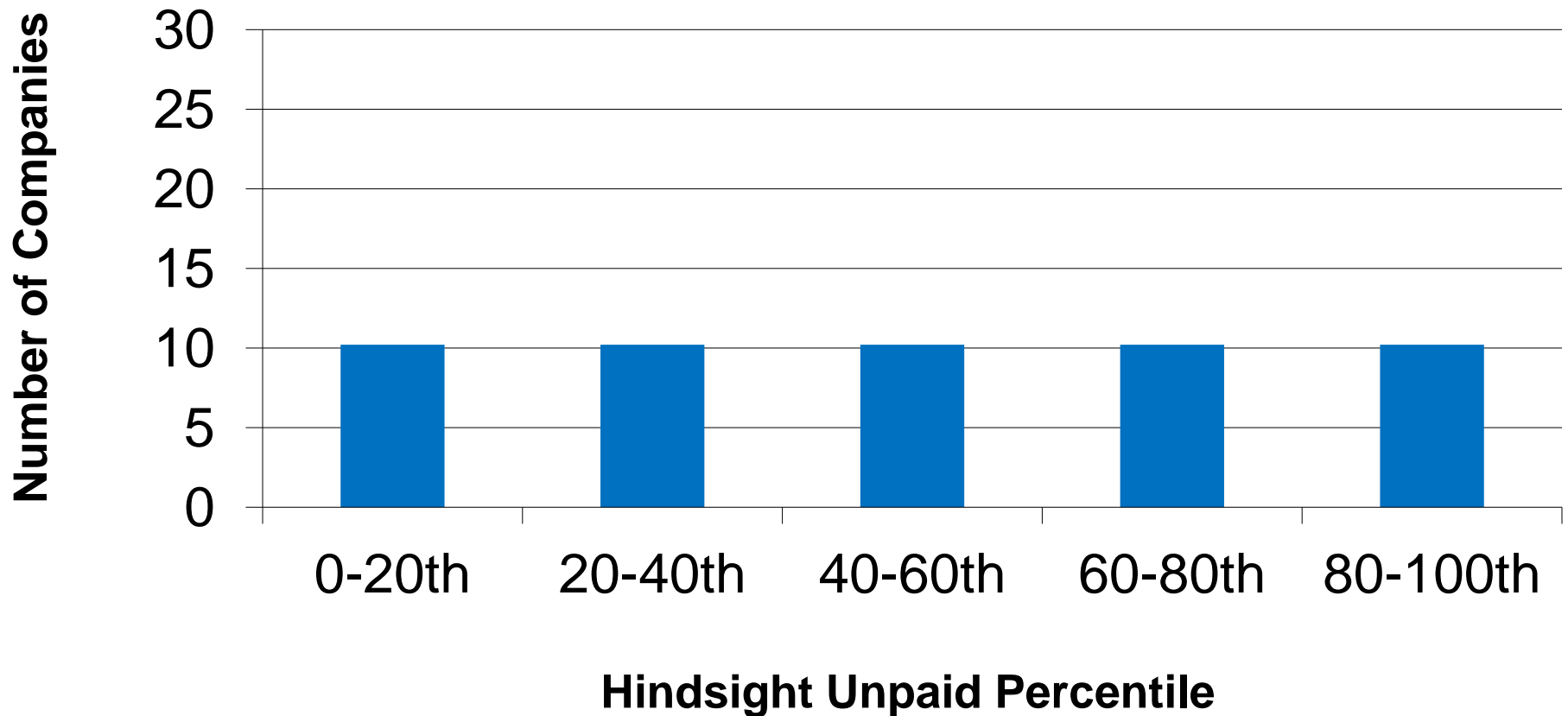
Company AA

85%

Company AB

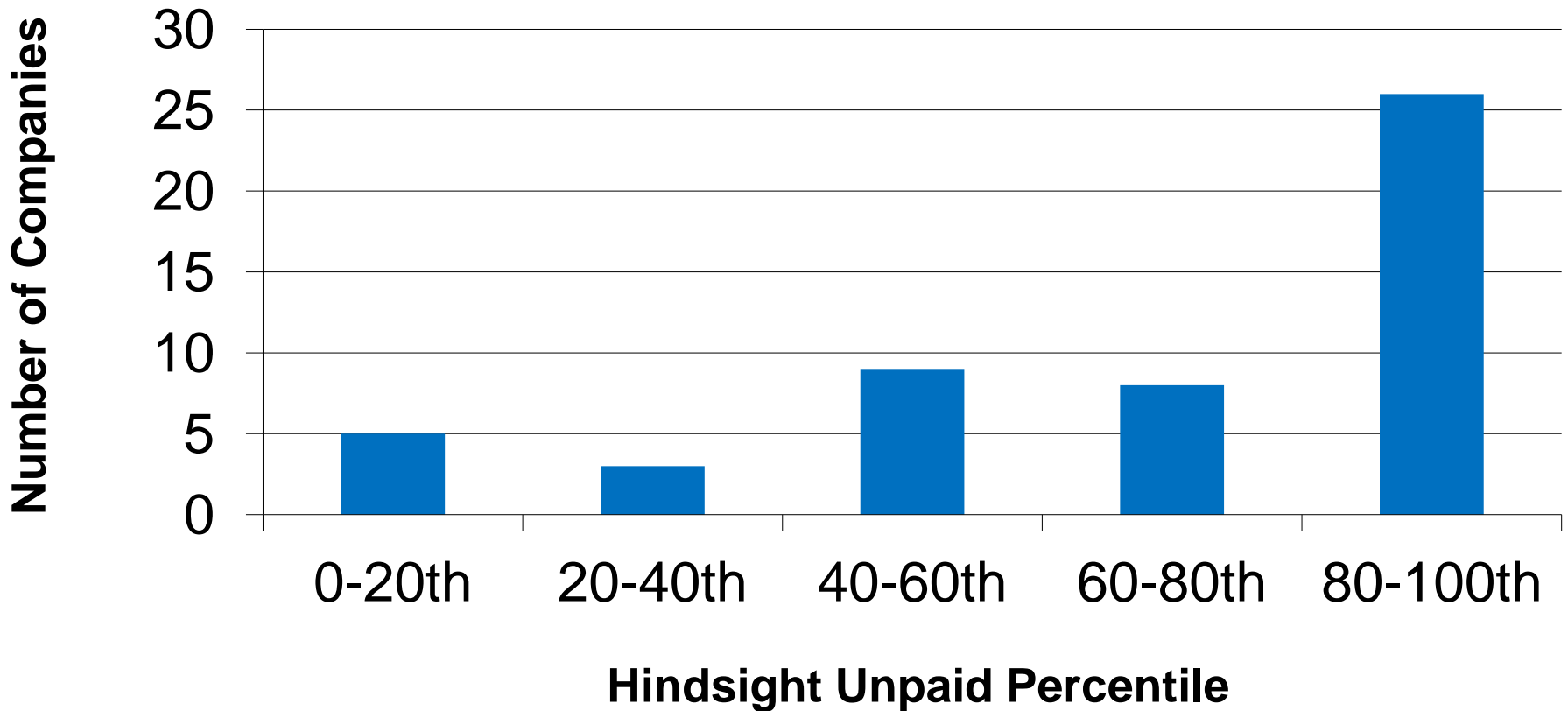
37%

Ideal Histogram of the Hindsight Percentile



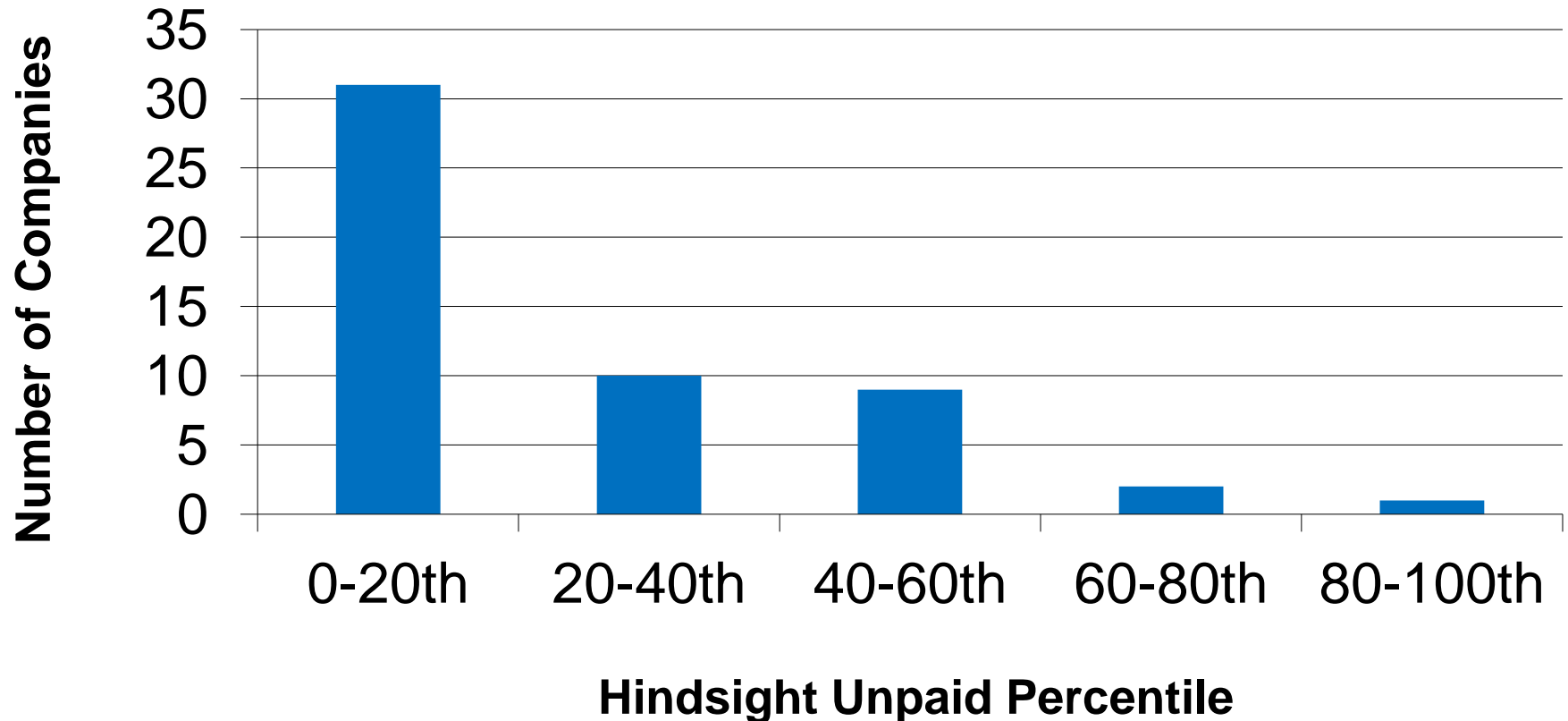
Homeowners as of 12/2000

Histogram of the Hindsight Percentile

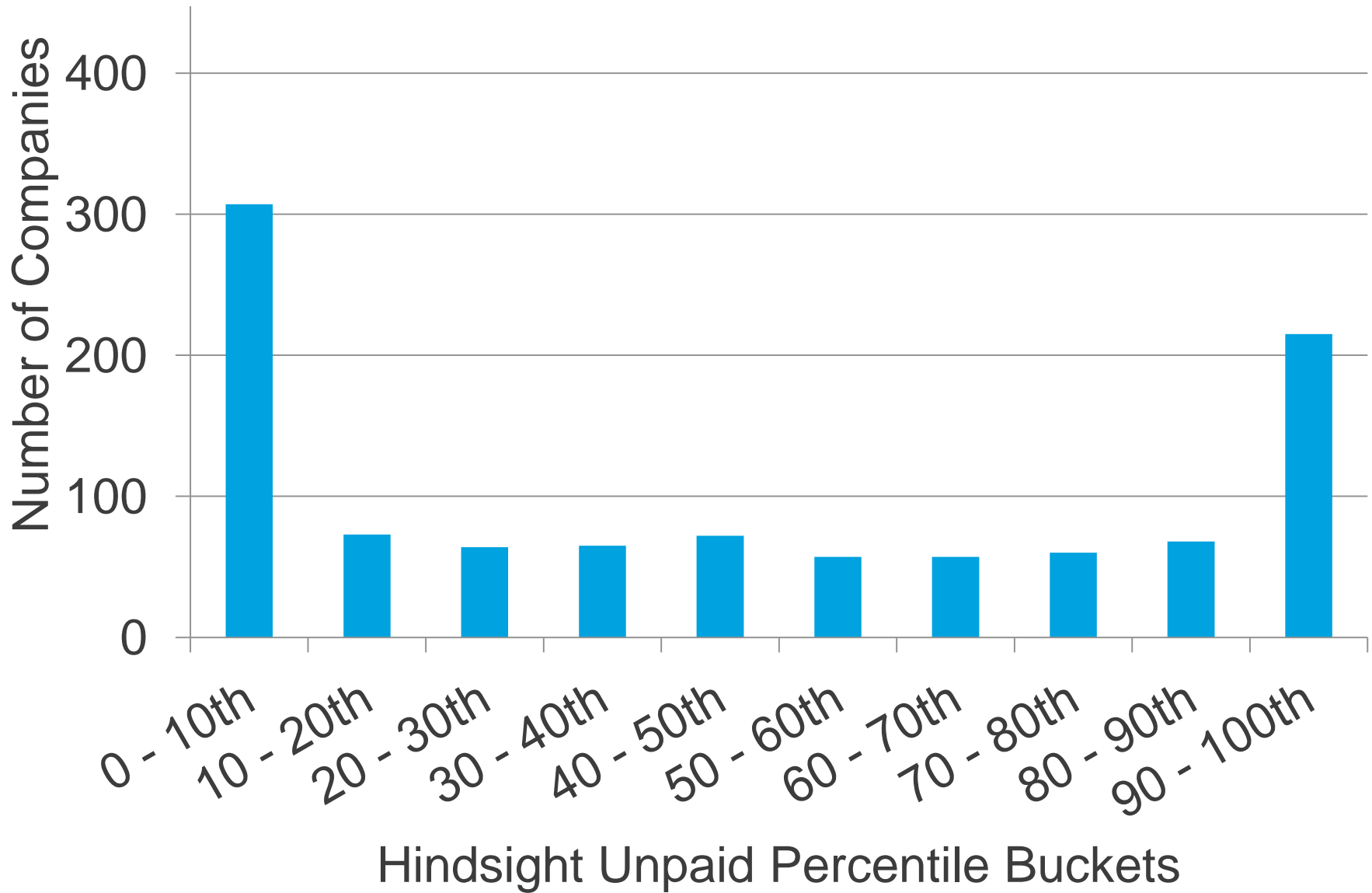


Homeowners as of 12/1996

Histogram of the Hindsight Percentile



Homeowners: Percentiles 1989-2002



Why are our distributions too narrow?

Reserve risk split into two:

- systemic risk
- independent risk

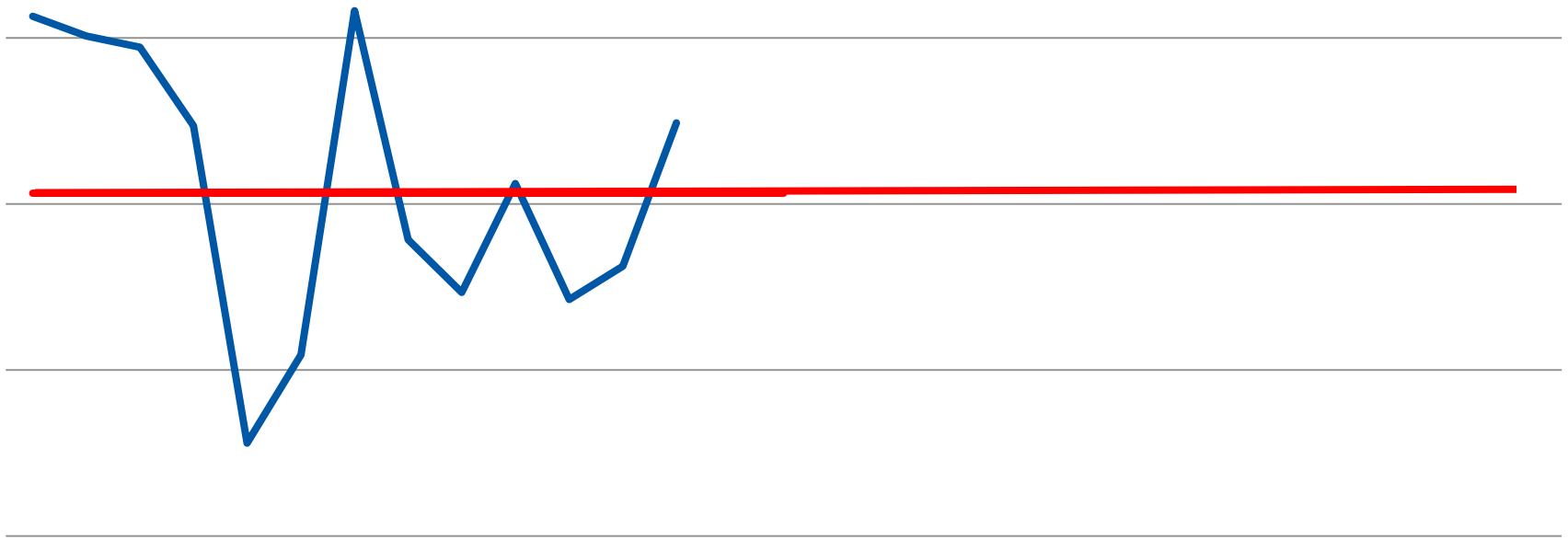
Why are our distributions too narrow?

Reserve risk split into two:

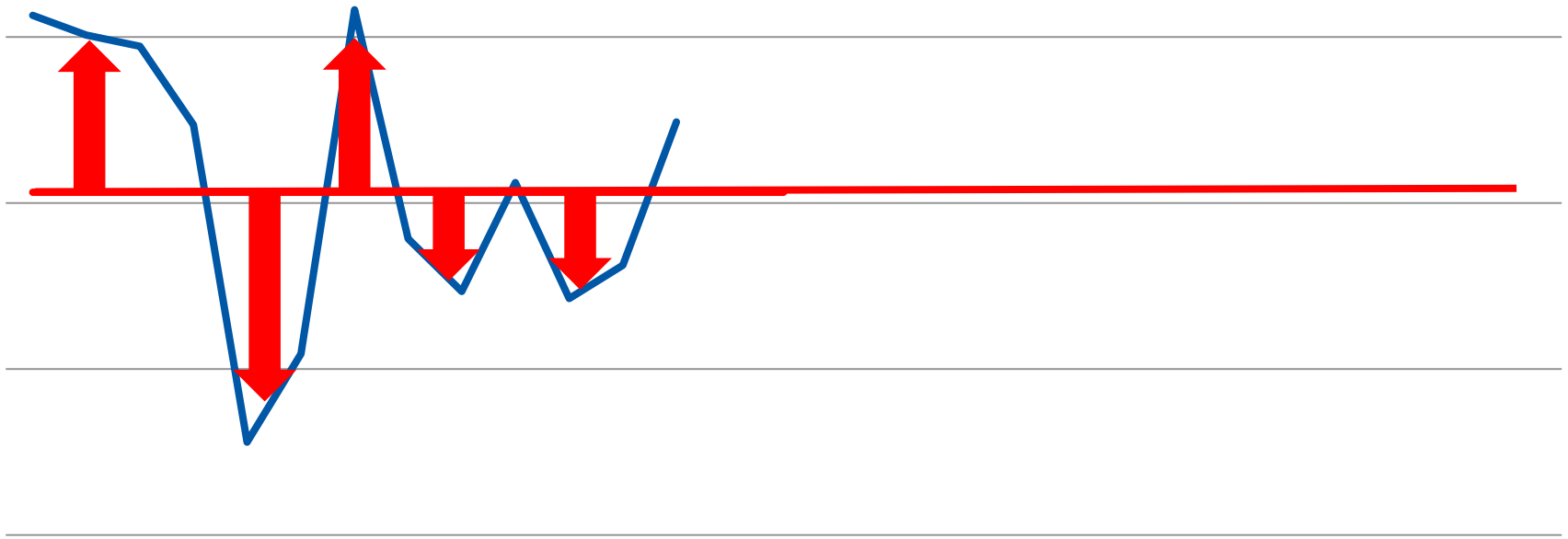
- systemic risk
- independent risk

Models only cover independent risk, not systemic risk

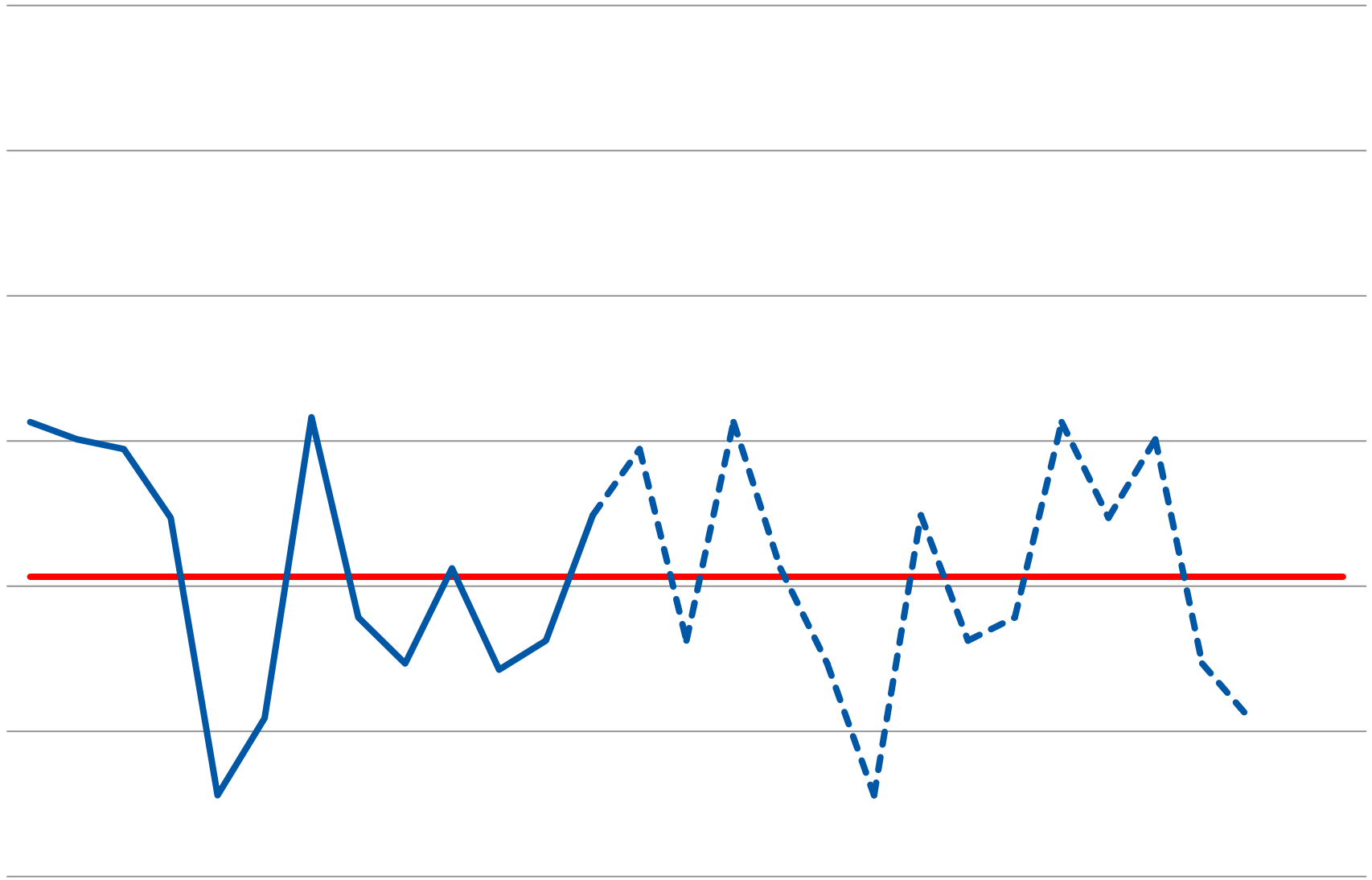
Measuring Independent Risk



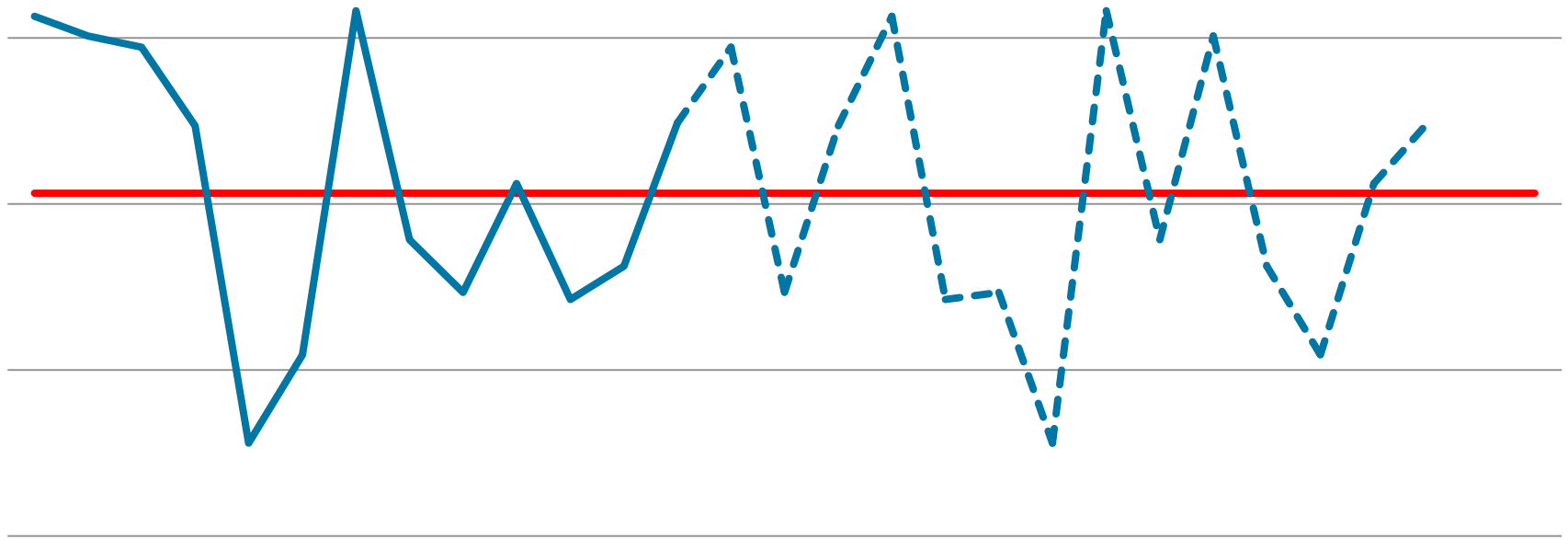
Measuring Independent Risk



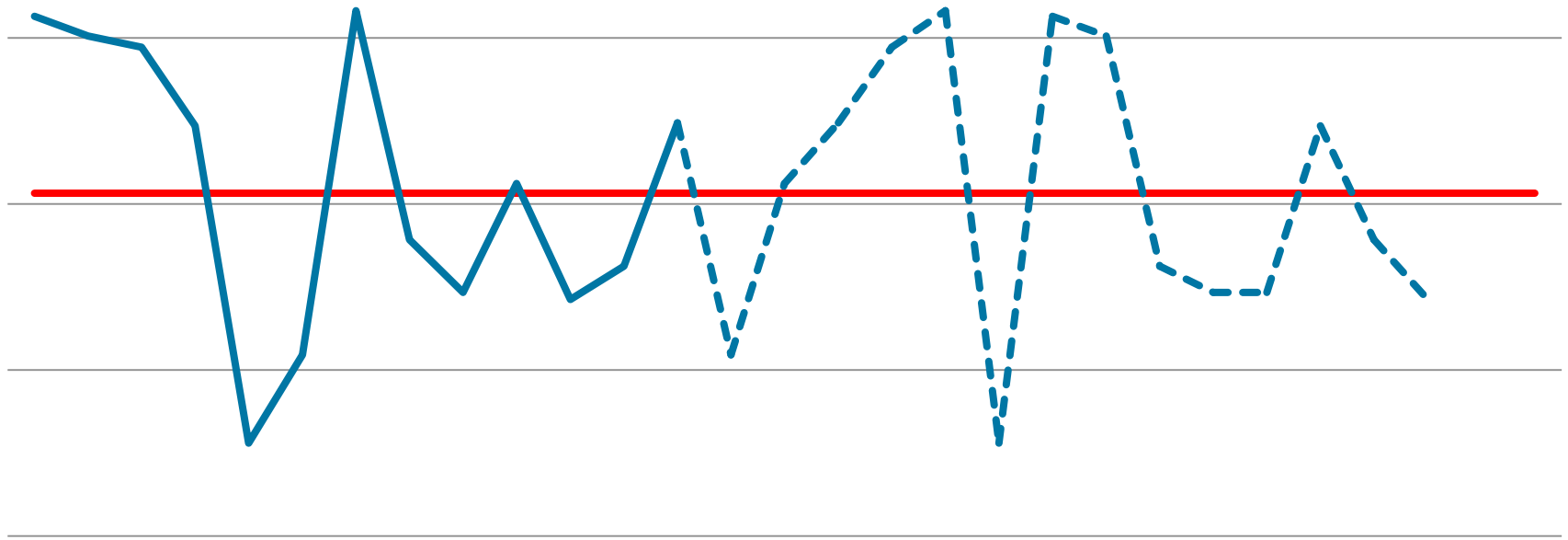
Measuring Independent Risk



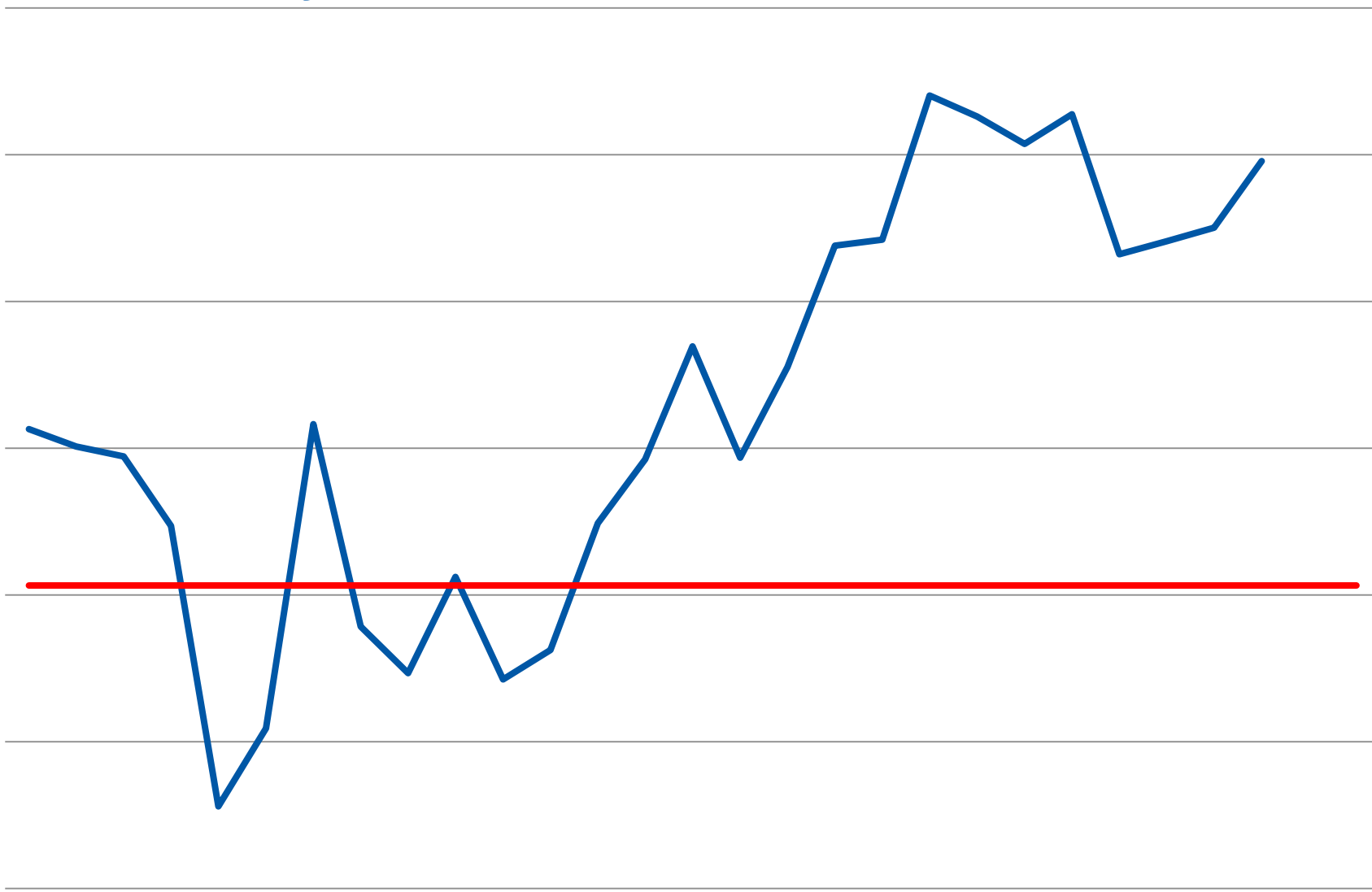
Measuring Independent Risk



Measuring Independent Risk



...but not Systemic Risk!



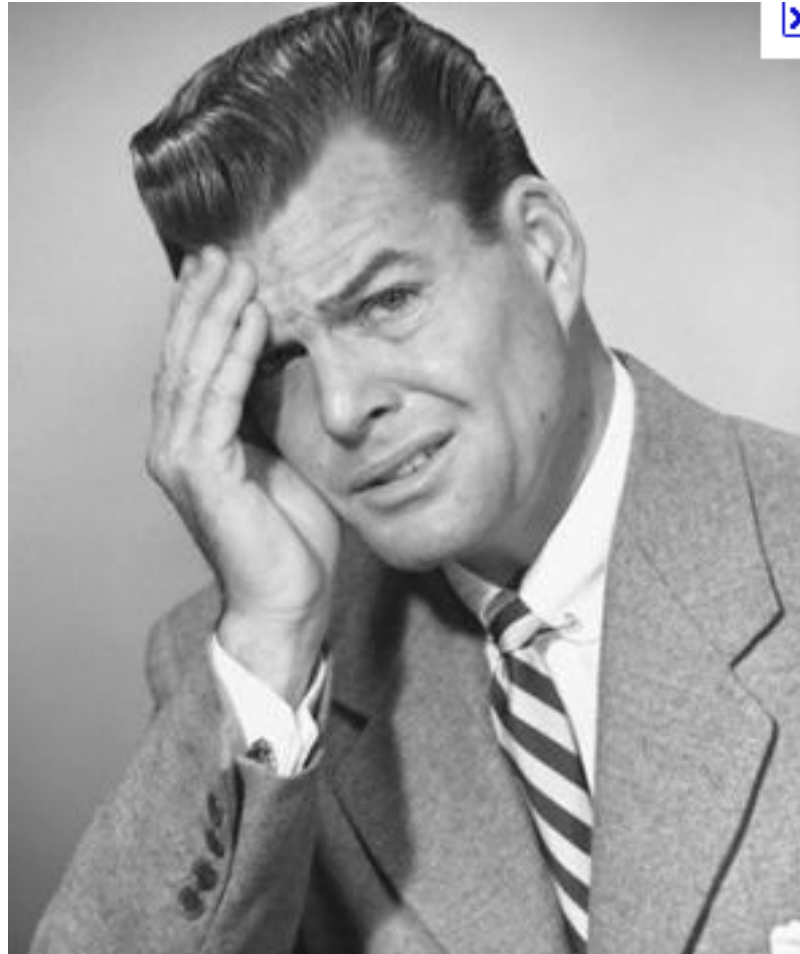


What can we do about it?

Inflation Risk?



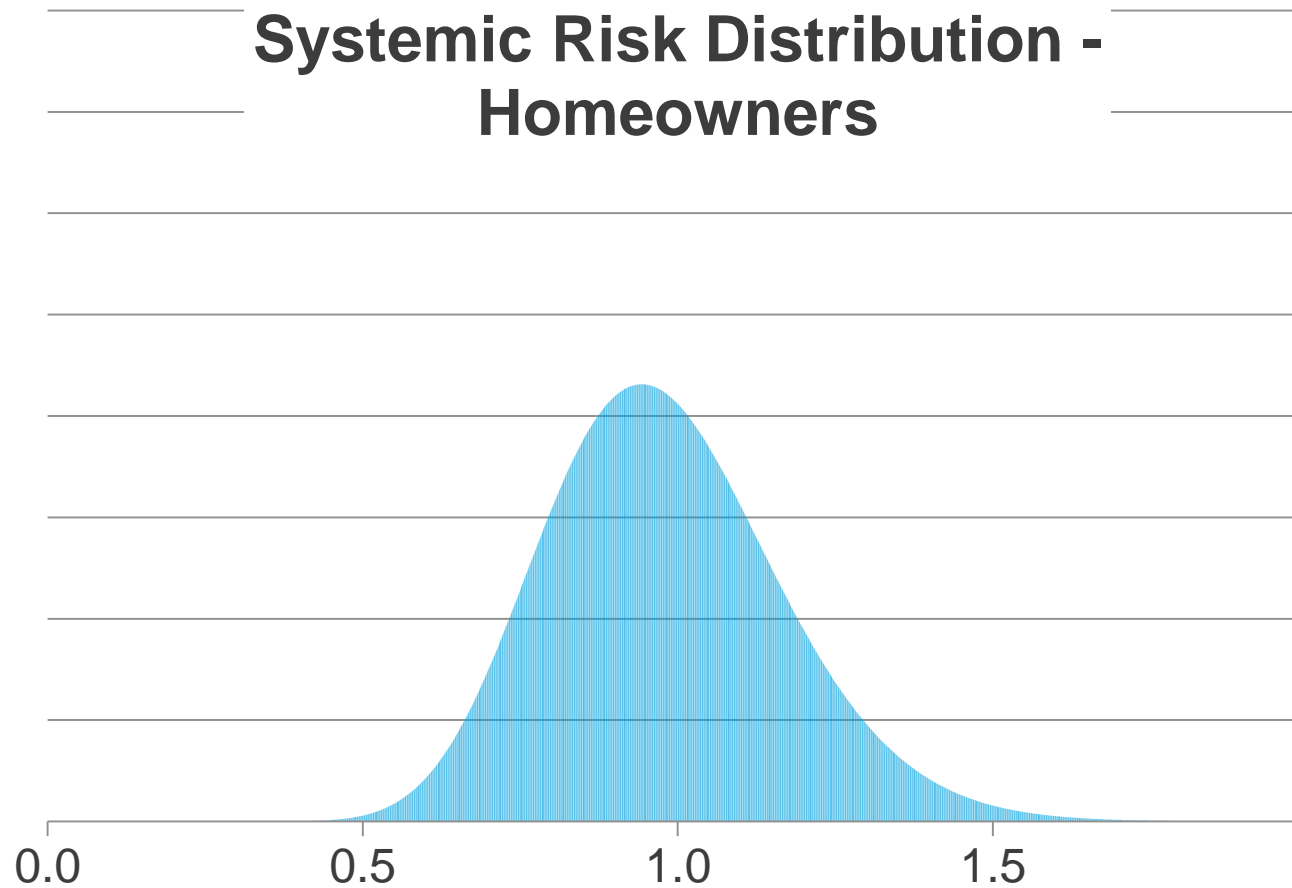
Tort Reform Risk?



Legislative Risk?

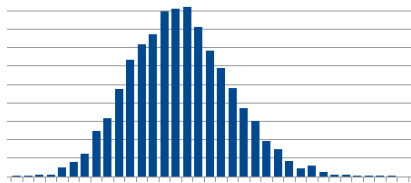


What can we do about it?



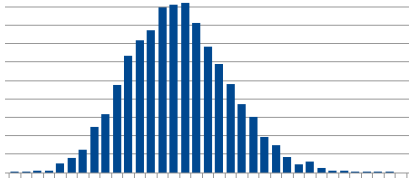
Reserve Risk – without Systemic Risk

Independent risk

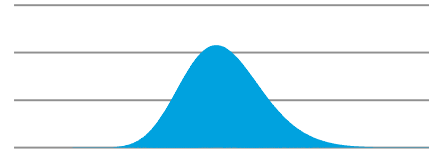


Reserve Risk – without Systemic Risk

Independent risk

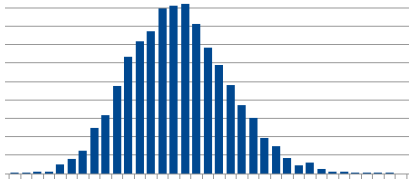


Systemic risk

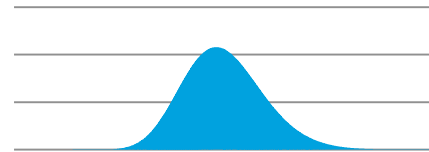


Reserve Risk – without Systemic Risk

Independent risk



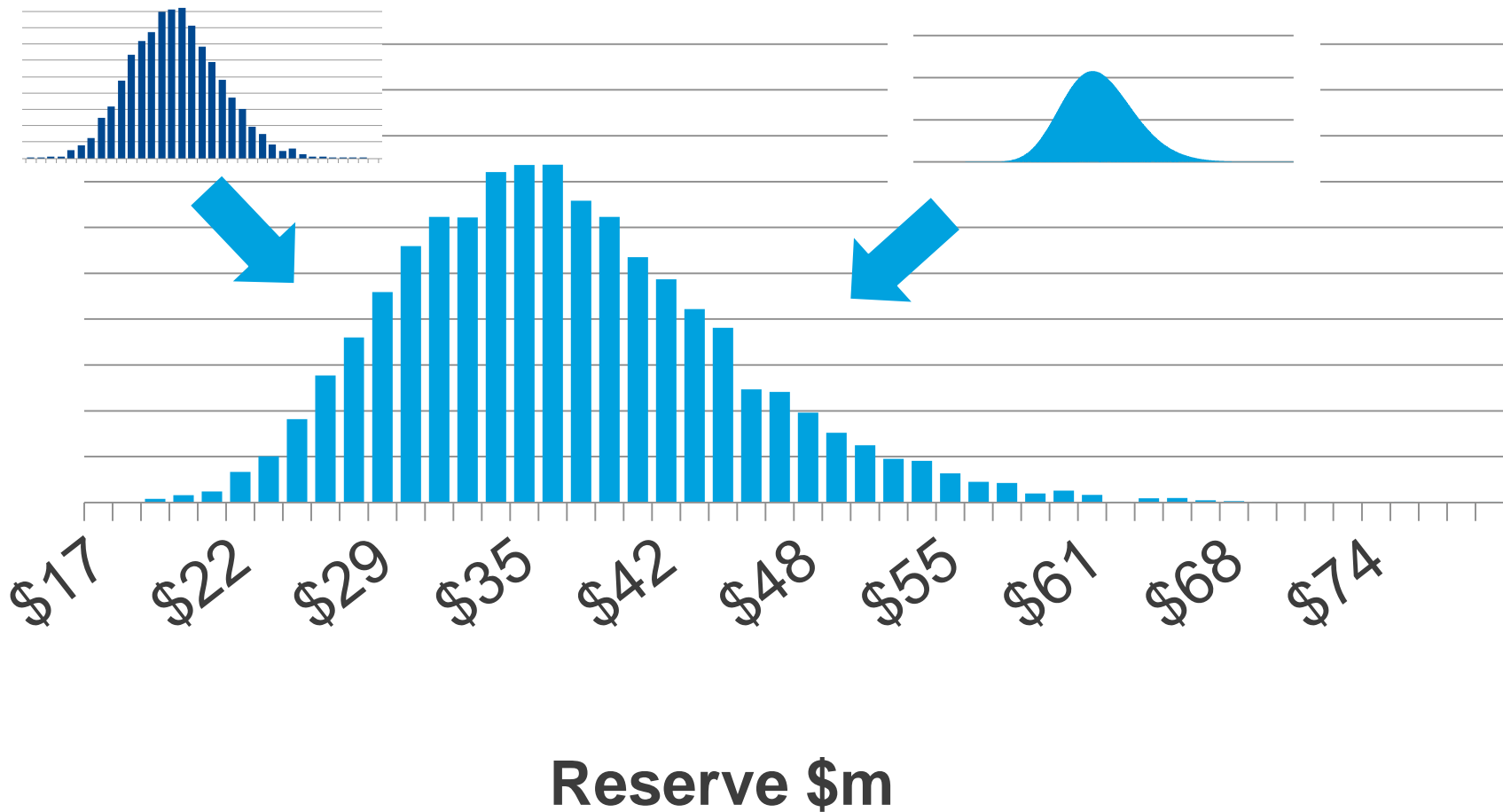
Systemic risk



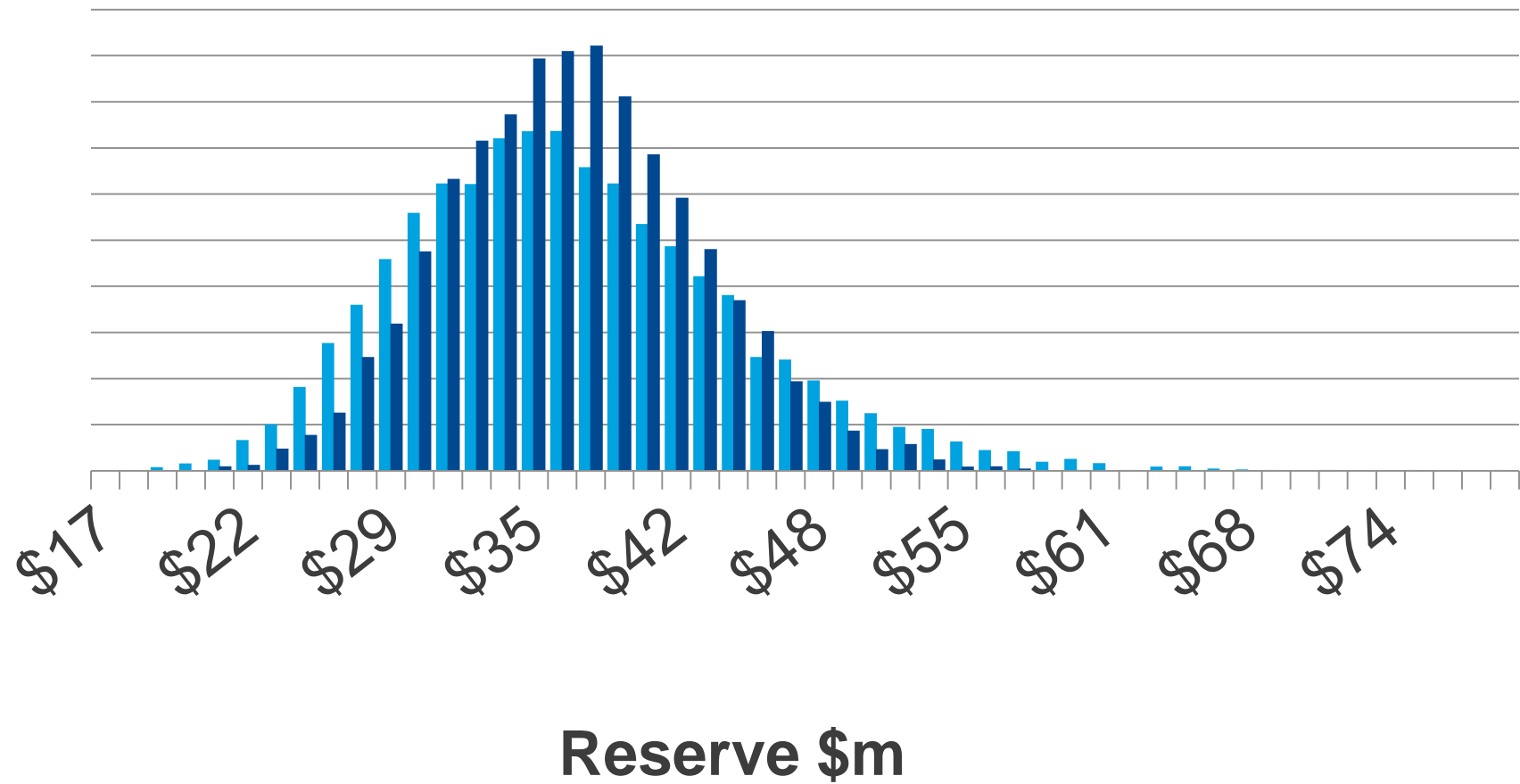
Reserve Risk – with Systemic Risk

Independent risk

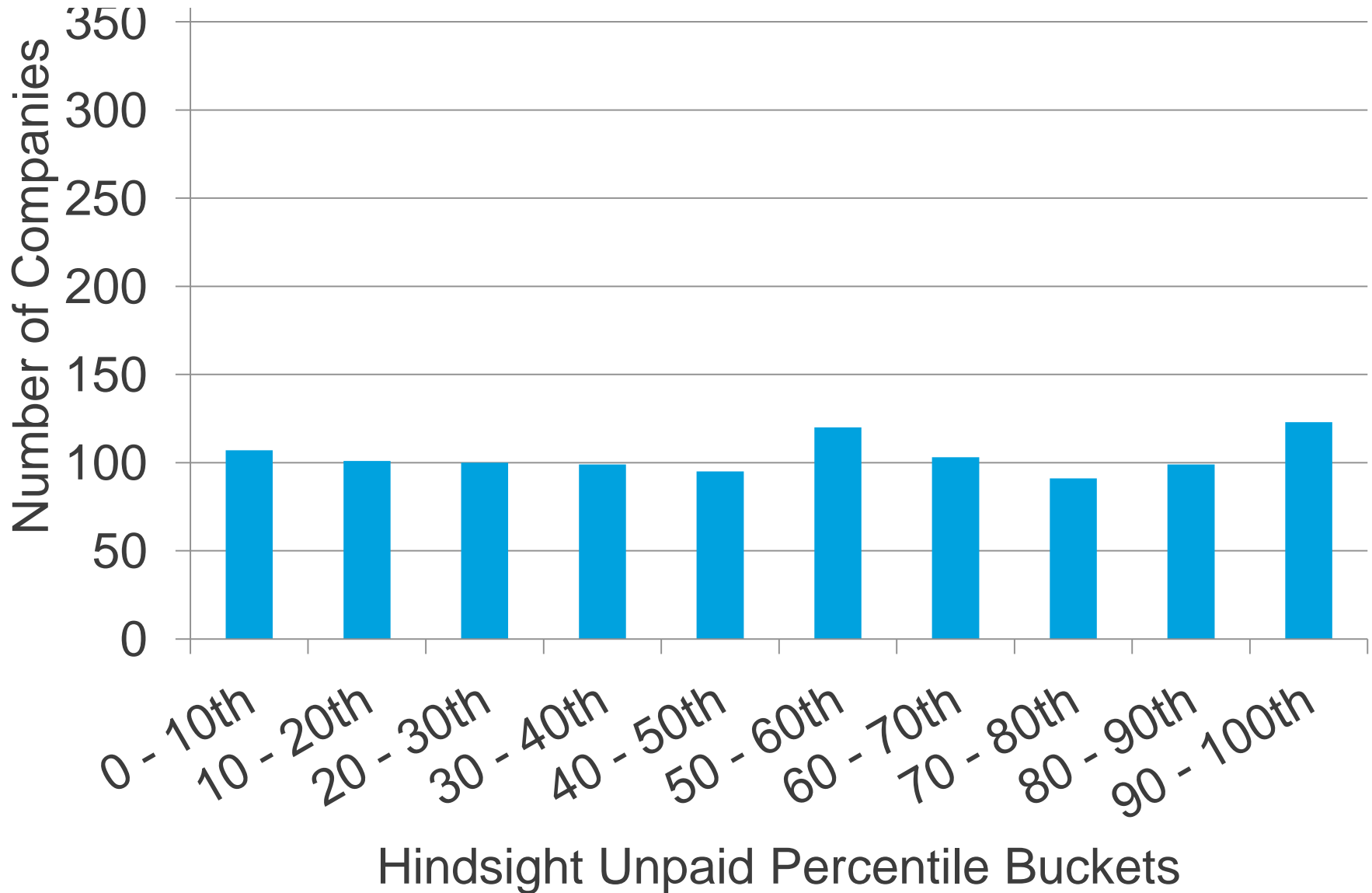
Systemic risk



Reserve Risk – with and without Systemic Risk



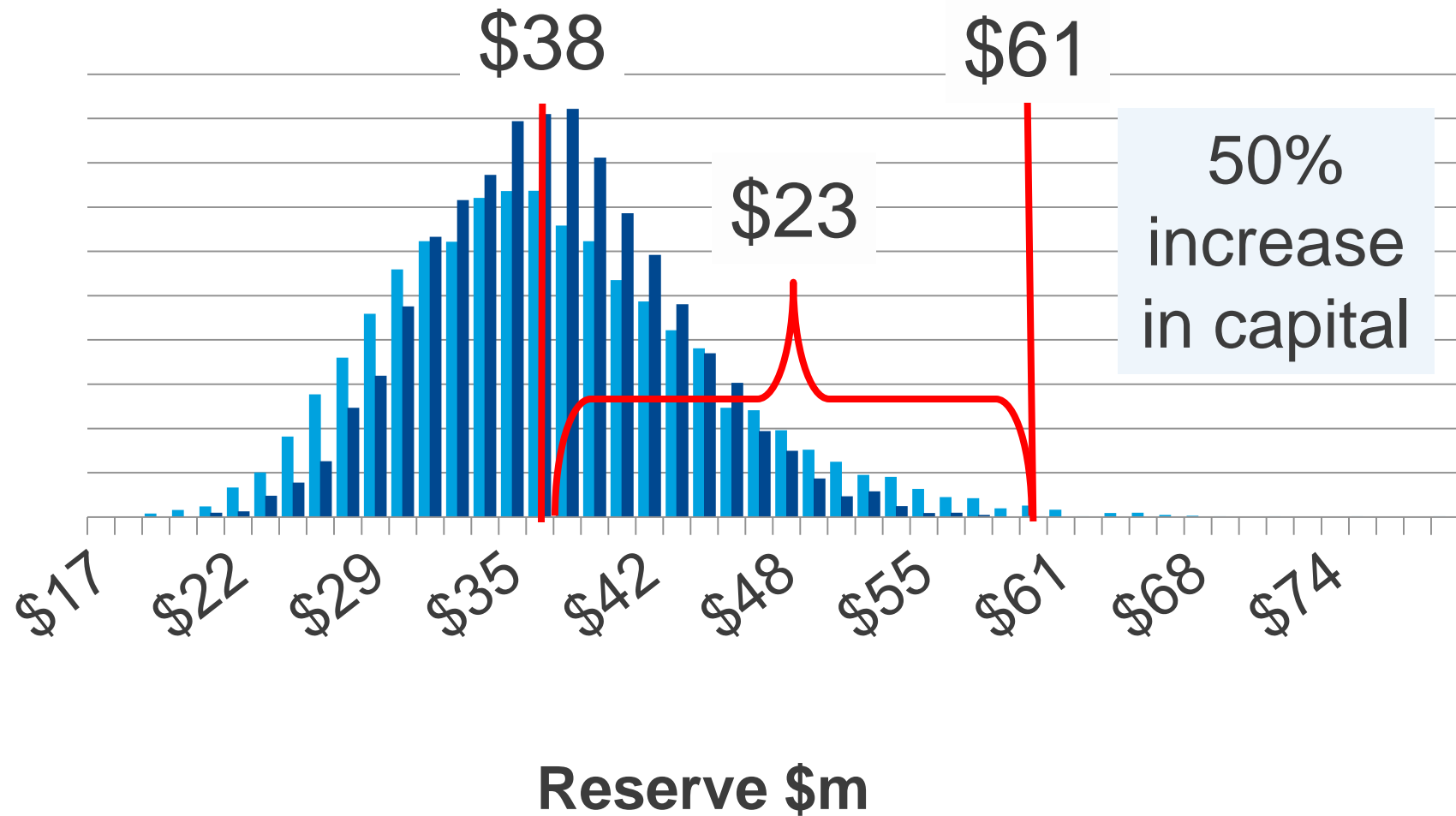
Homeowners percentiles after systemic risk



Indicated Capital without Systemic Risk



Indicated Capital with Systemic Risk



Reserve Risk Model – can we get it right?

1. Are we under-estimating capital?
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Reserve Risk Model – can we get it right?

1. Are we under-estimating capital?
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Reserve Distribution

	WC
95 th	1.15
CV	9%
Mean	1.00

Reserve Distribution

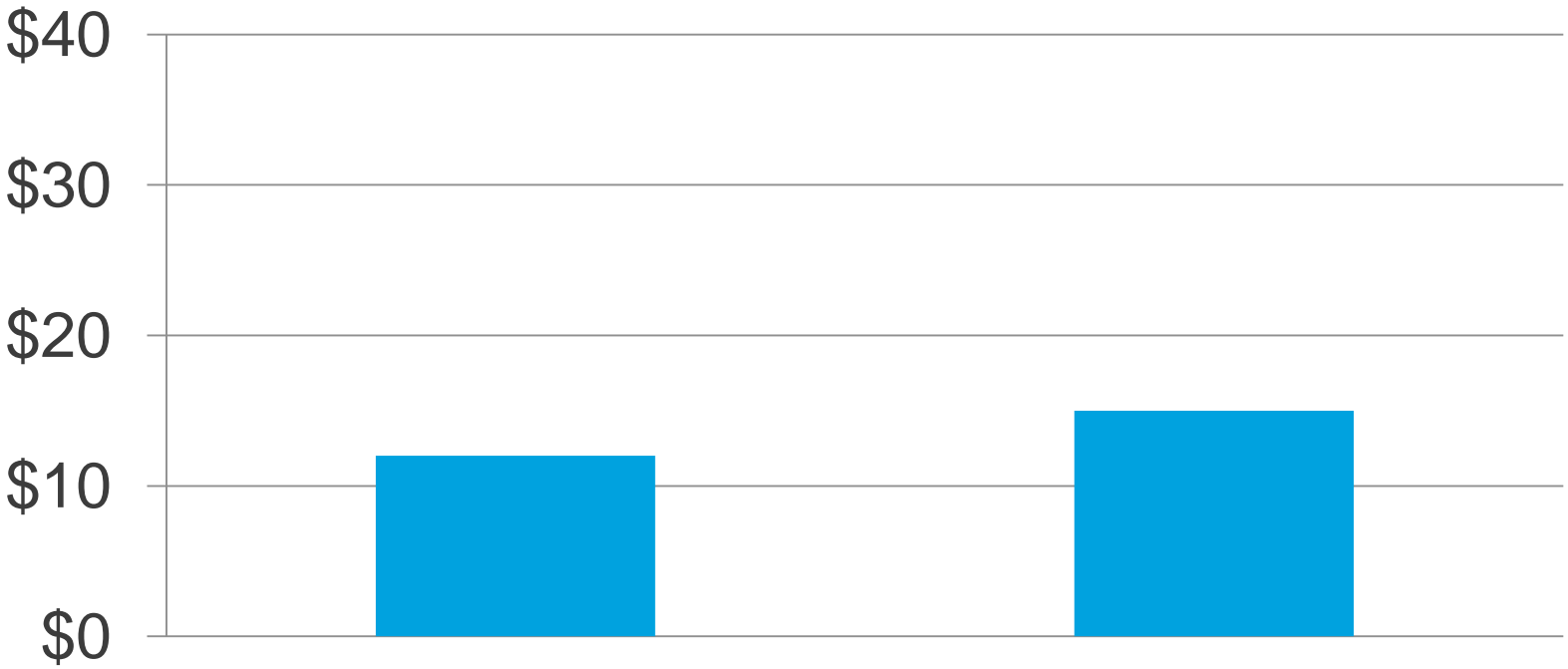
	HO	WC
95 th	1.12	1.15
CV	8%	9%
Mean	1.00	1.00

Reserve Distribution

	HO	WC
95 th	1.12	1.15

Reserve Distribution

	HO	WC
95 th	1.12	1.15



Reserve Distribution

	HO	WC
95 th	1.12	1.15

Reserve Distribution

	HO	WC
95 th	1.12	1.15

Accident Year 2000:

Reserve Distribution

	HO	WC
95 th	1.12	1.15

Accident Year 2000:

Estimated \$13bn

Reserve Distribution

	HO	WC
95 th	1.12	1.15

Accident Year 2000:

Estimated \$13bn

Actual \$18bn

Reserve Distribution

	HO	WC
95 th	1.12	1.15

Accident Year 2000:

Estimated \$13bn

Actual \$18bn

Actual / Estimate 1.35

Reserve Distribution

	HO	WC
95 th	1.12	1.15

Accident Year 2000:

Estimated \$13bn

Actual \$18bn

Actual / Estimate 1.35

AY 2000: 1.35

Reserve Distribution

	HO	WC
95 th	1.12	1.15

Accident Year 2000:

Estimated \$13bn

Actual \$18bn

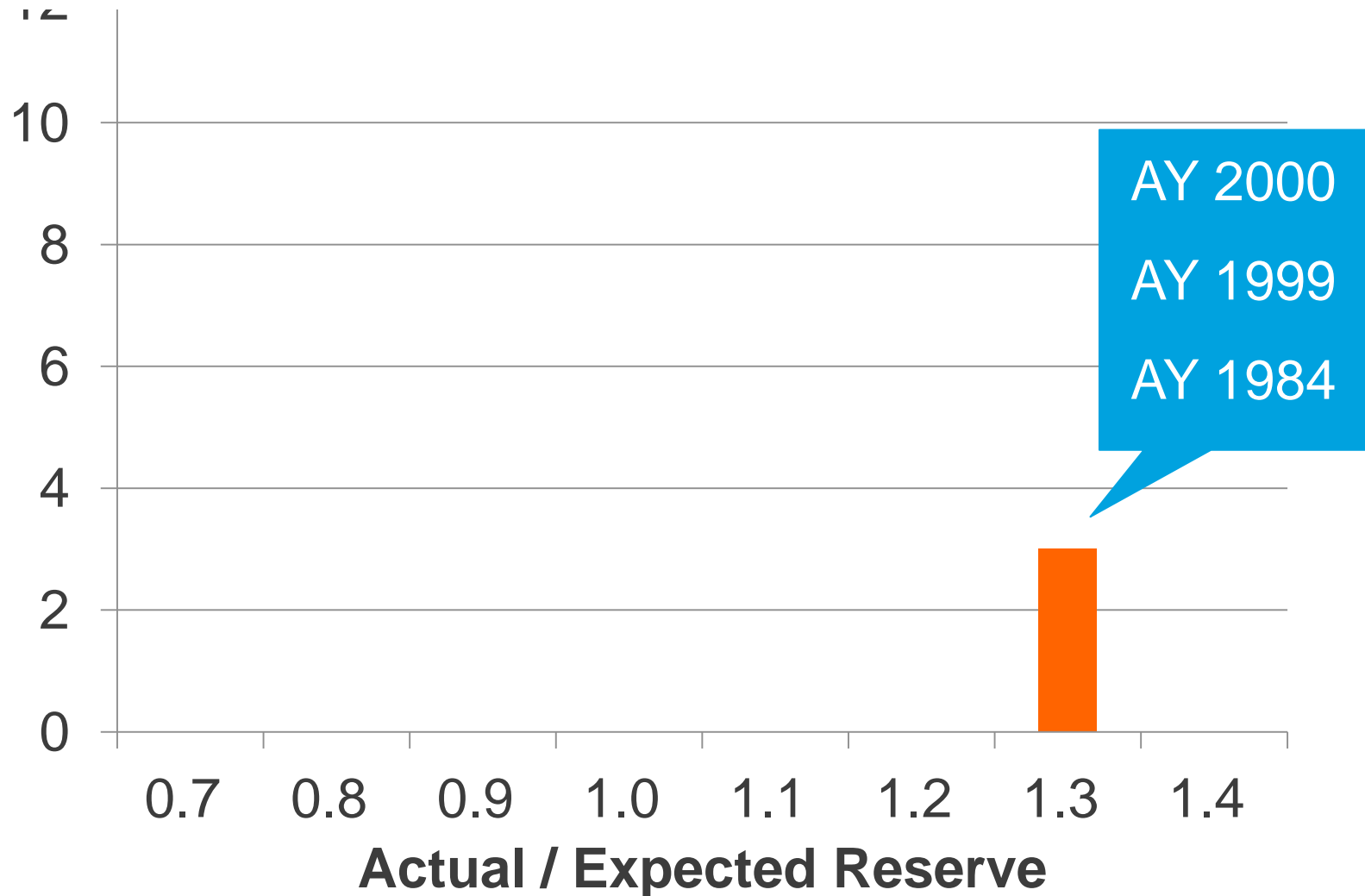
Actual / Estimate 1.35

AY 2000: 1.35

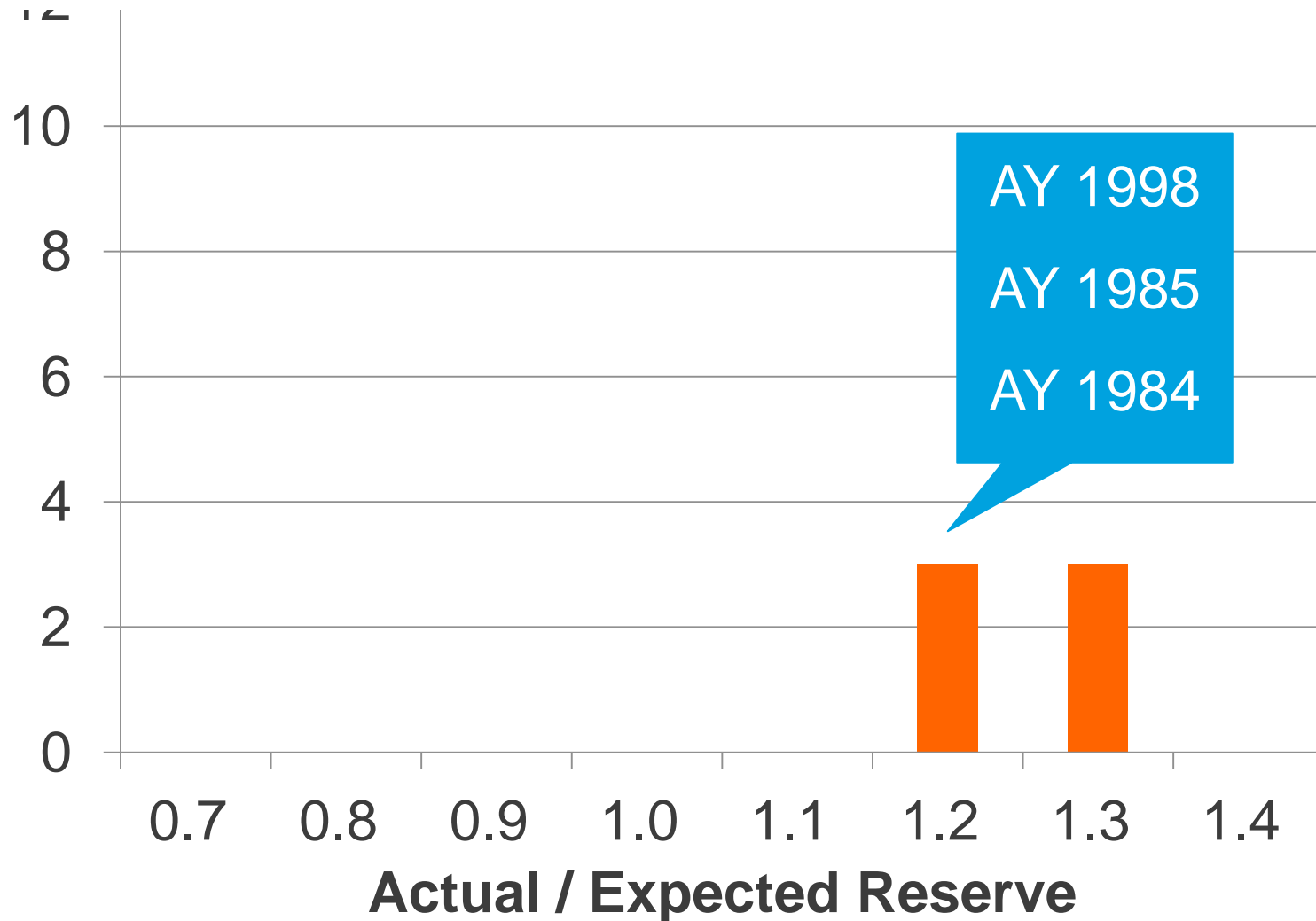
AY 1999: 1.32

AY 1984: 1.27

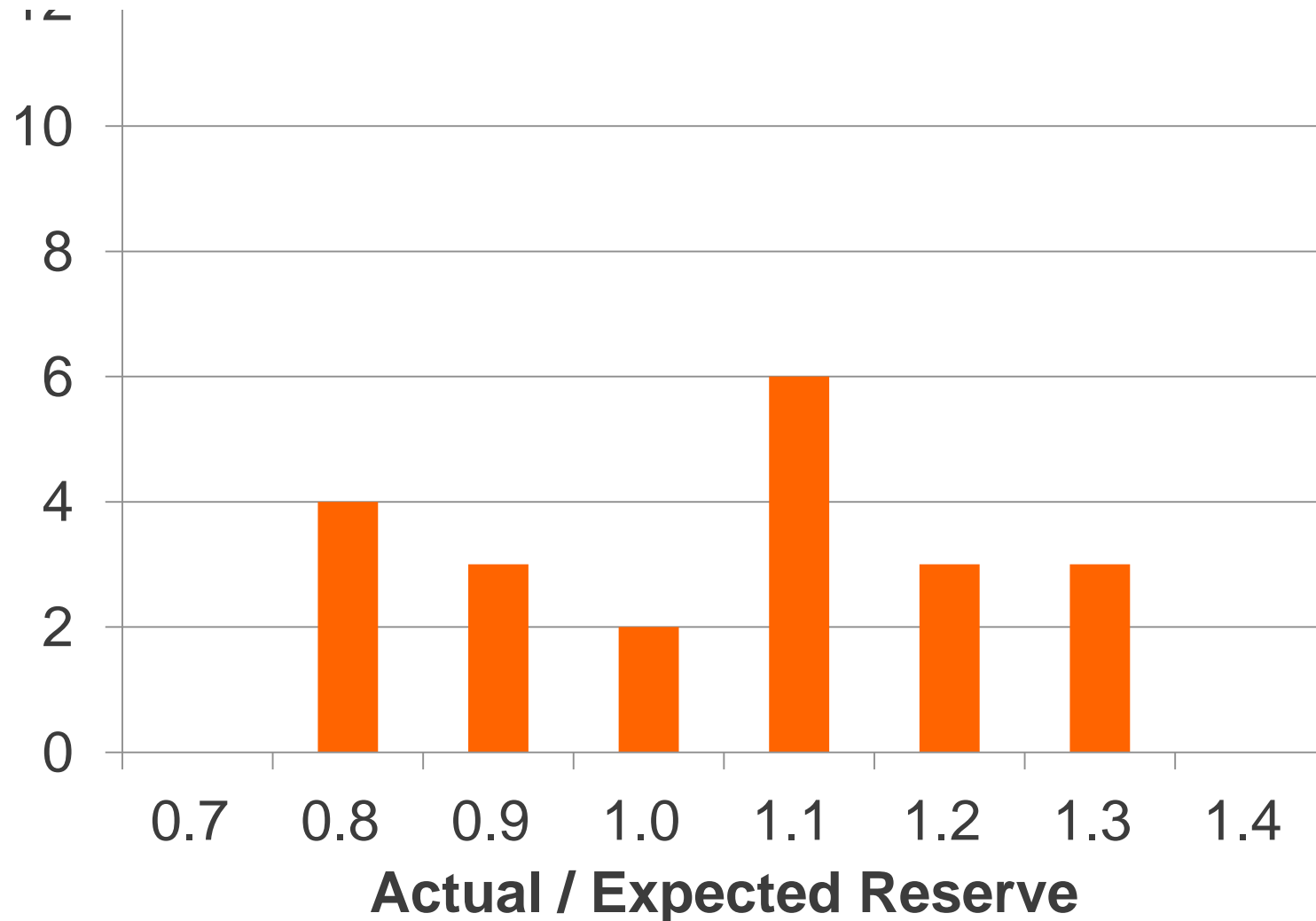
Real Reserve Distribution – Workers Comp



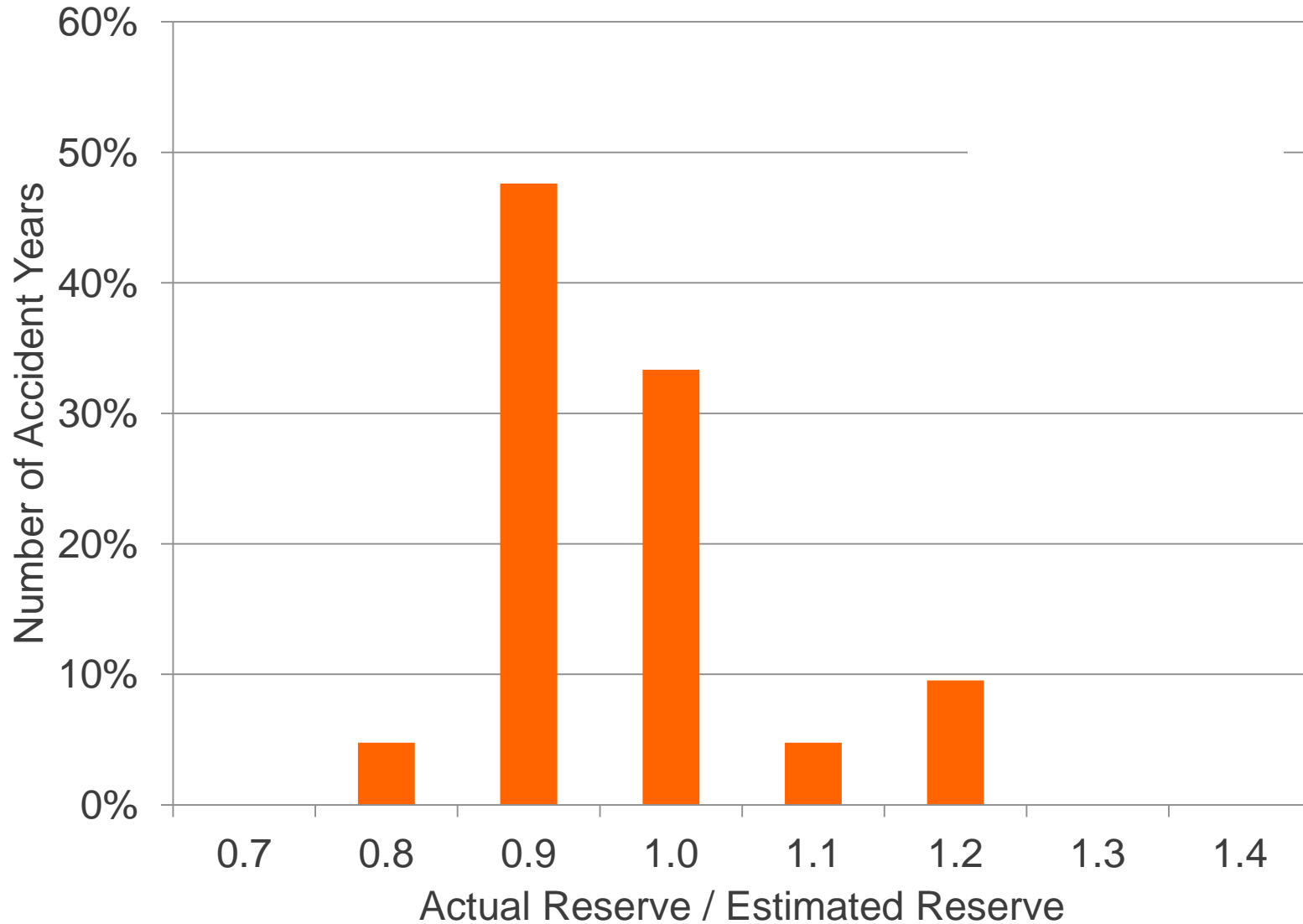
Real Reserve Distribution – Workers Comp



Real Reserve Distribution – Workers Comp

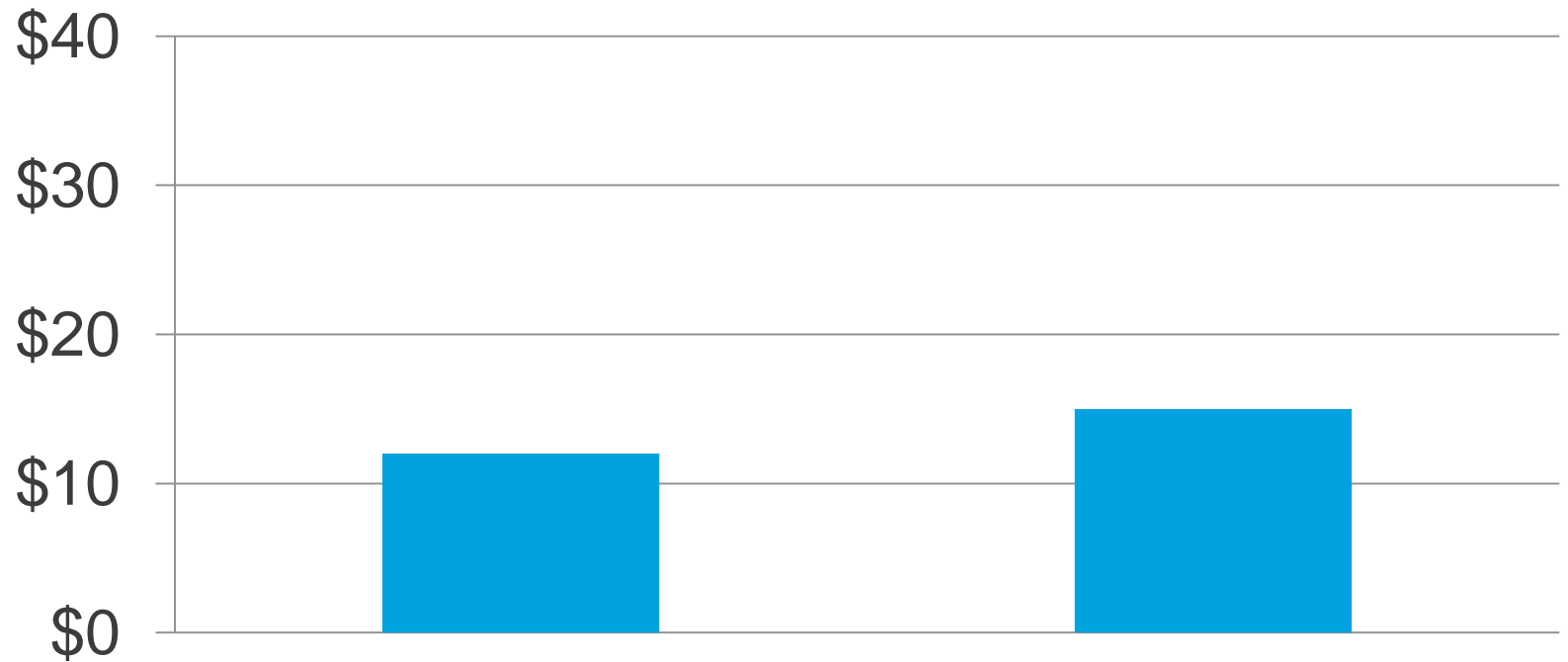


Real Reserve Distribution - Homeowners



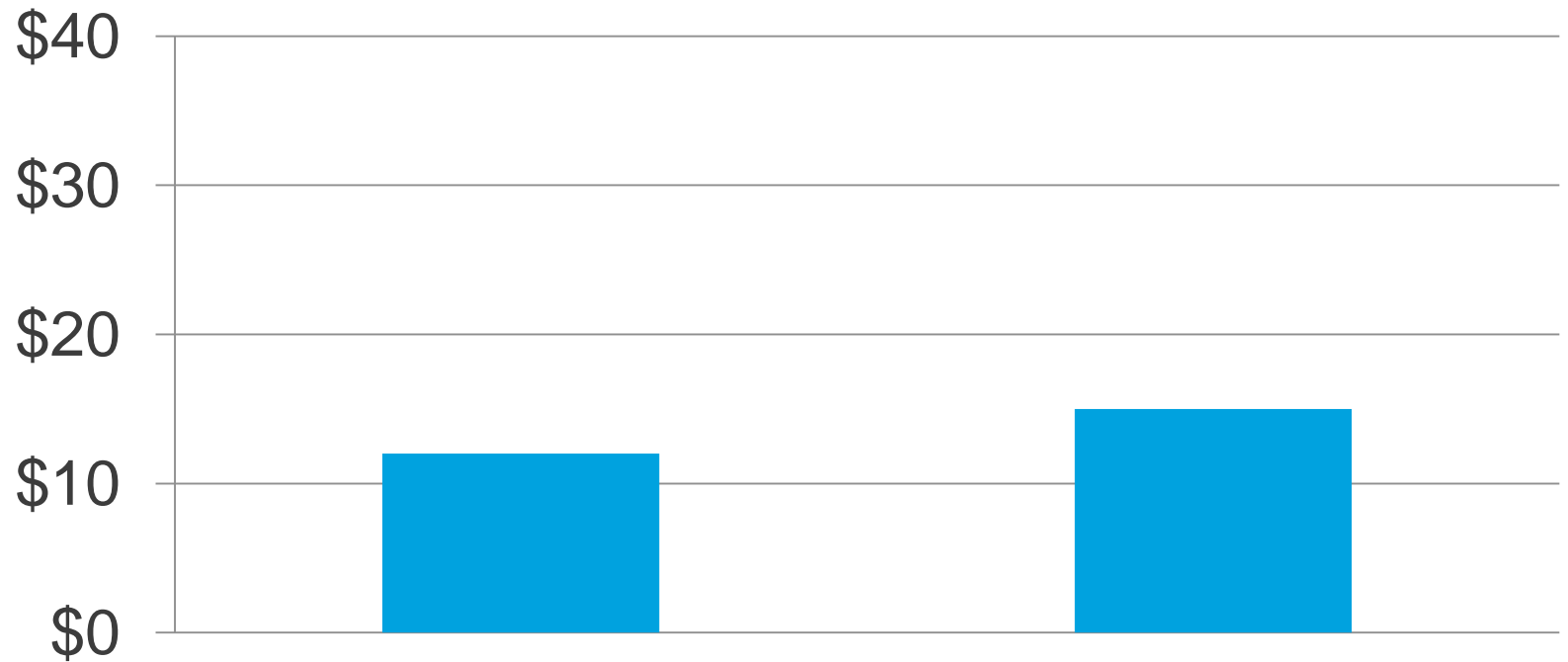
Reserve Distribution

	HO	WC
95 th bootstrap	1.12	1.15



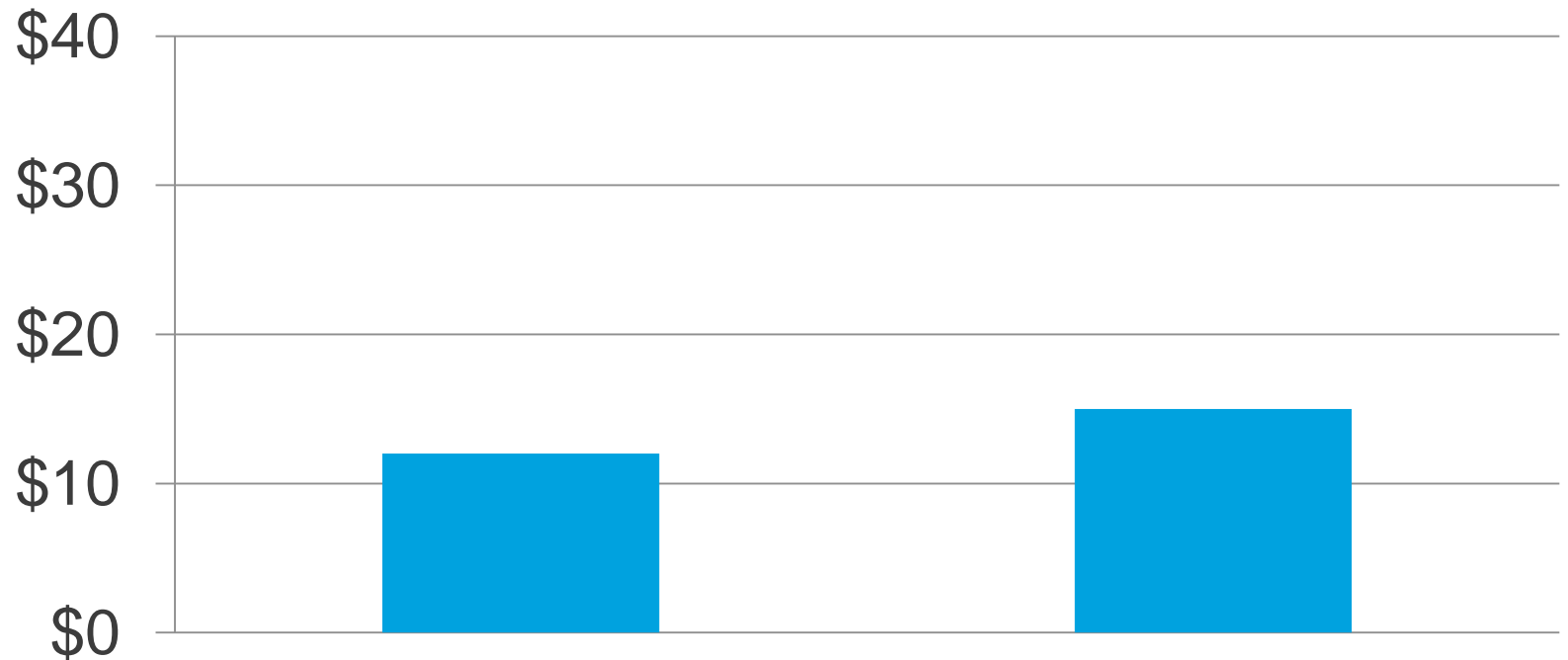
Reserve Distribution

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95 th real*		



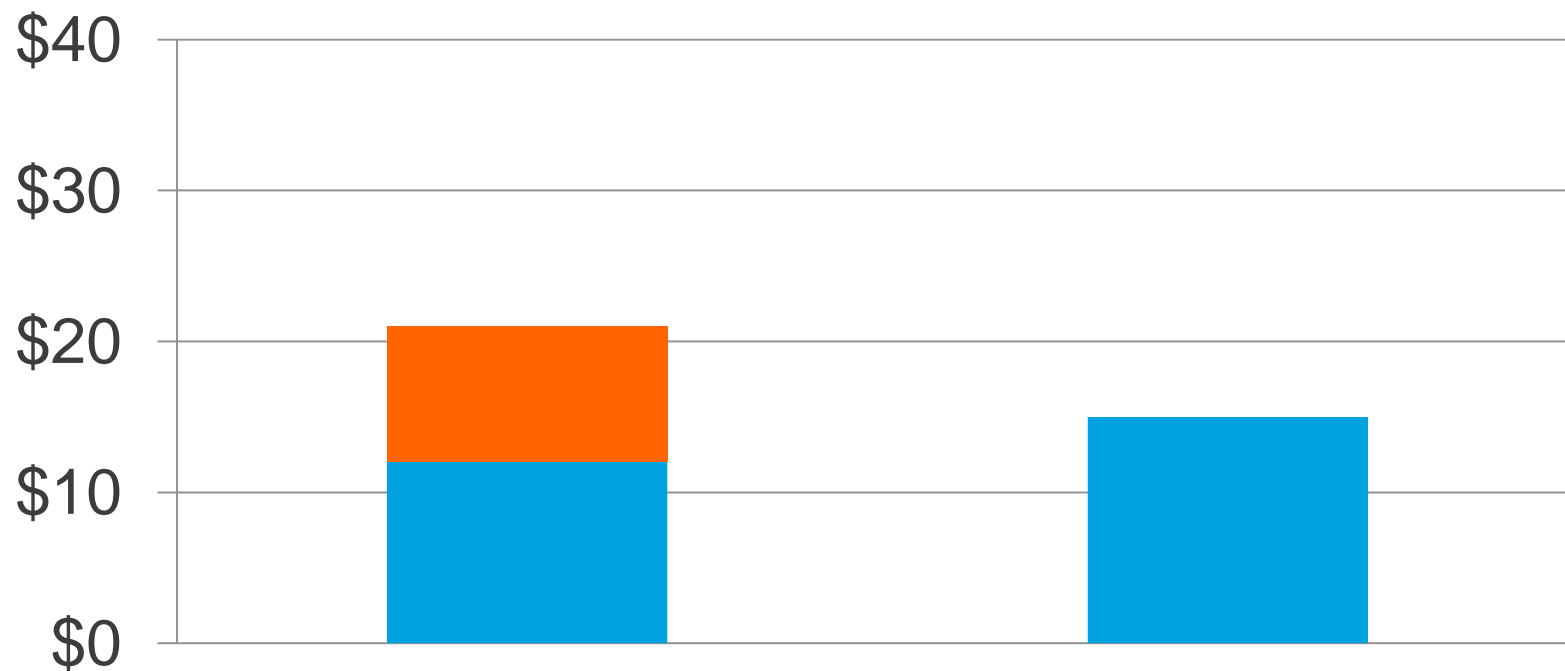
Reserve Distribution

	HO	WC
95 th bootstrap	1.12	1.15
95 th real*	1.21	



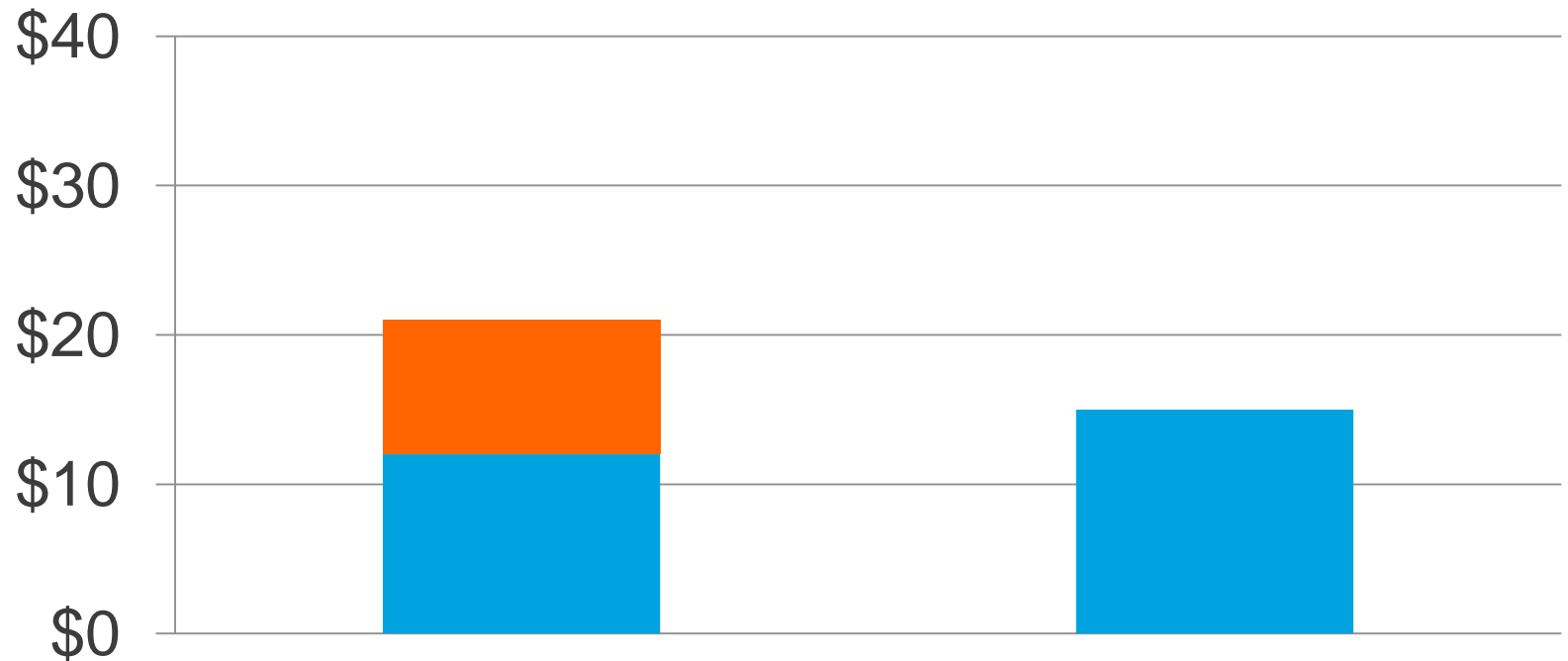
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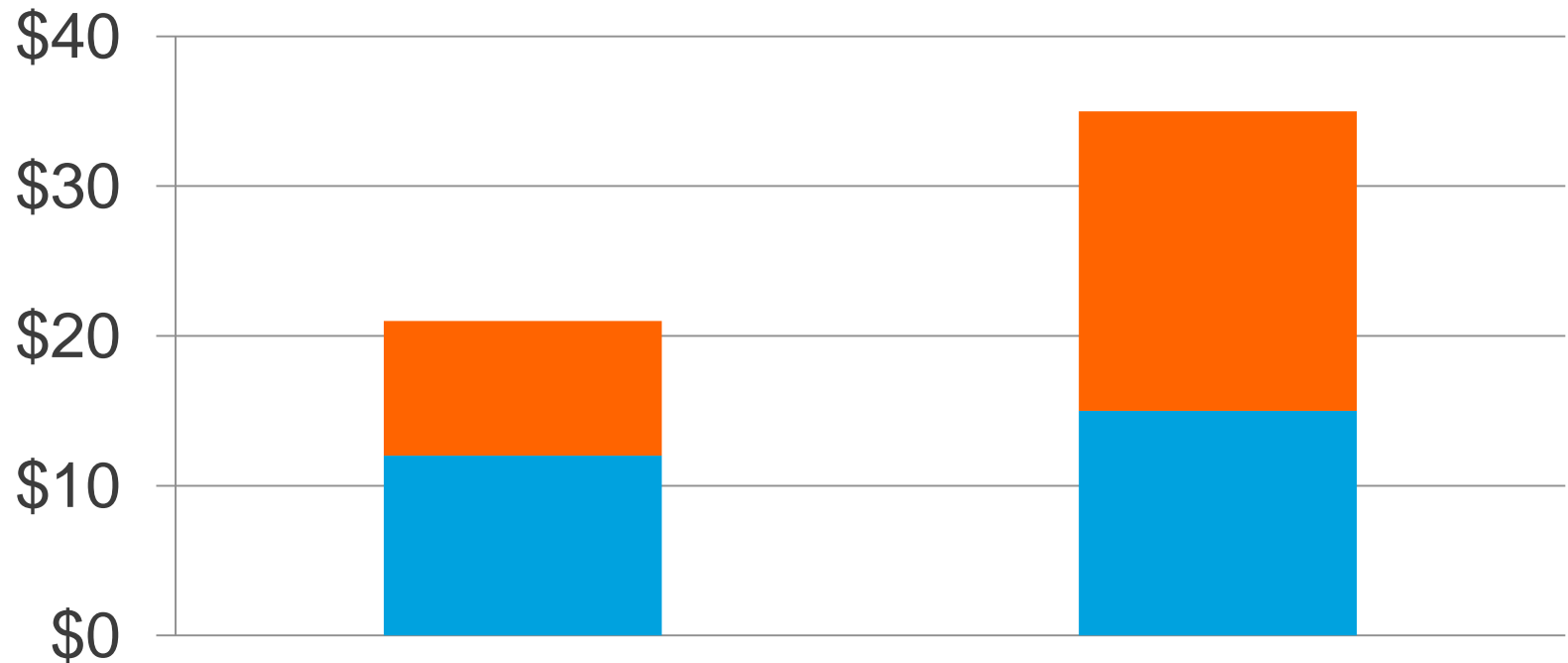
Reserve Distribution

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Reserve Distribution

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Can we get it right??

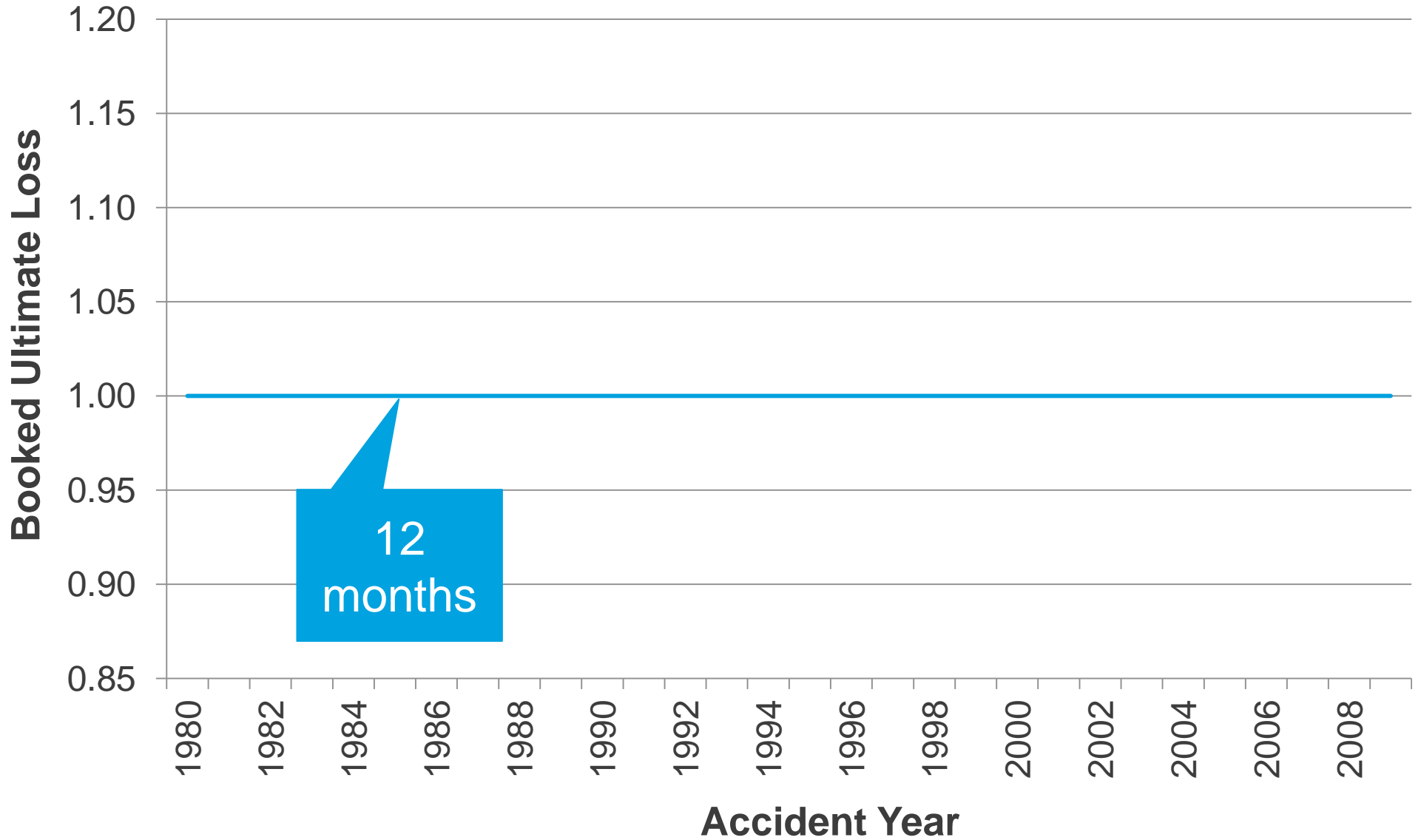
1. Reserve risk model
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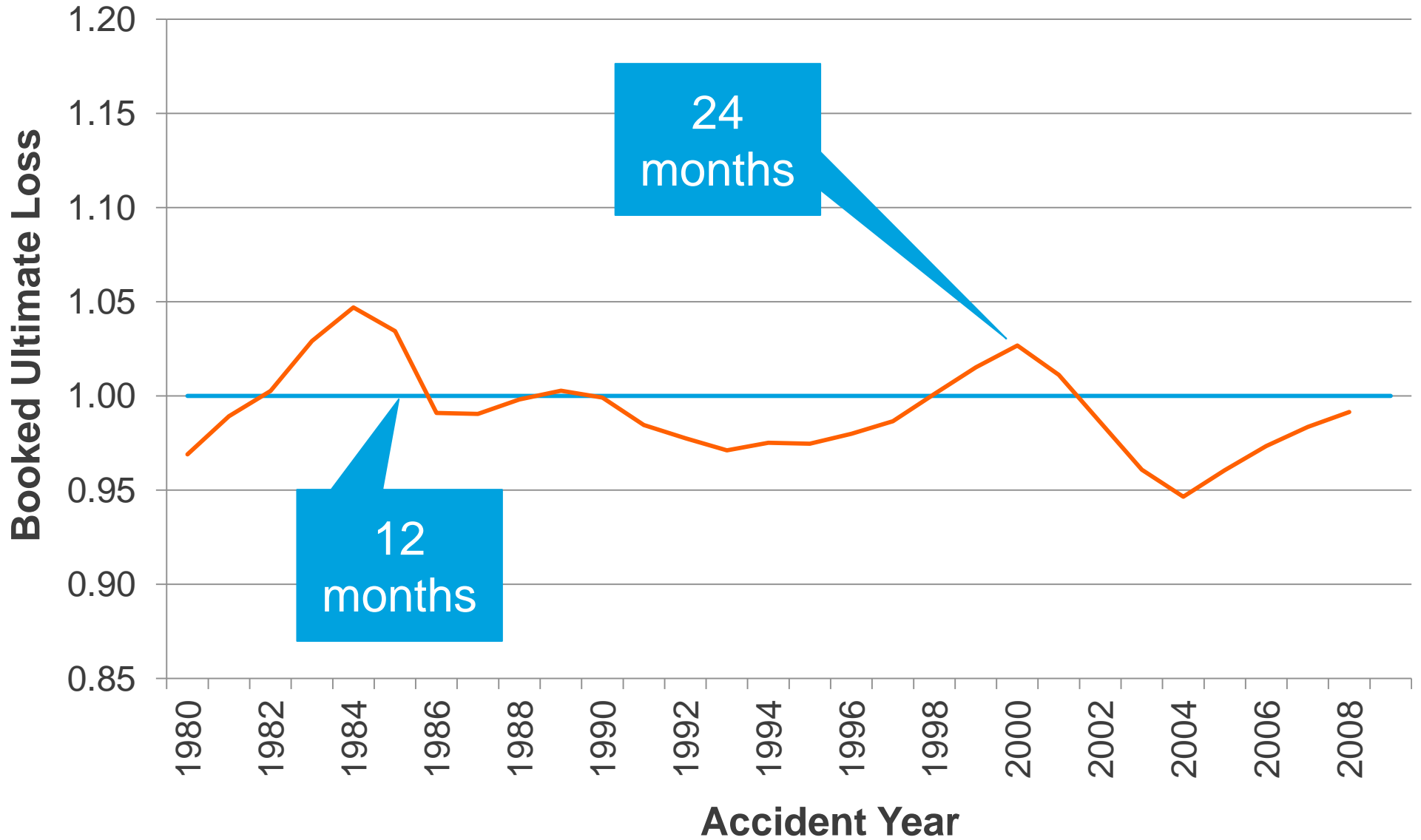
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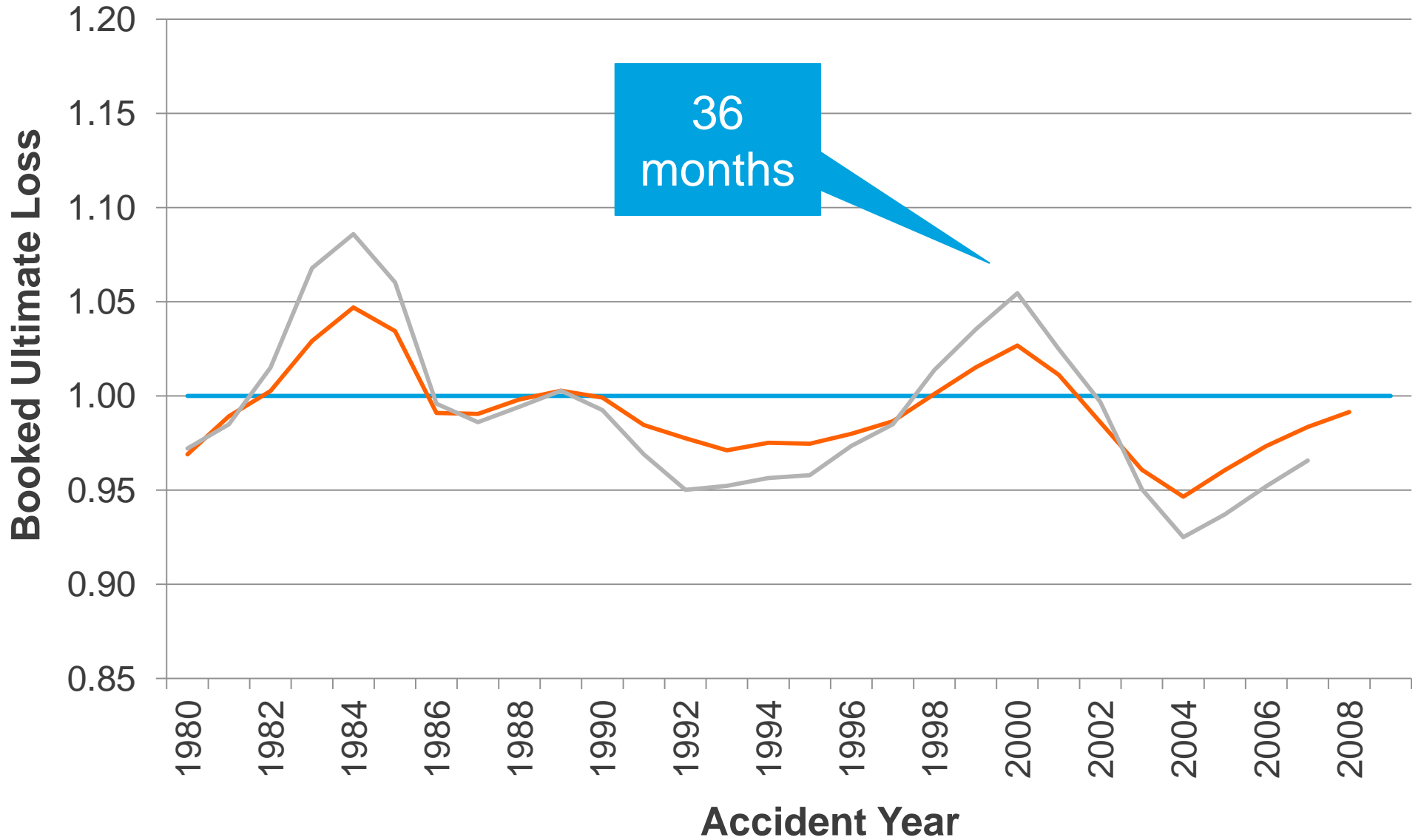
Reserve Cycle



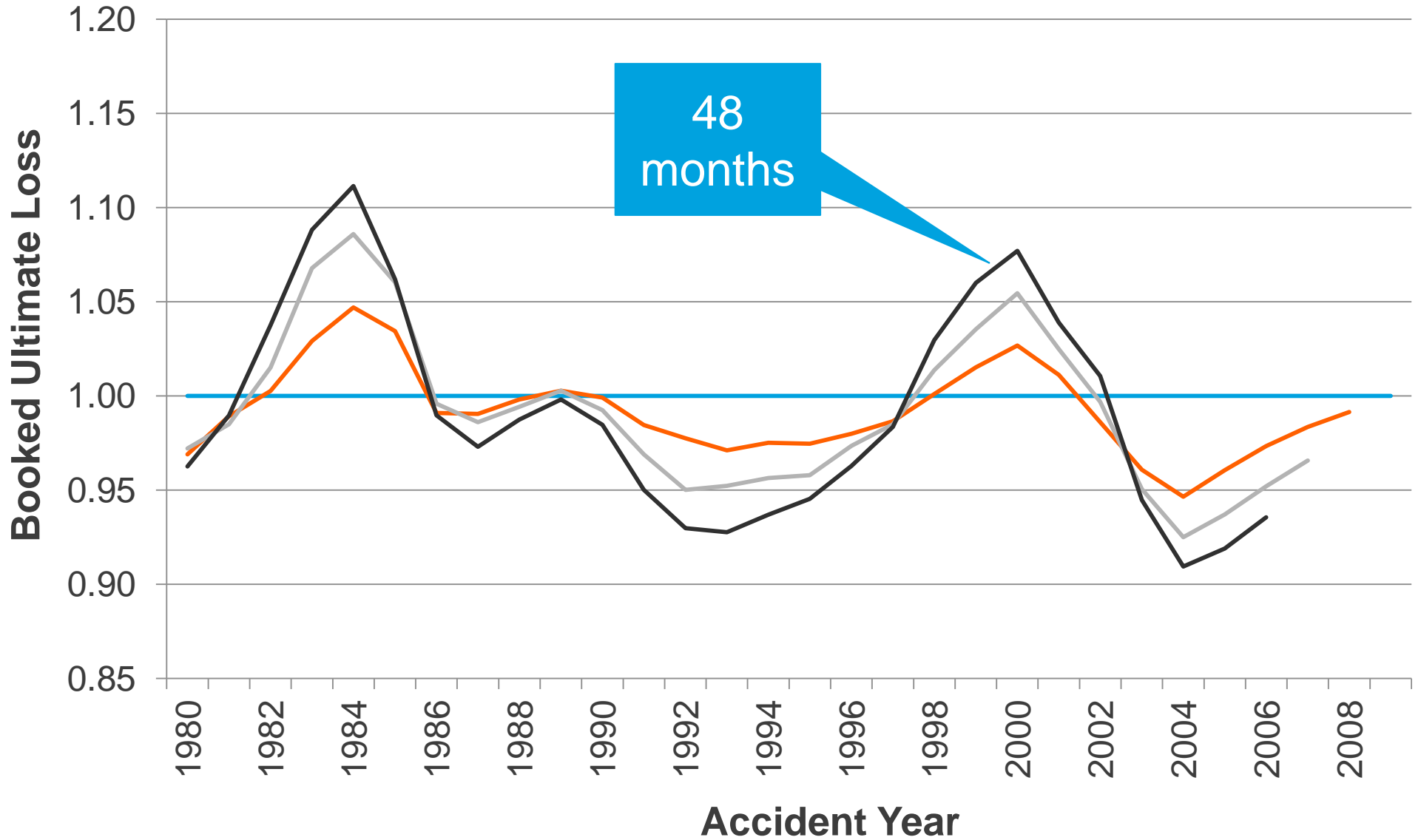
Reserve Cycle



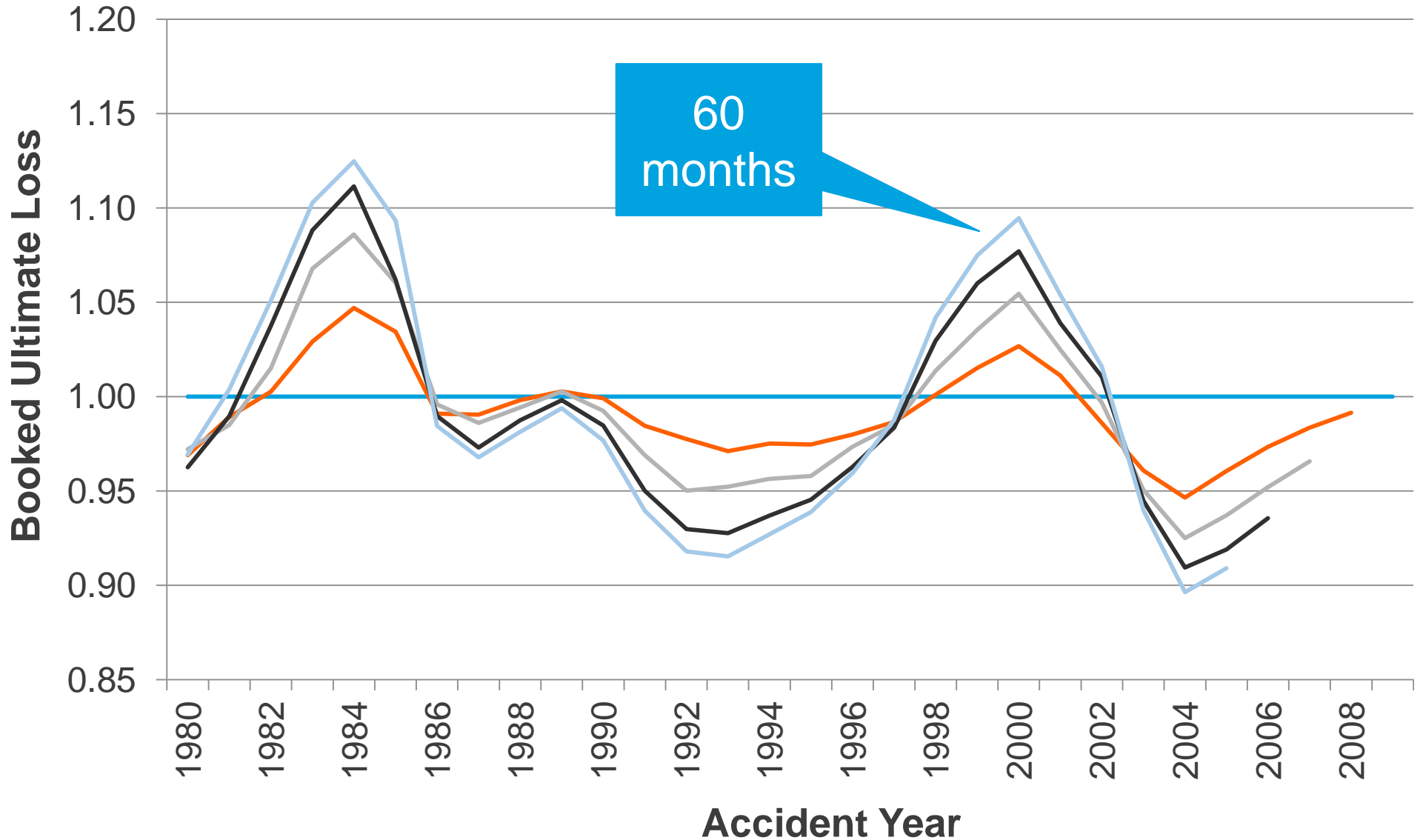
Reserve Cycle



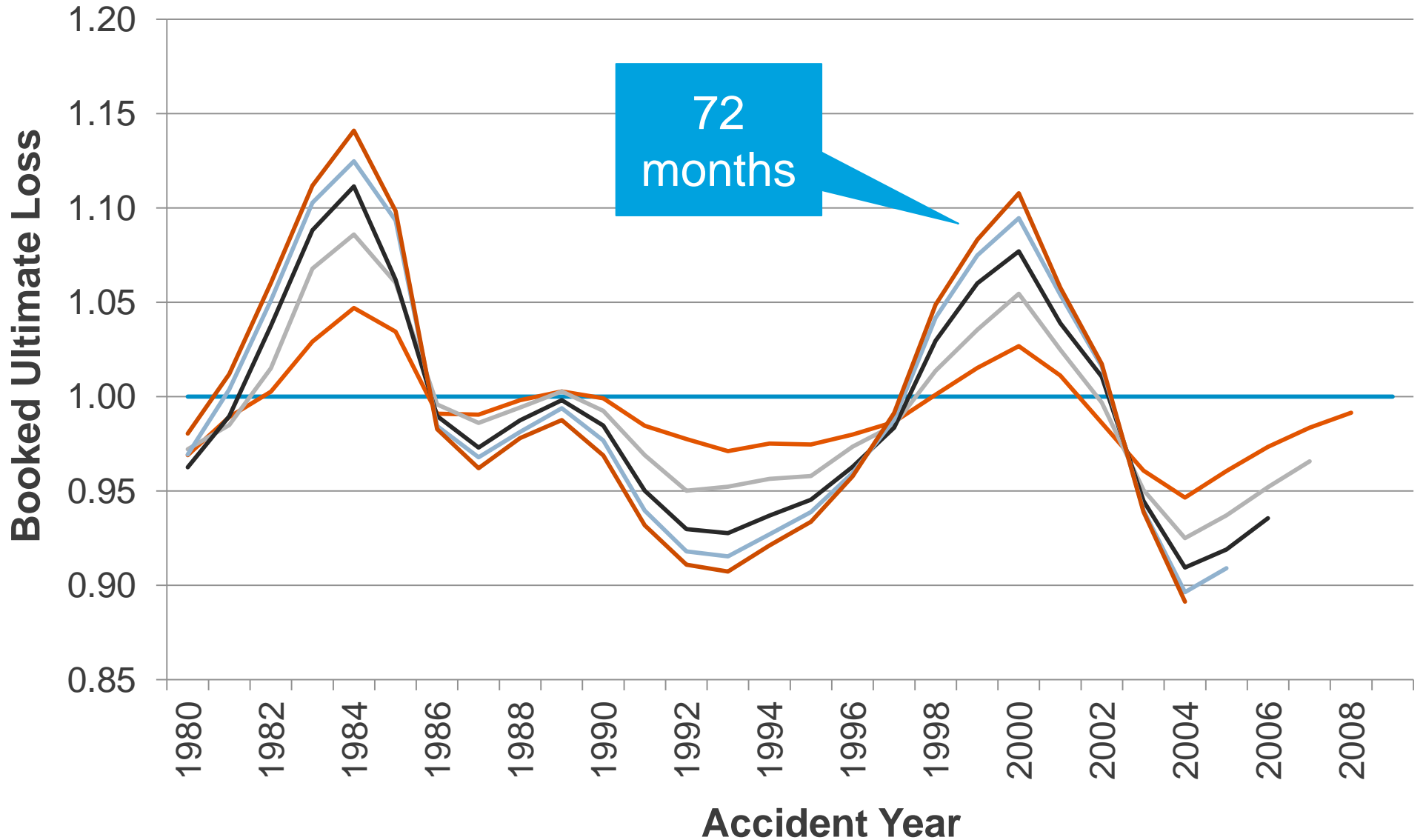
Reserve Cycle



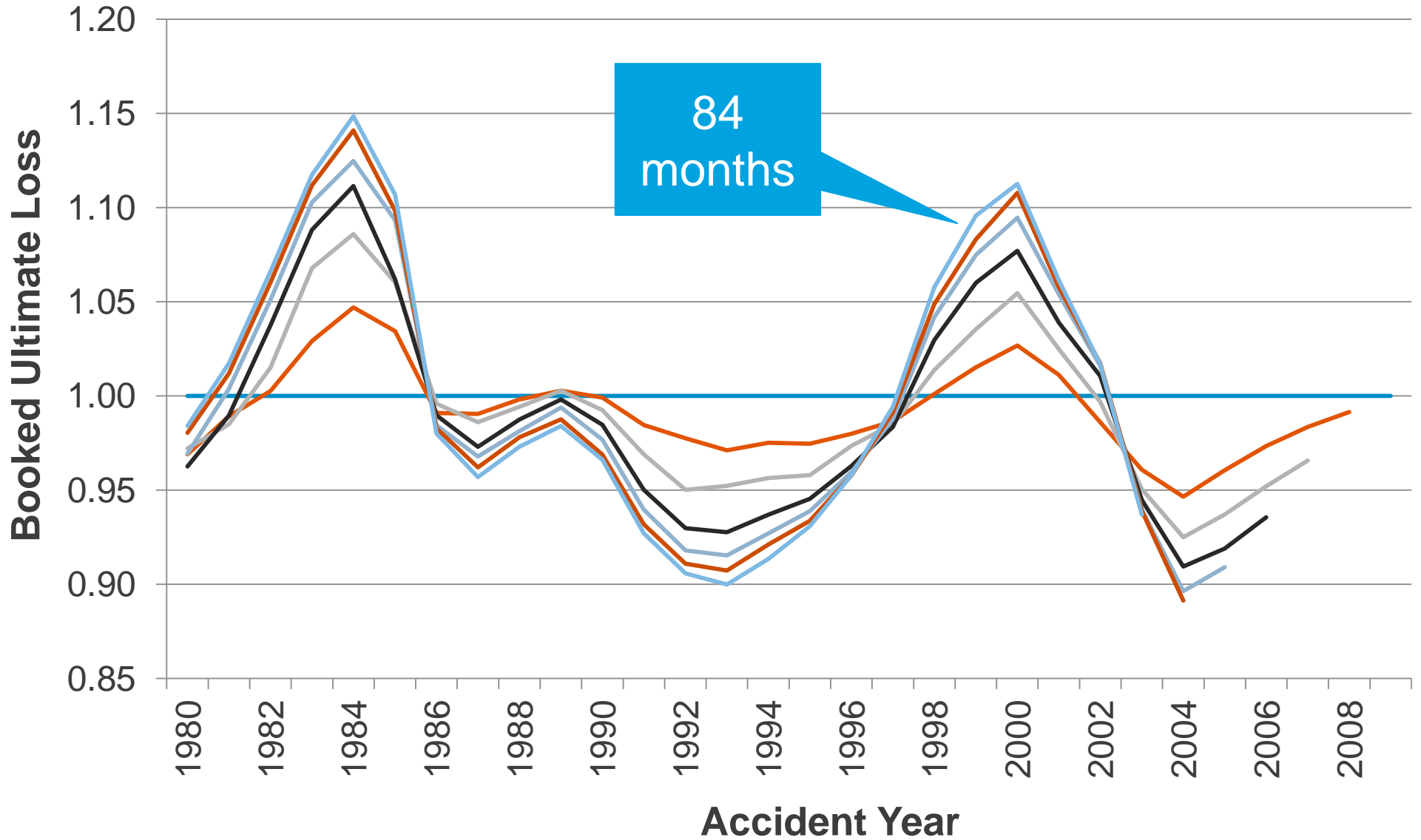
Reserve Cycle



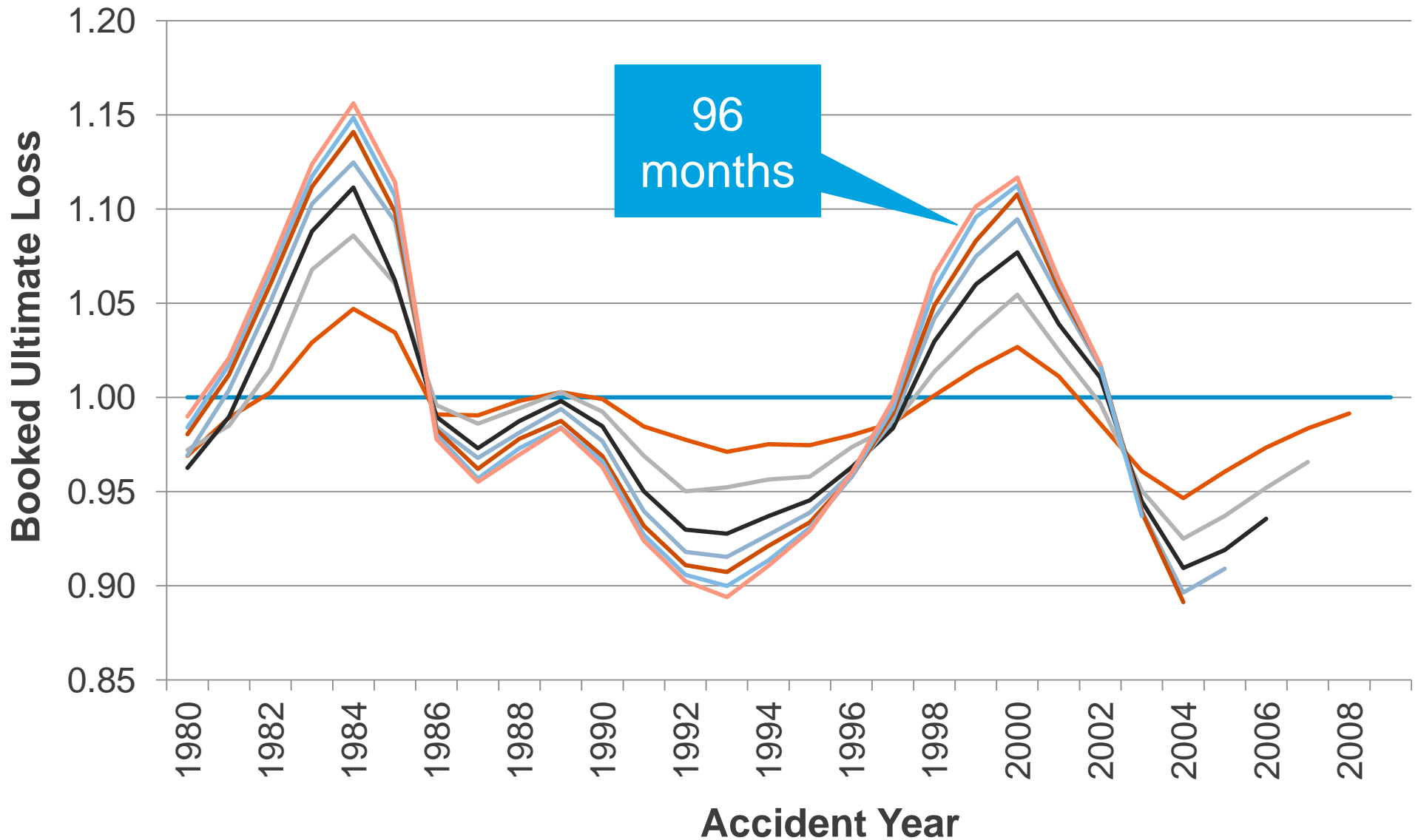
Reserve Cycle



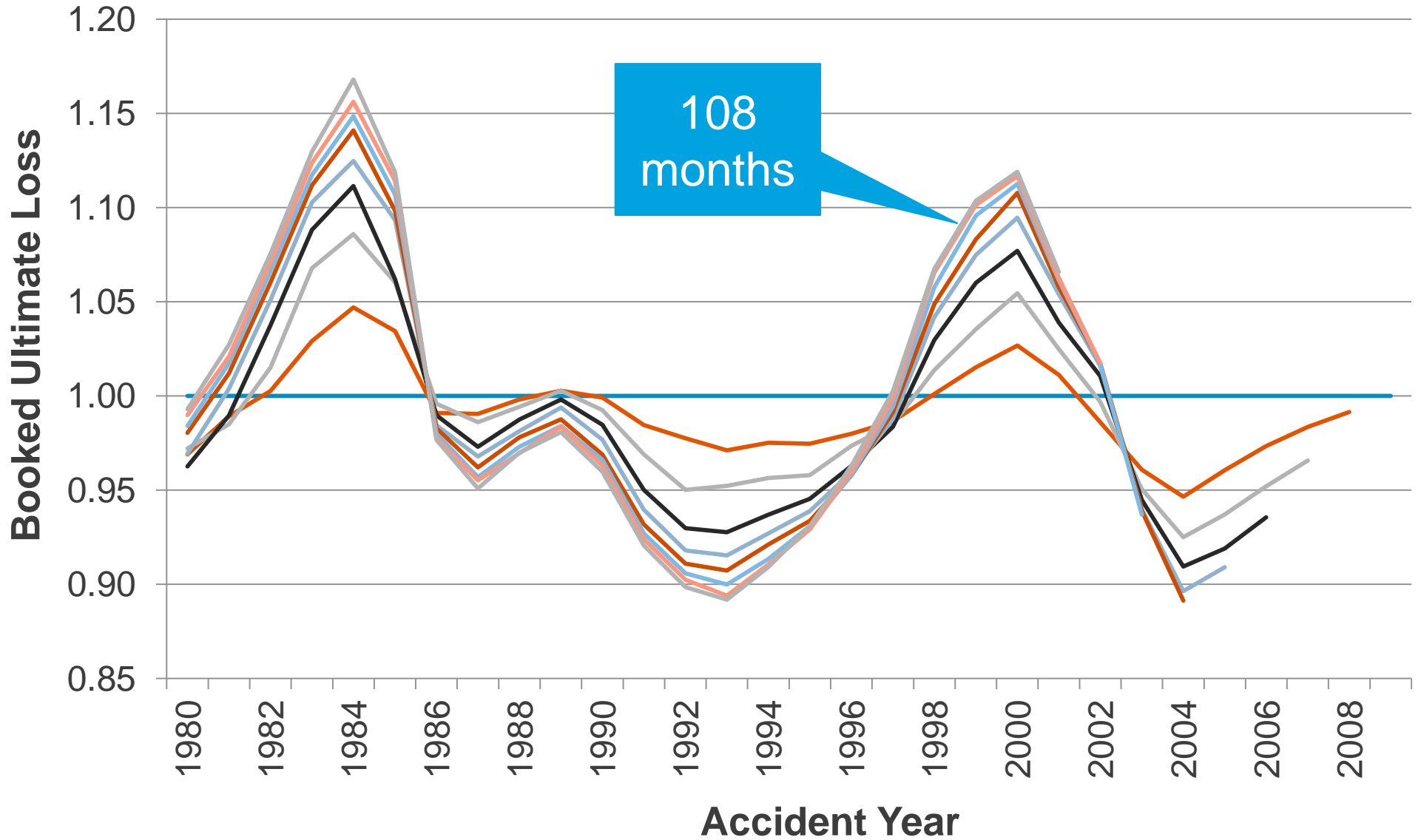
Reserve Cycle



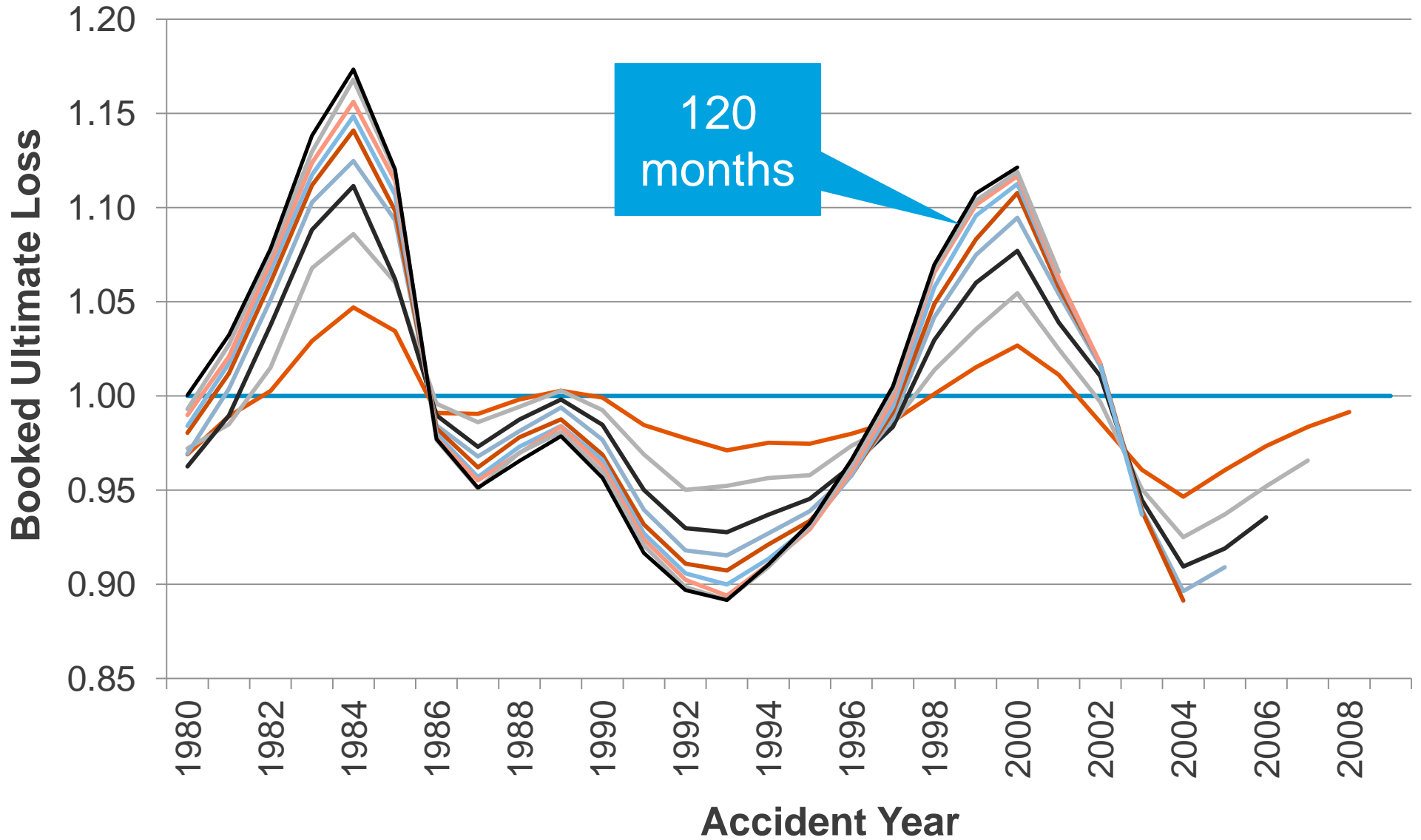
Reserve Cycle



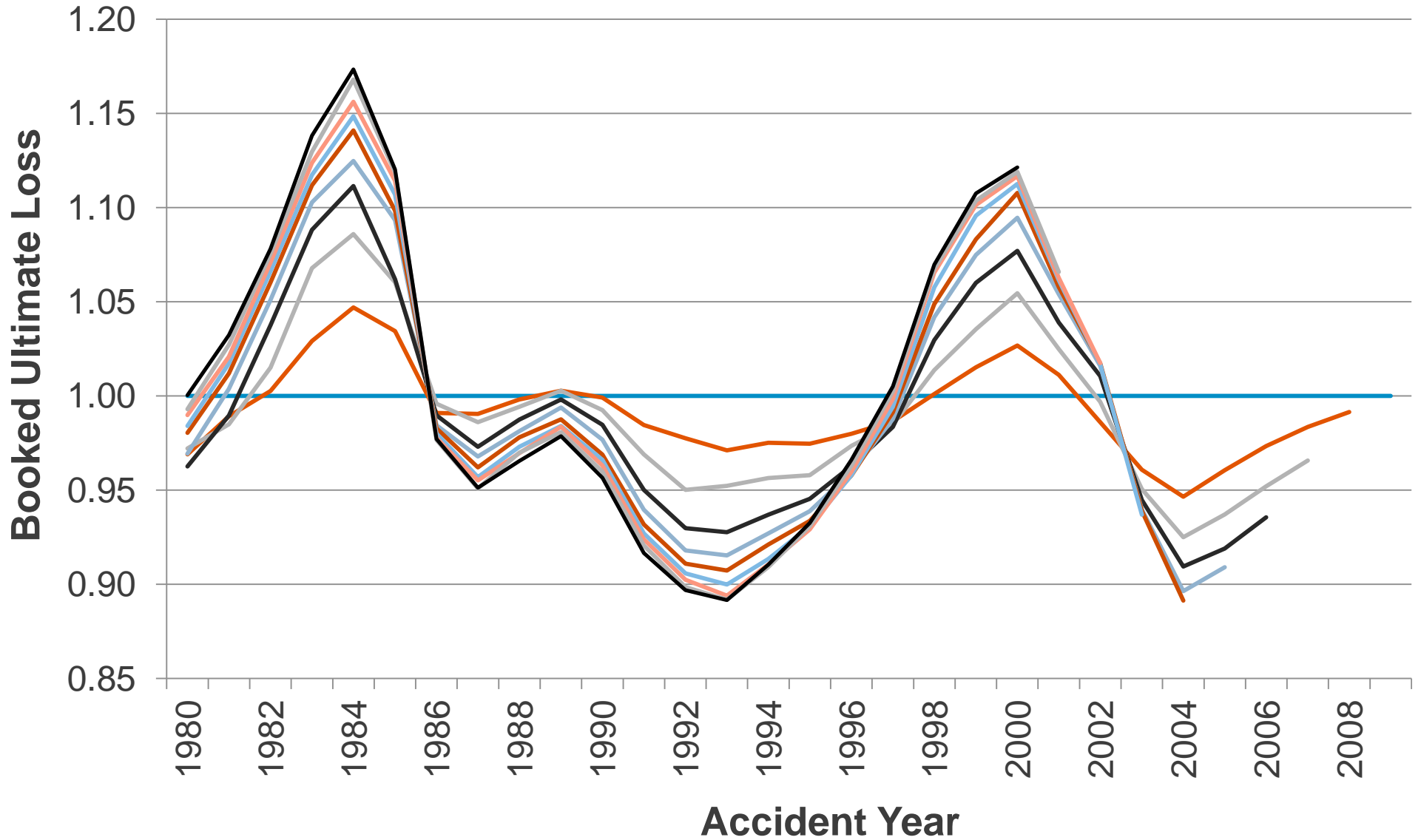
Reserve Cycle



Reserve Cycle

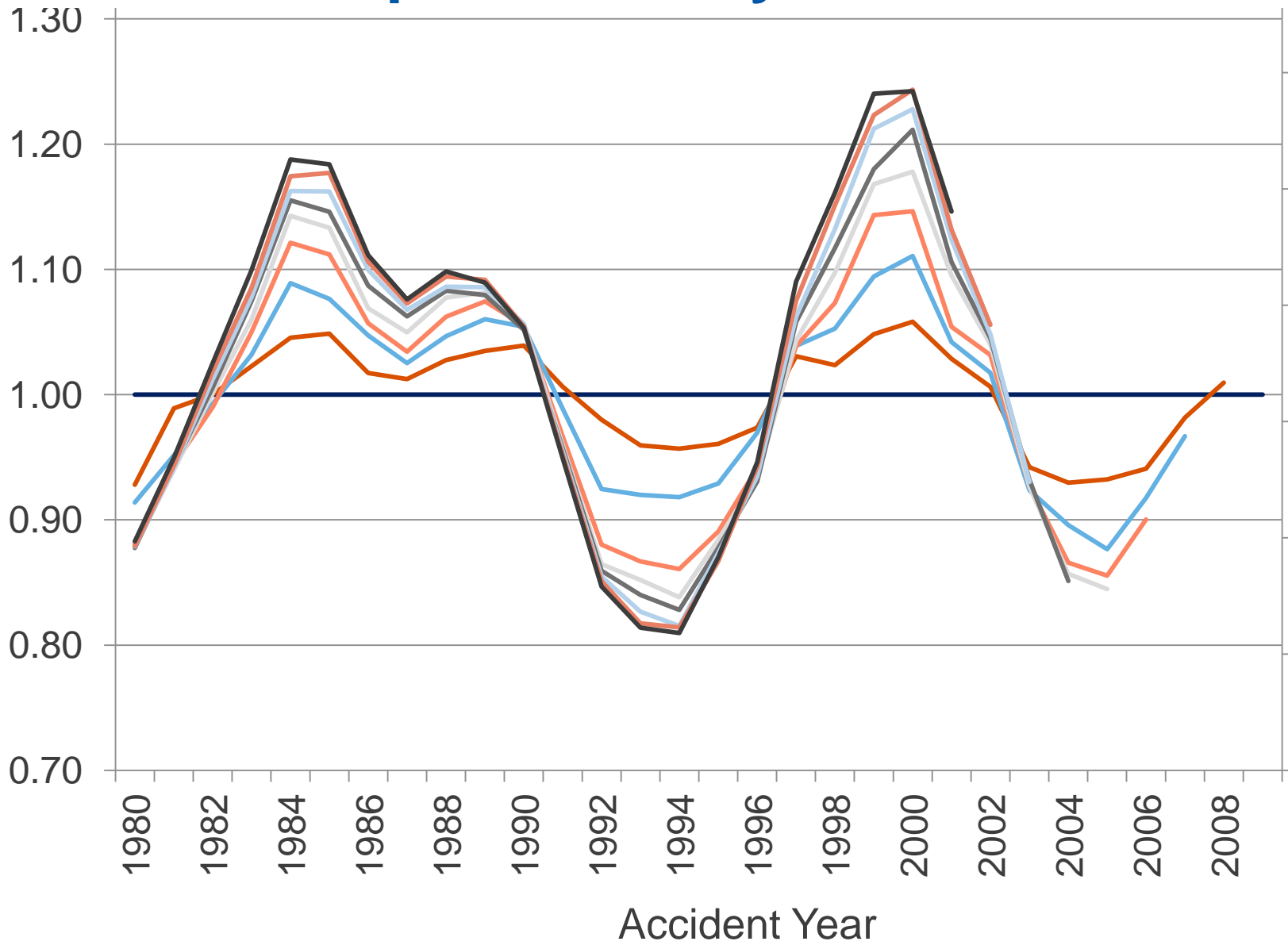


Reserve Cycle

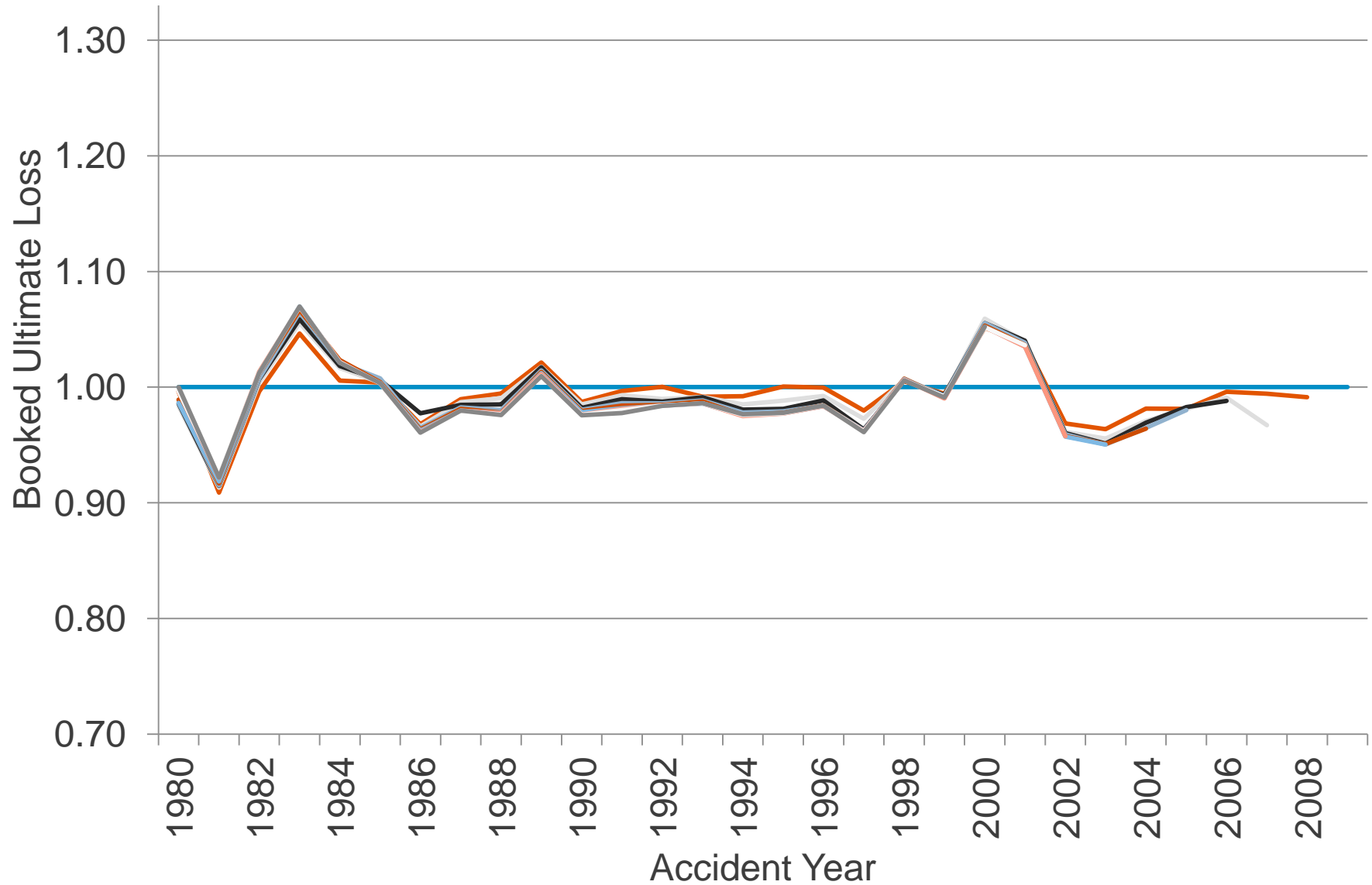


Workers Compensation Cycle

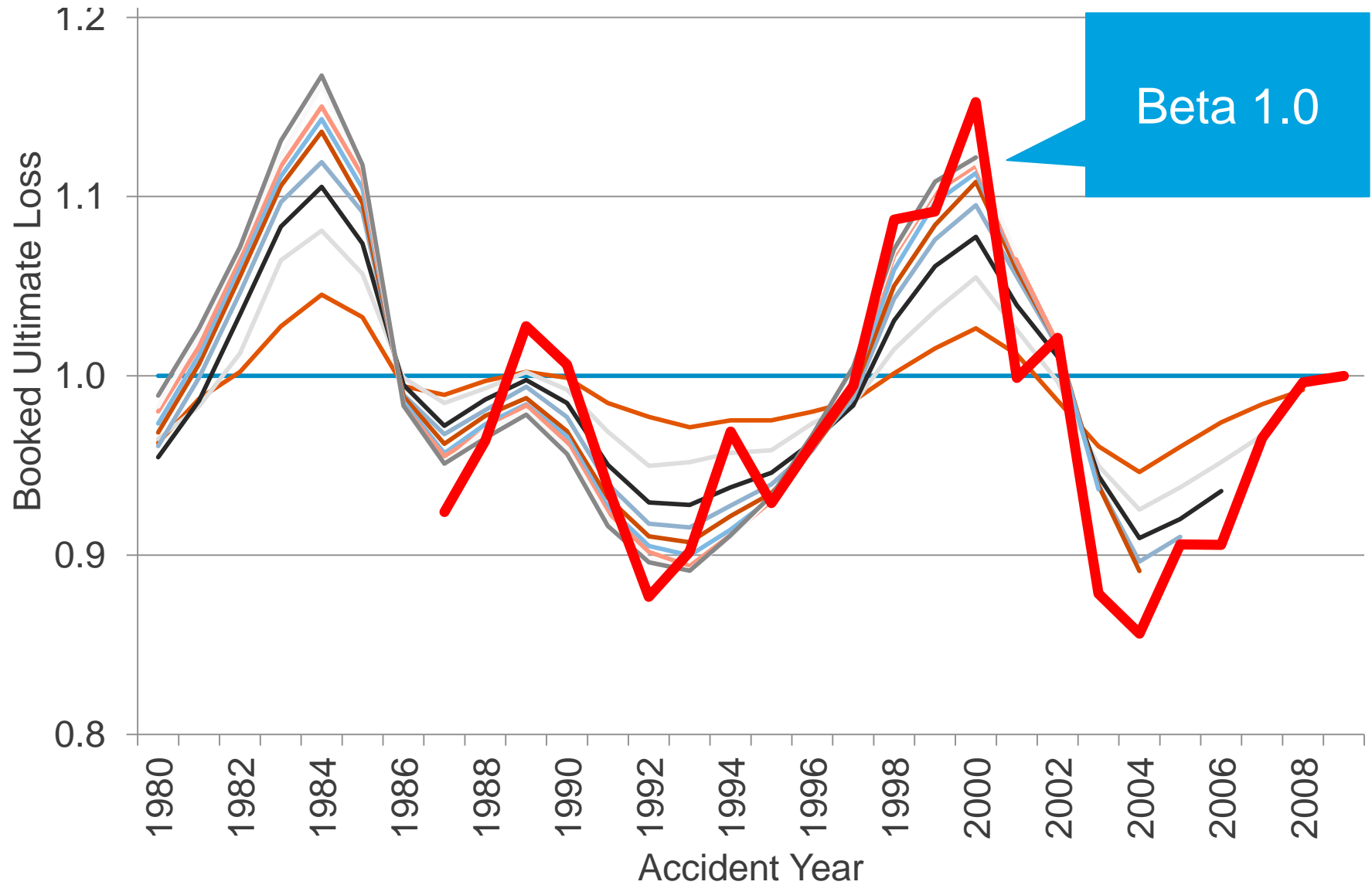
Booked Ultimate Loss



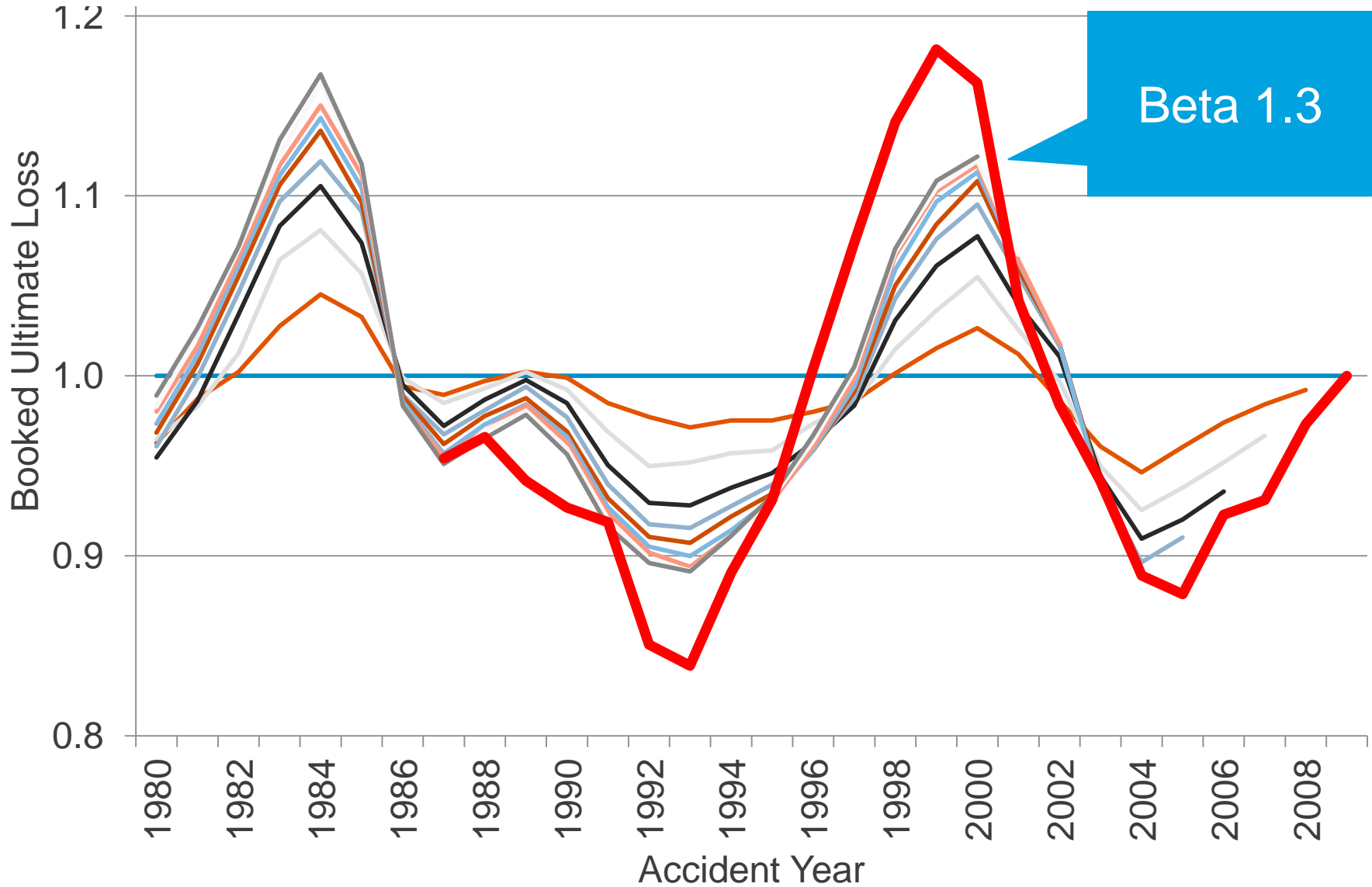
Homeowners Cycle



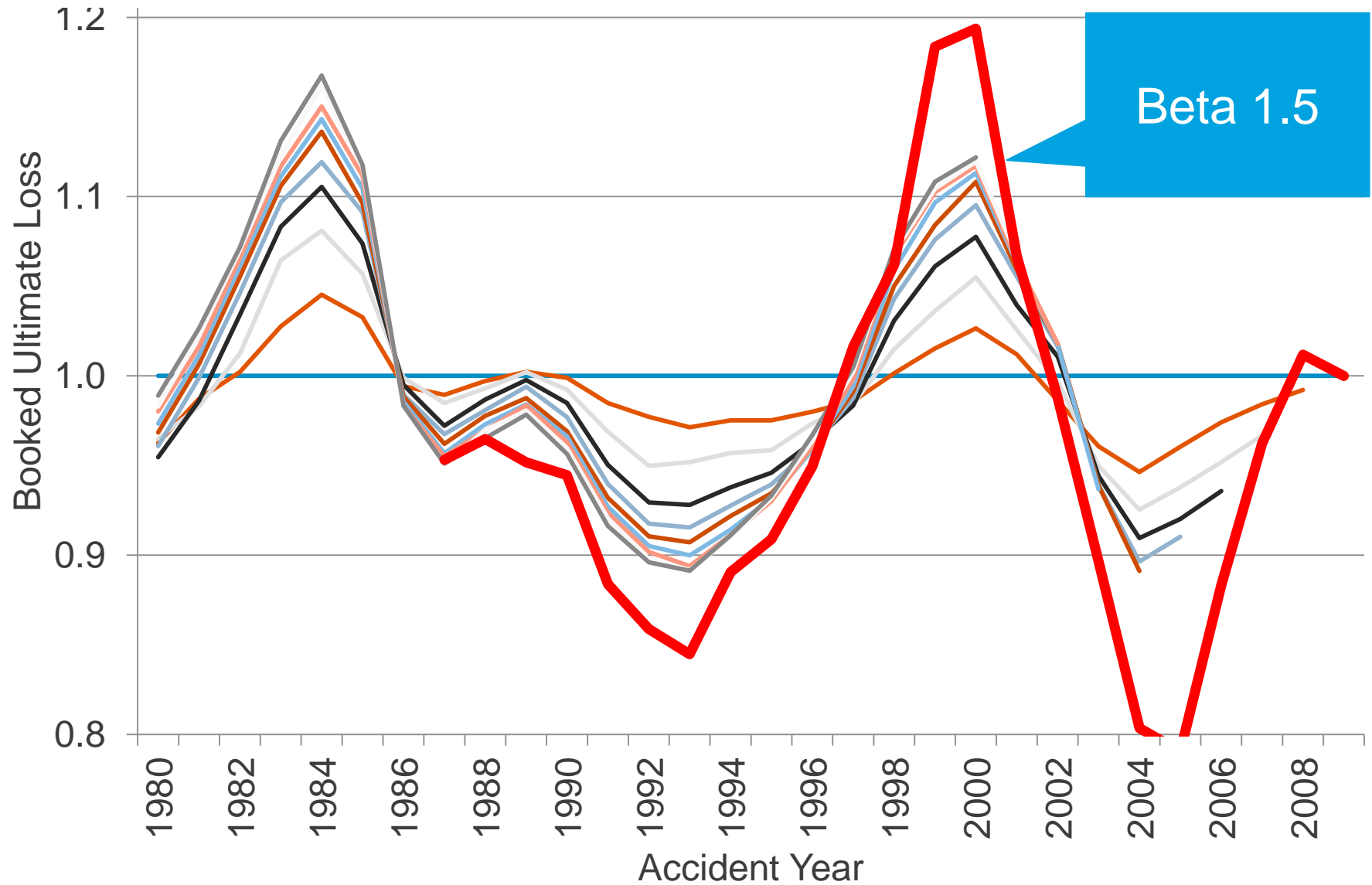
Reserve Cycle – Company A



Reserve Cycle – Company B



Reserve Cycle – Company C



Model risk in the best estimate model

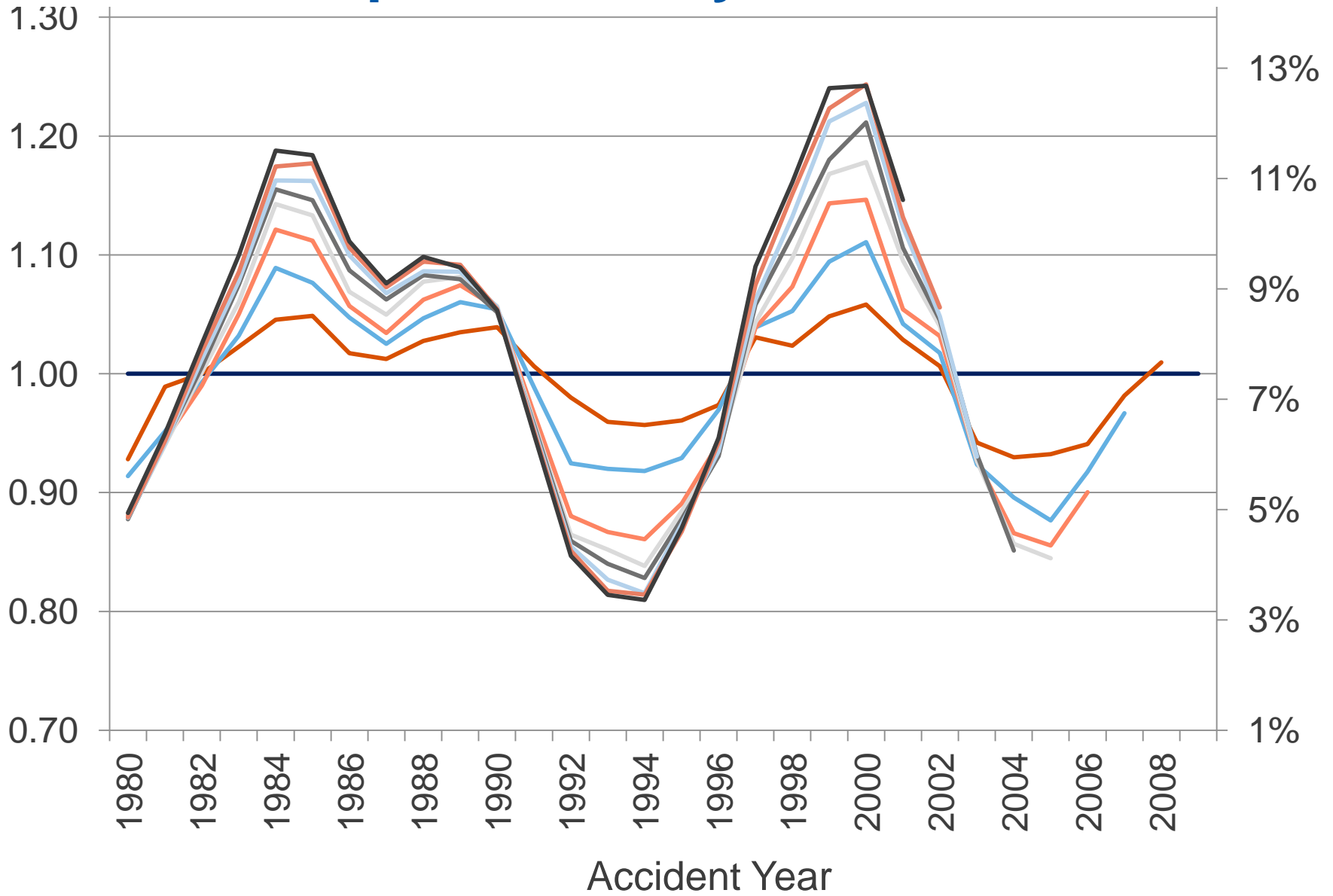
1. Why do we have a cycle?
2. Do we need to break this cycle?

Model risk in the best estimate model

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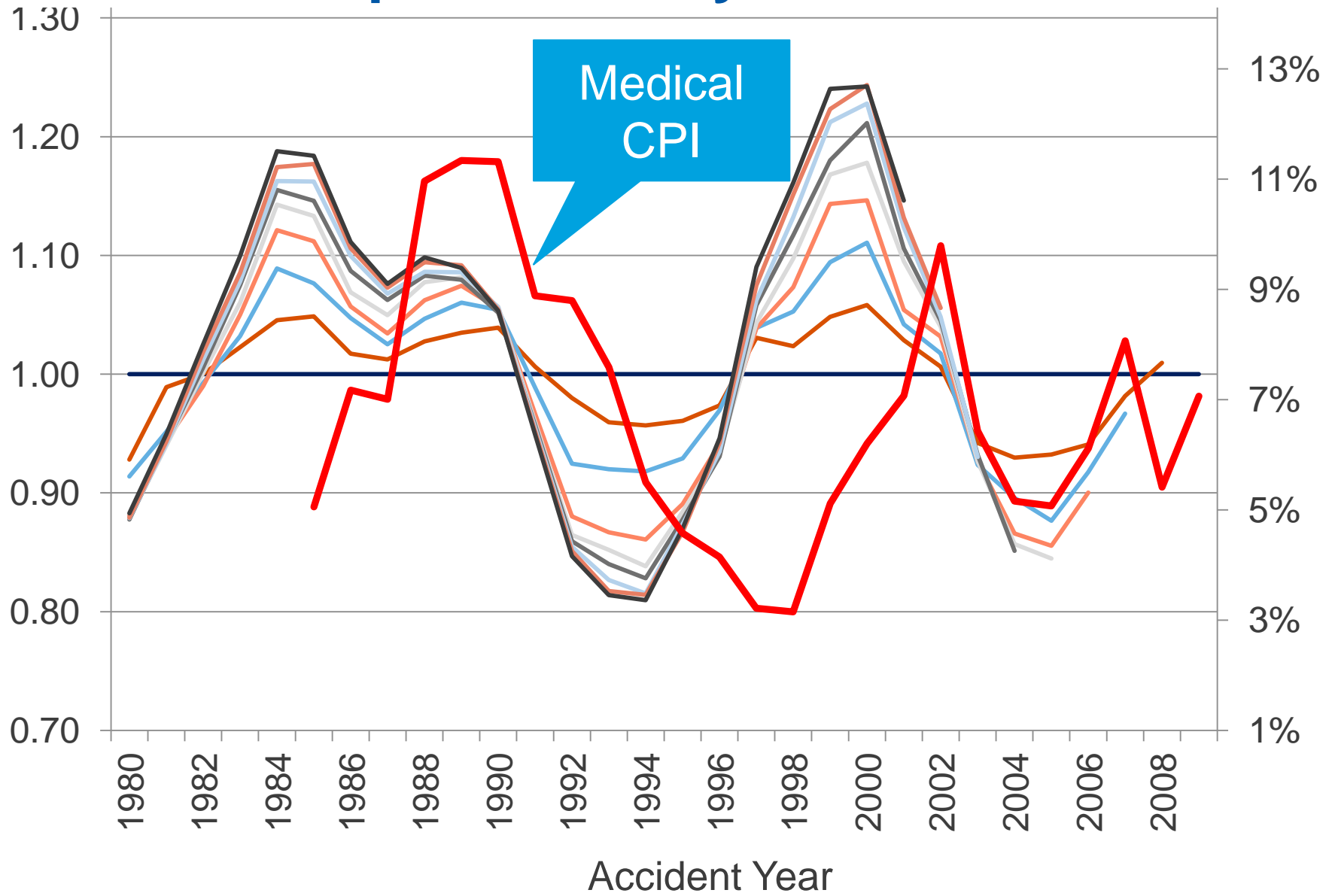
Workers Compensation Cycle & Inflation

Booked Ultimate Loss

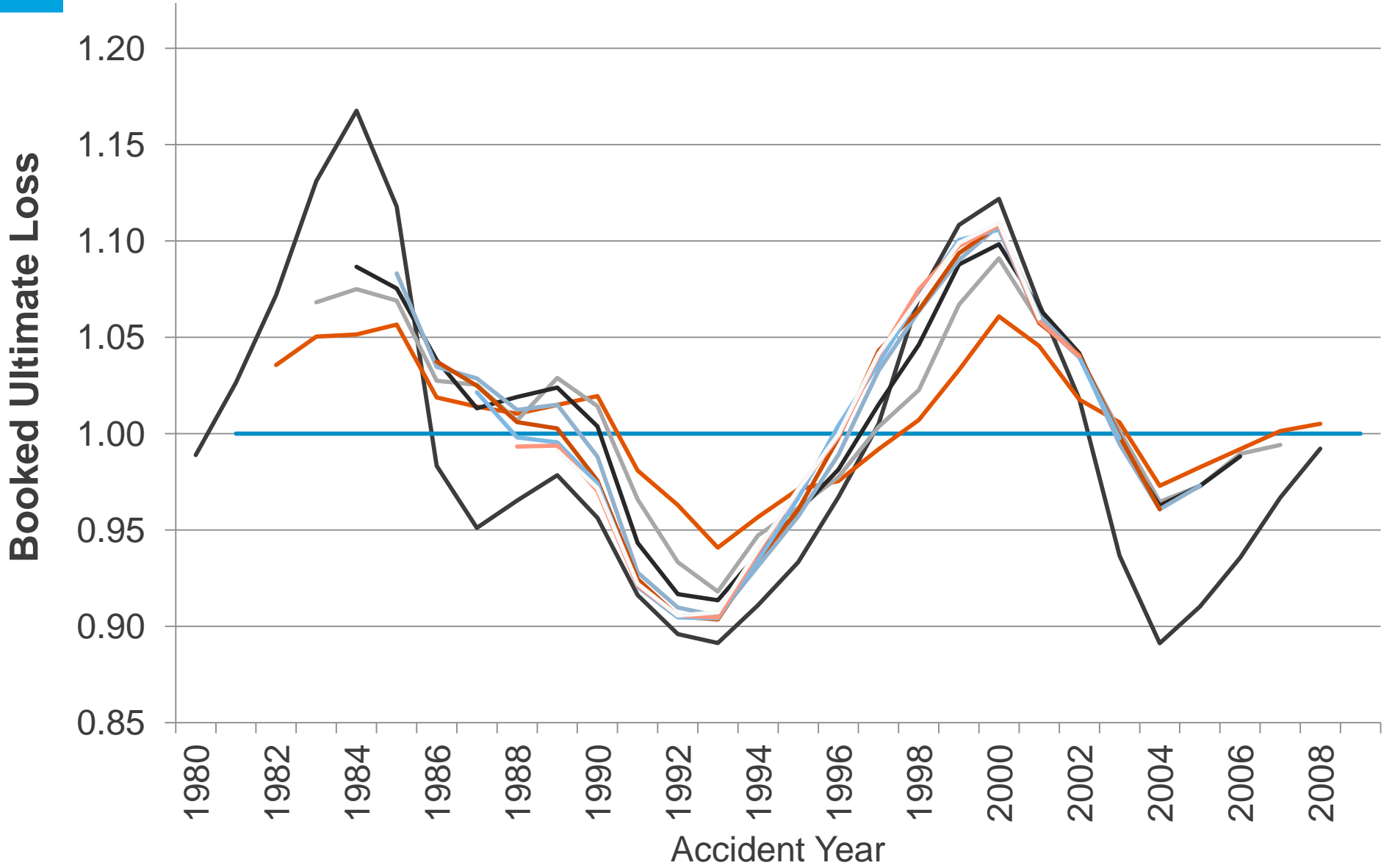


Workers Compensation Cycle & Inflation

Booked Ultimate Loss



Incurred Chainladder Cycle



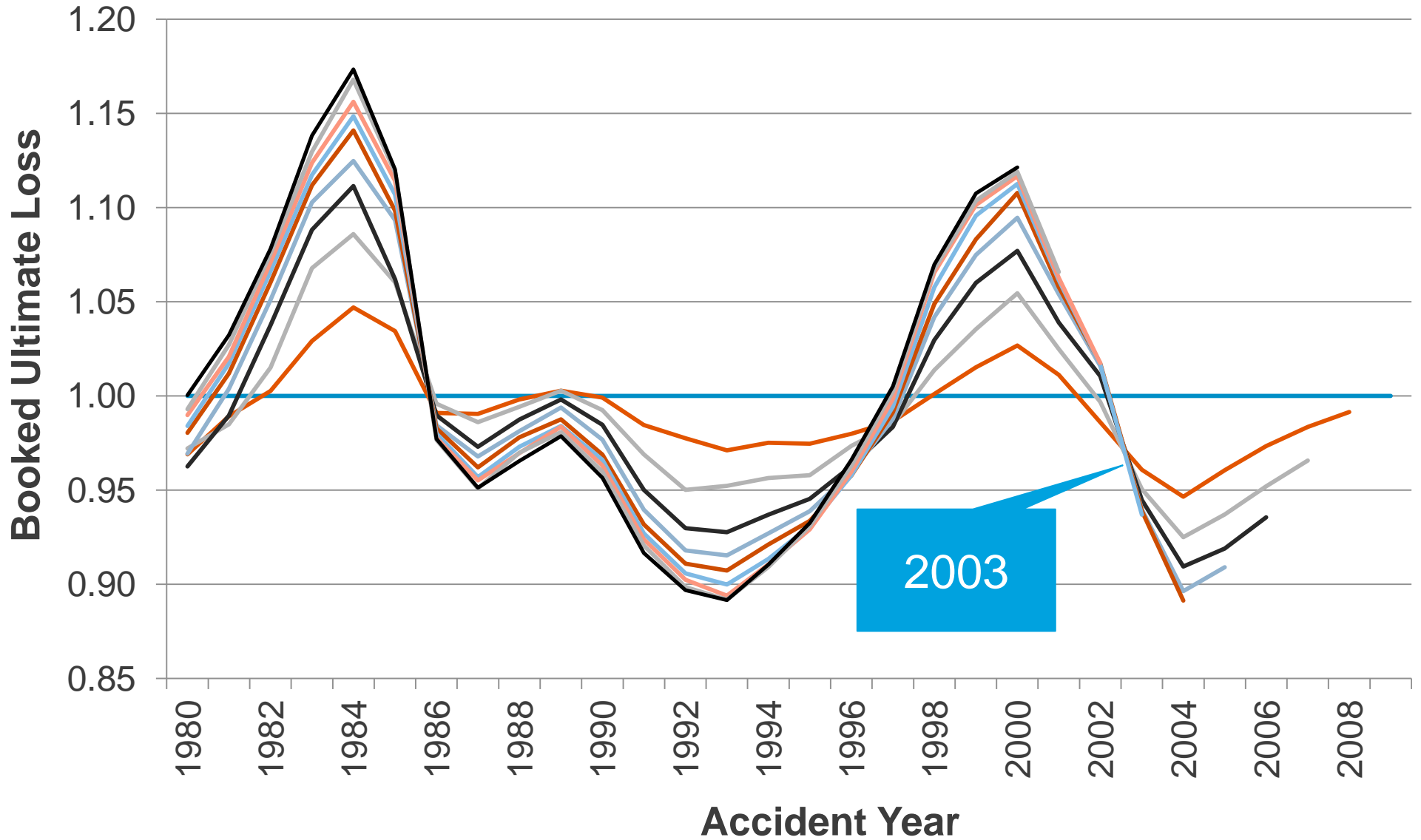
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Reserving Cycle



Top stories for CAS actuaries 2003:

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 - Standard & Poor's published an article in November (2003) stating that "actuaries are signing off on reserves that turn out to be wildly inaccurate. It's an abysmal track record."

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- Standard & Poor's published an article in November (2003) stating that "actuaries are signing off on reserves that turn out to be wildly inaccurate. It's an abysmal track record."

2. [L]evel of Reserve Deficiency...

- Despite substantial reserve increases by ...insurers, during 2003 rating agencies estimate that the non-asbestos reserve shortfall ...is between \$30 billion and \$60 billion.

Top stories for CAS actuaries 2004:

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9. Actuarial Organizations Respond to ...Criticism of Loss Reserving

[T]he CAS Board is working with a task force to prioritize a series of action plans relating to loss reserving.

Top stories for CAS actuaries 2004:

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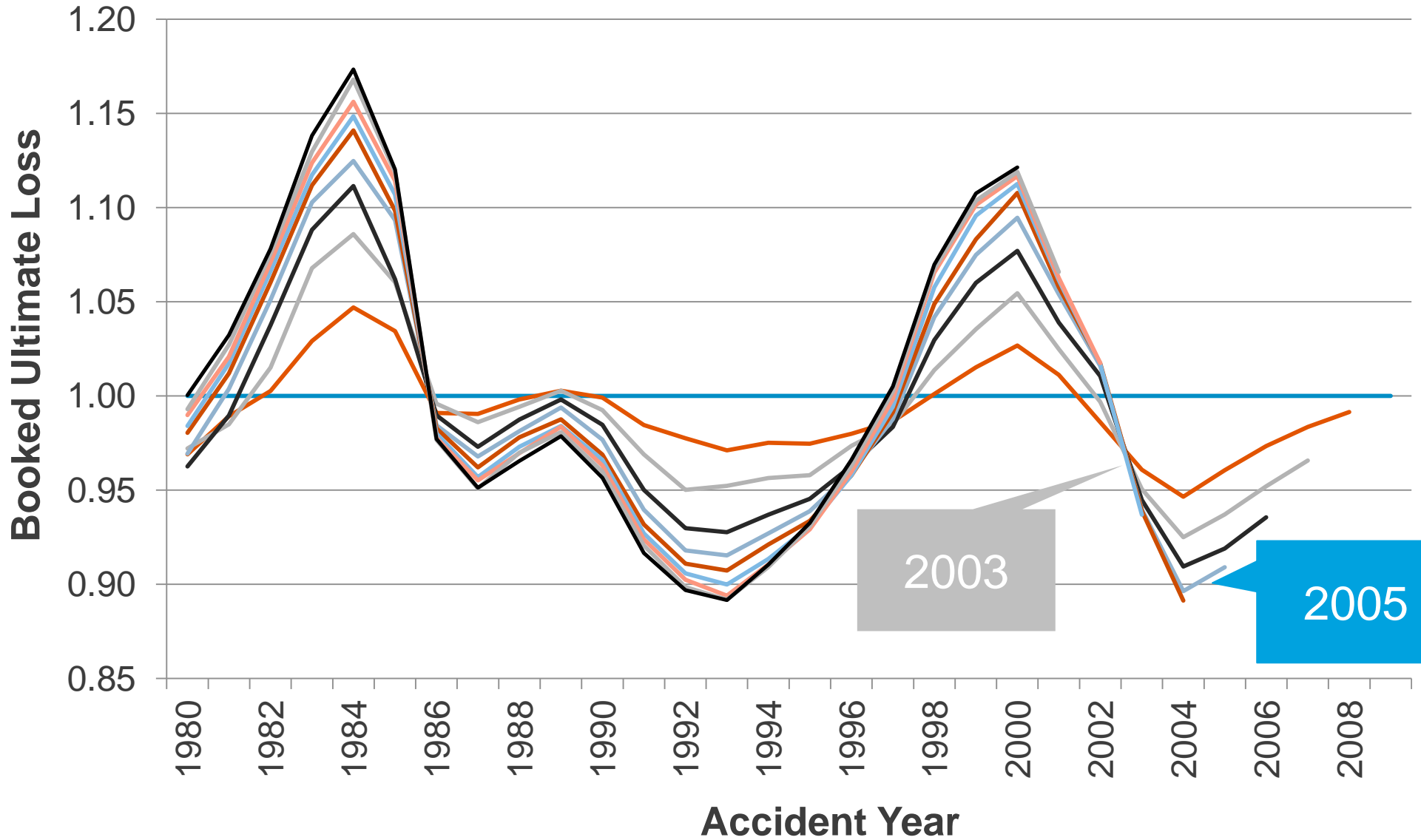
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The profession must continue... its self-review, as these issues will not go away on their own.

Reserving Cycle



Top stories for CAS actuaries 2005:

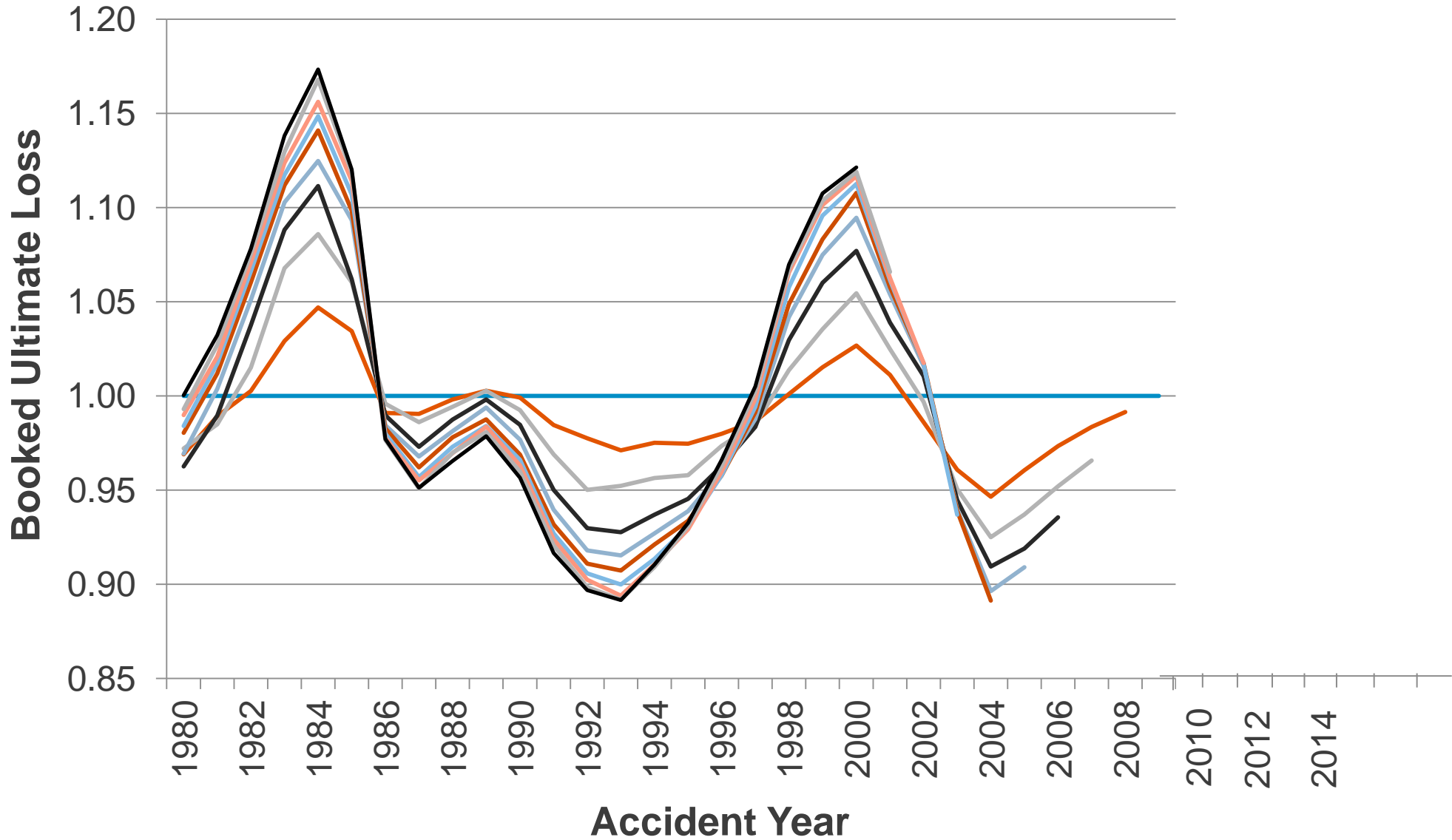
Top stories for CAS actuaries 2005:

- ?

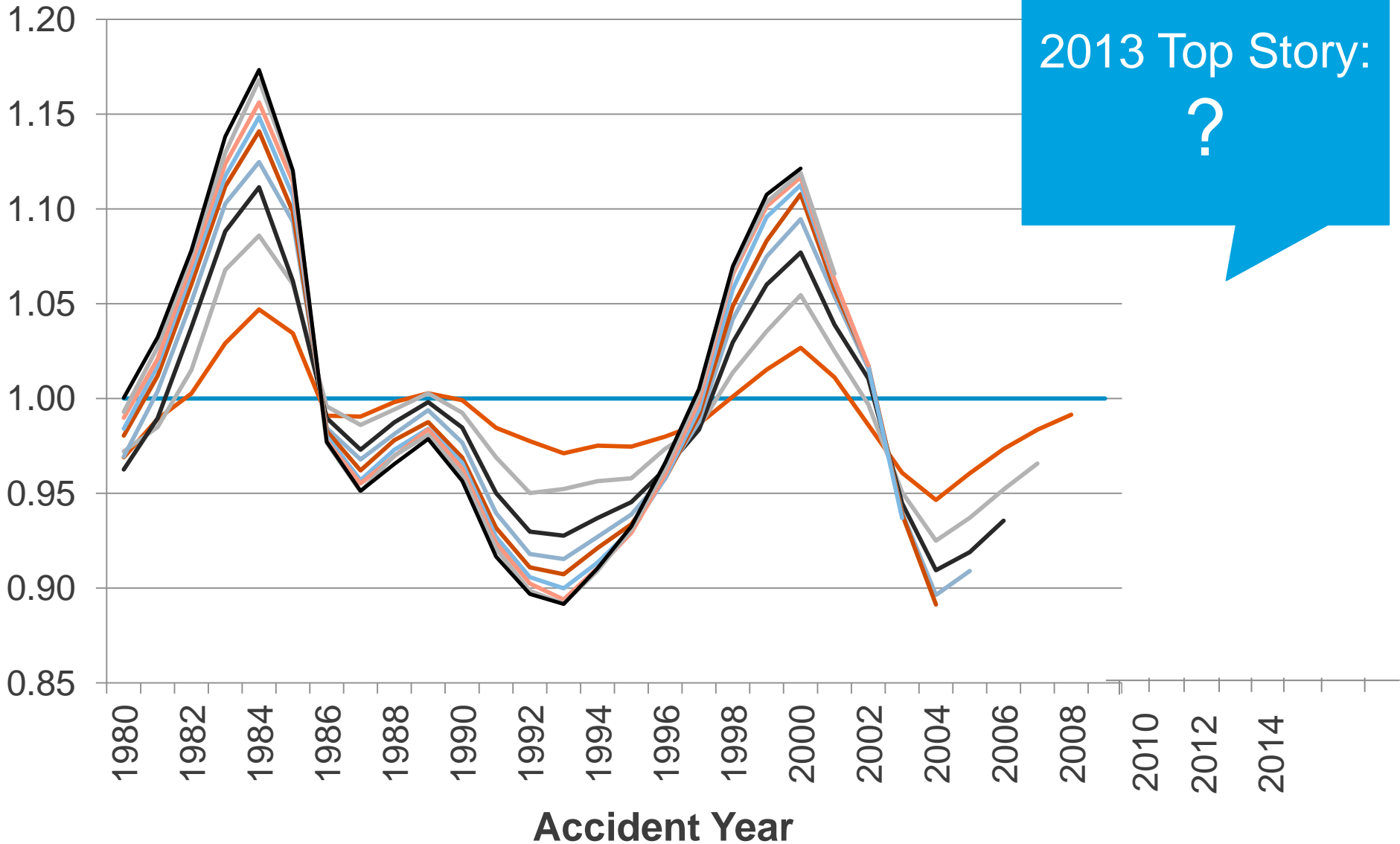
Top stories for CAS actuaries 2005:

- ? What reserving problem ?

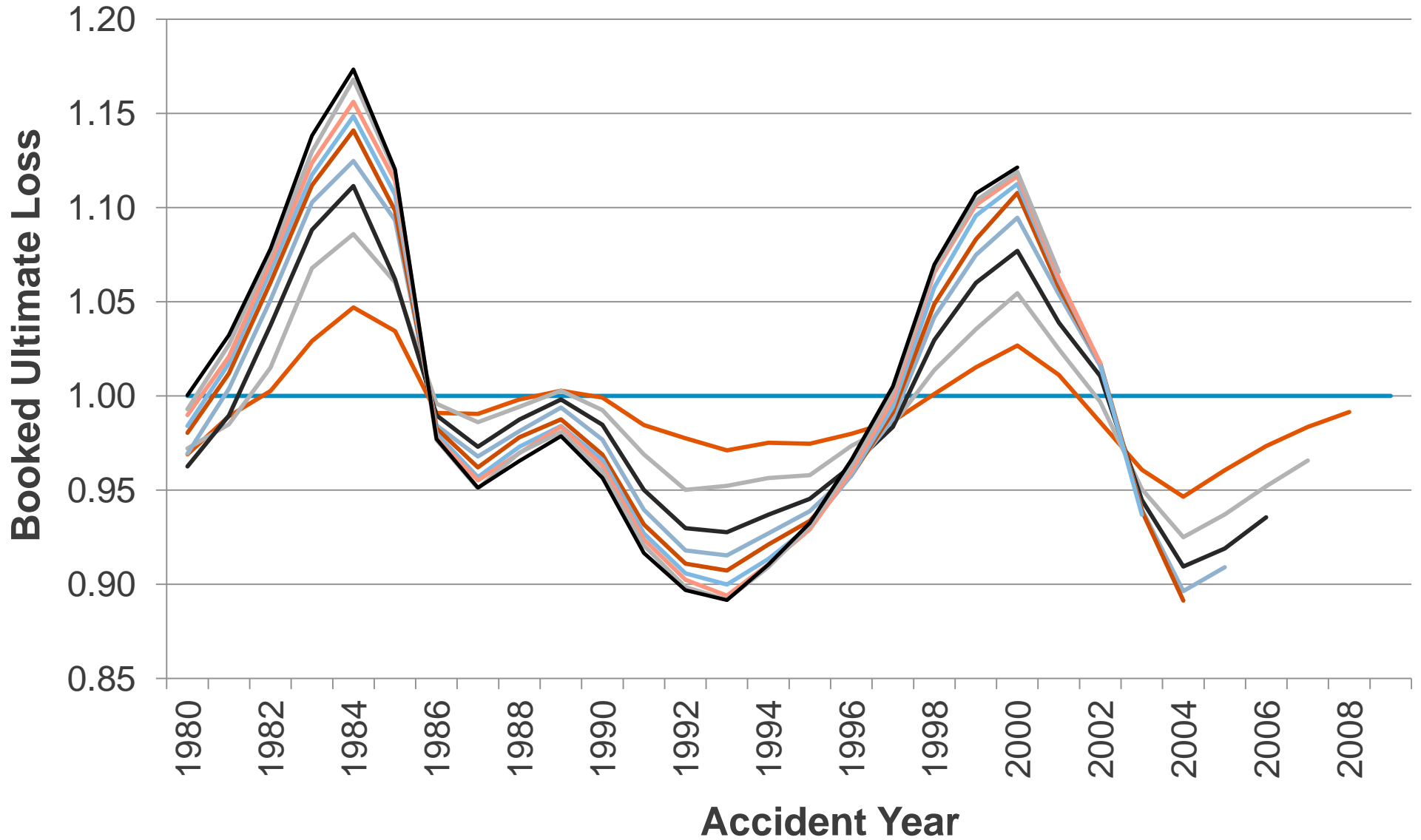
Reserving Cycle



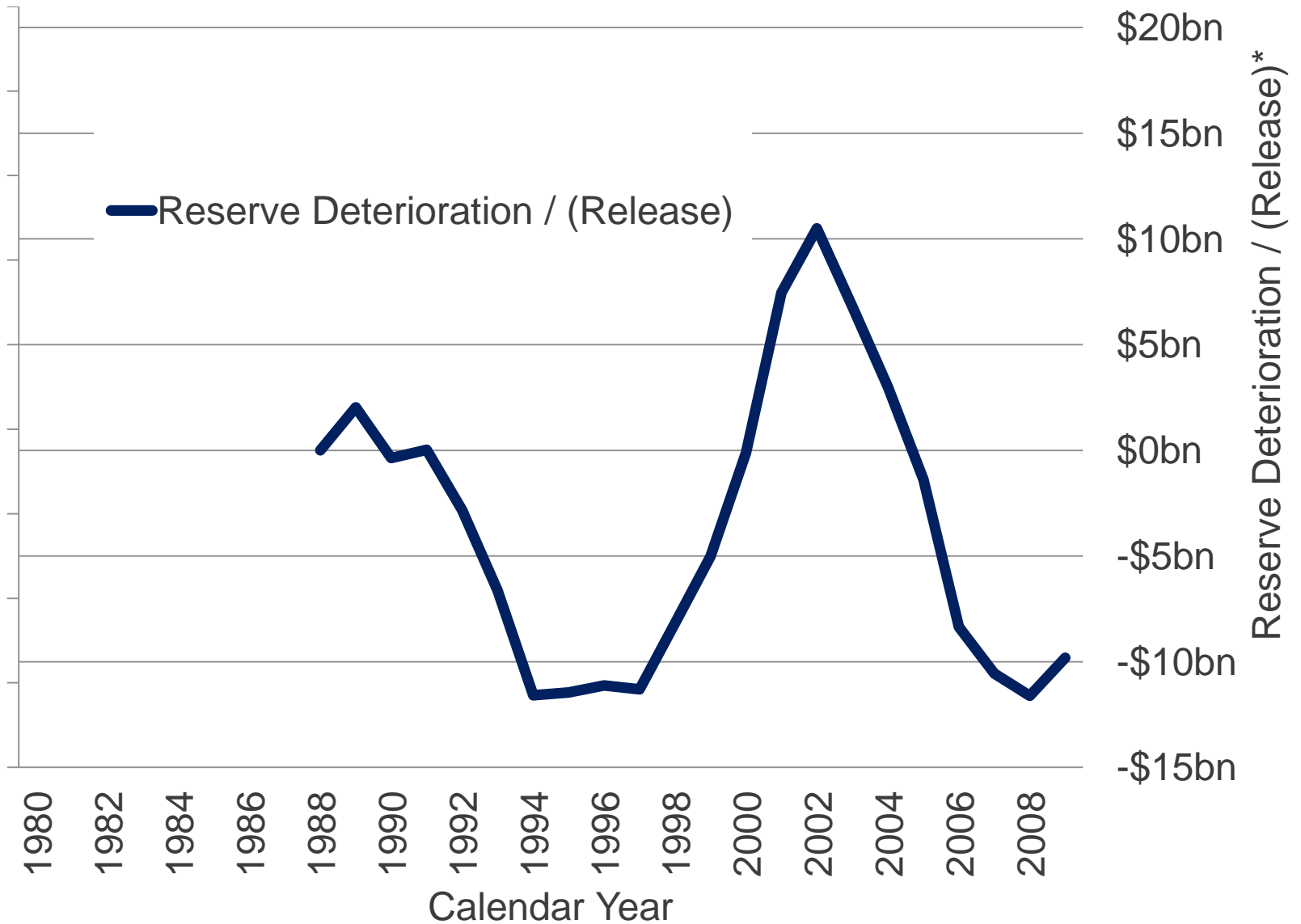
Reserving Cycle



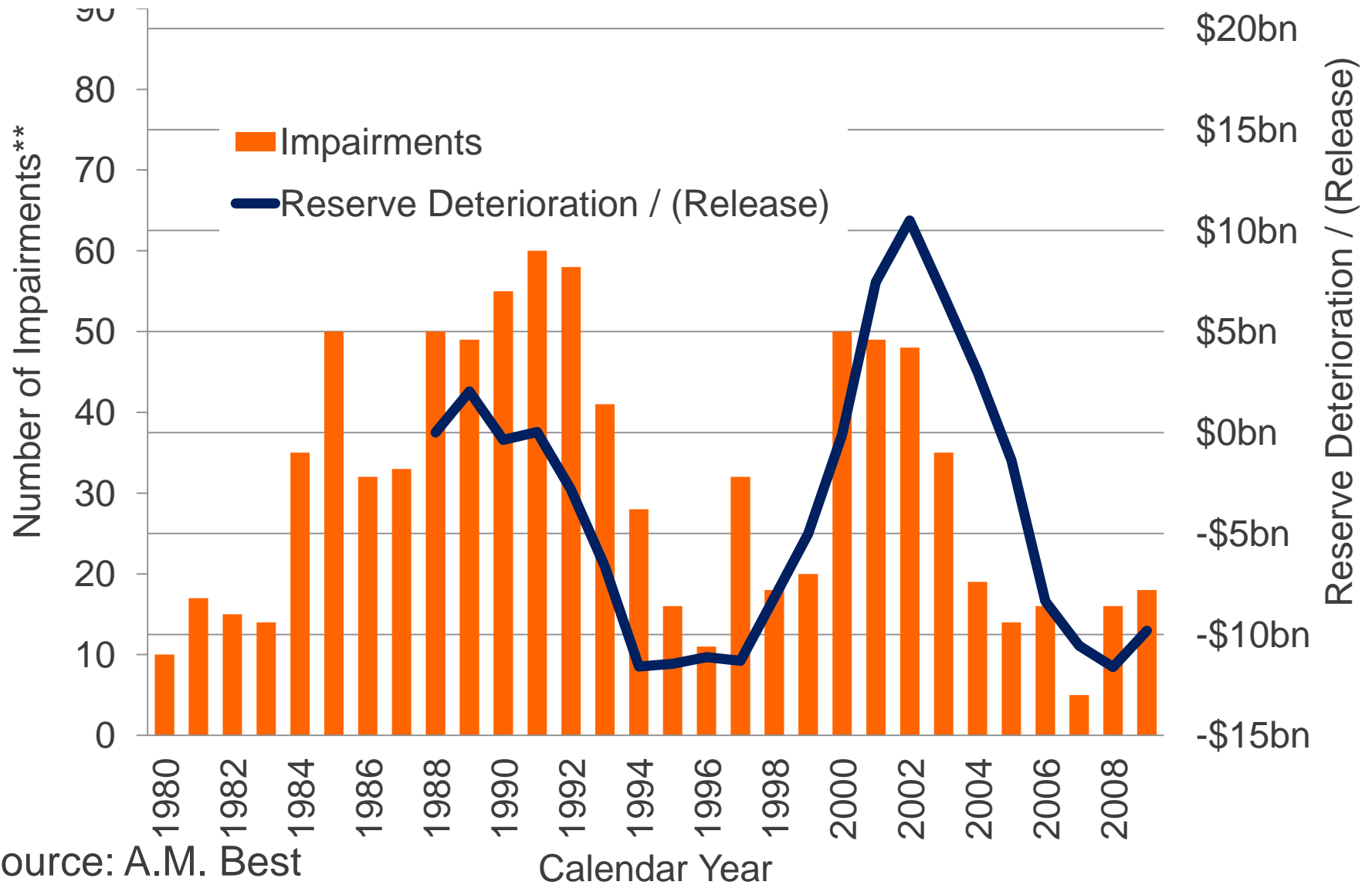
Reserving Cycle



Reserve Deterioration / (Release)*



Reserve Deterioration vs Impairments



**Source: A.M. Best

Model risk in the best estimate model

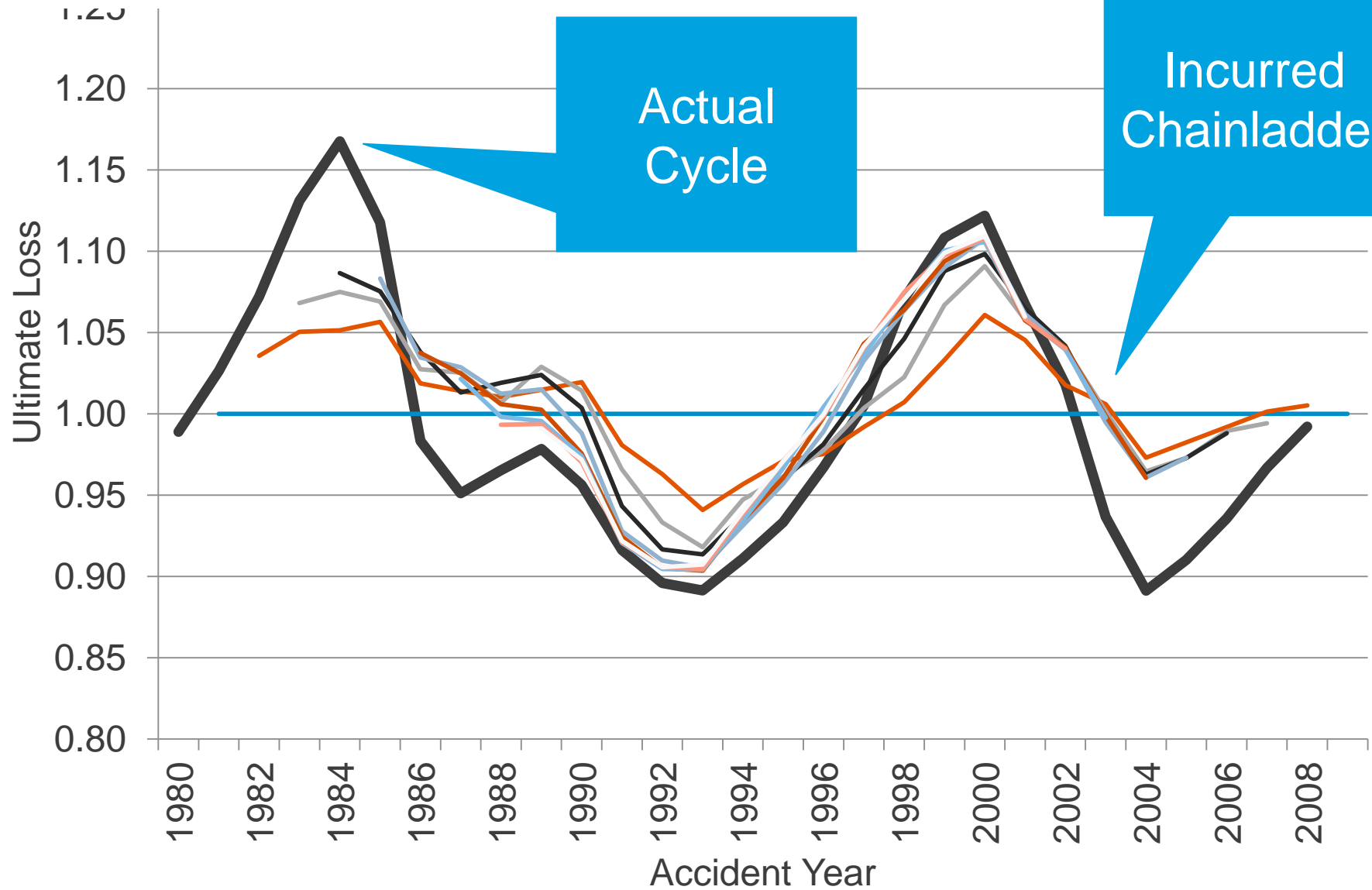
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Incurring Chain ladder Cycle



Paid Chain ladder Cycle

