GUY CARPENTER

Reserve Risk Models: Grey, White and Black Swans

Jessica Leong, FCAS, FIAA, MAAA

Lead Casualty Specialty Actuary

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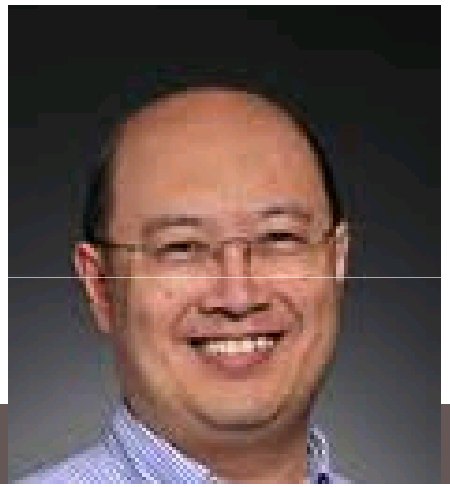
- Andrew Lo
Director of the MIT laboratory
for financial engineering



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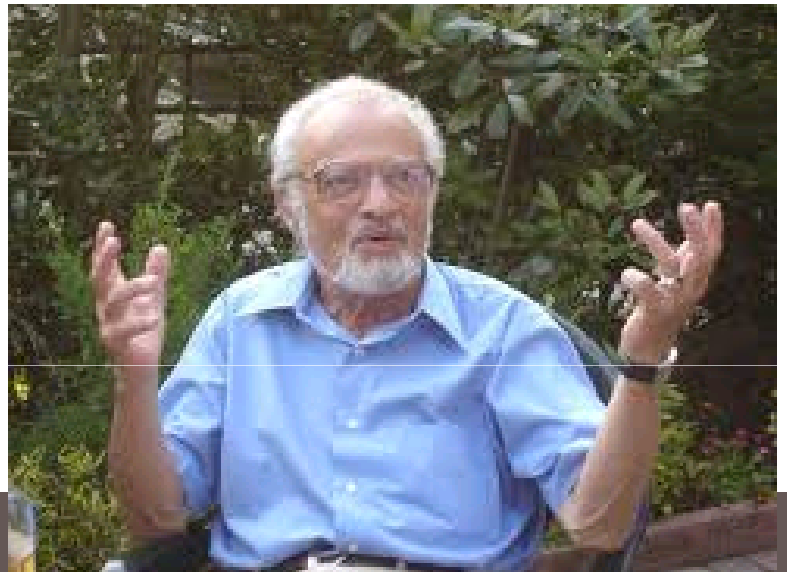
University of London



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2. Let’s start again:

   (i) Observing reserve risk

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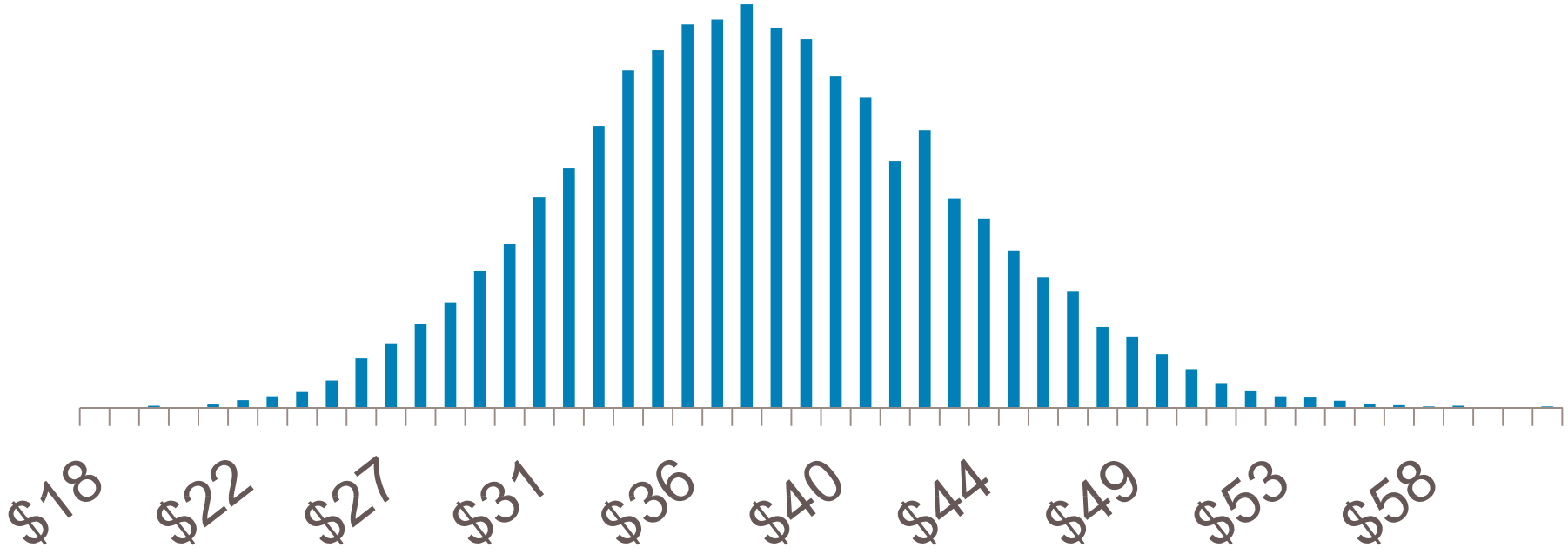
- No tail factor

Company A

Distribution of Homeowners Unpaid as of 12/2000



Reserve $m

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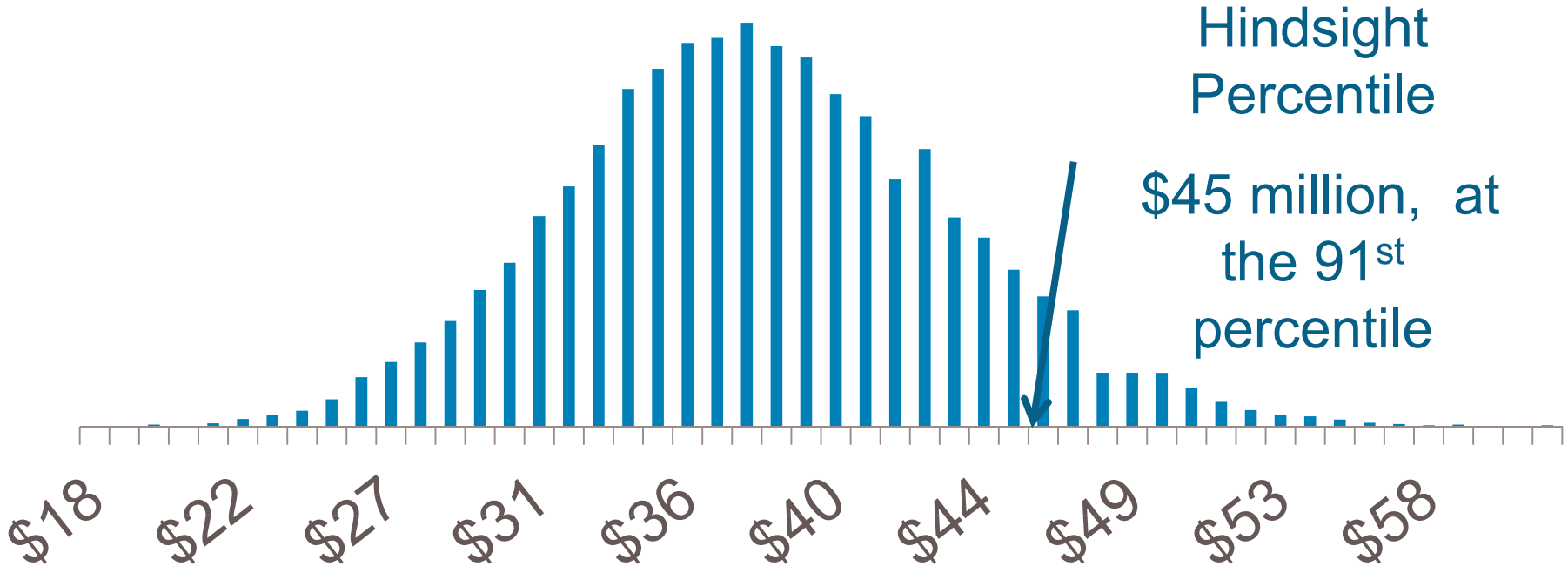
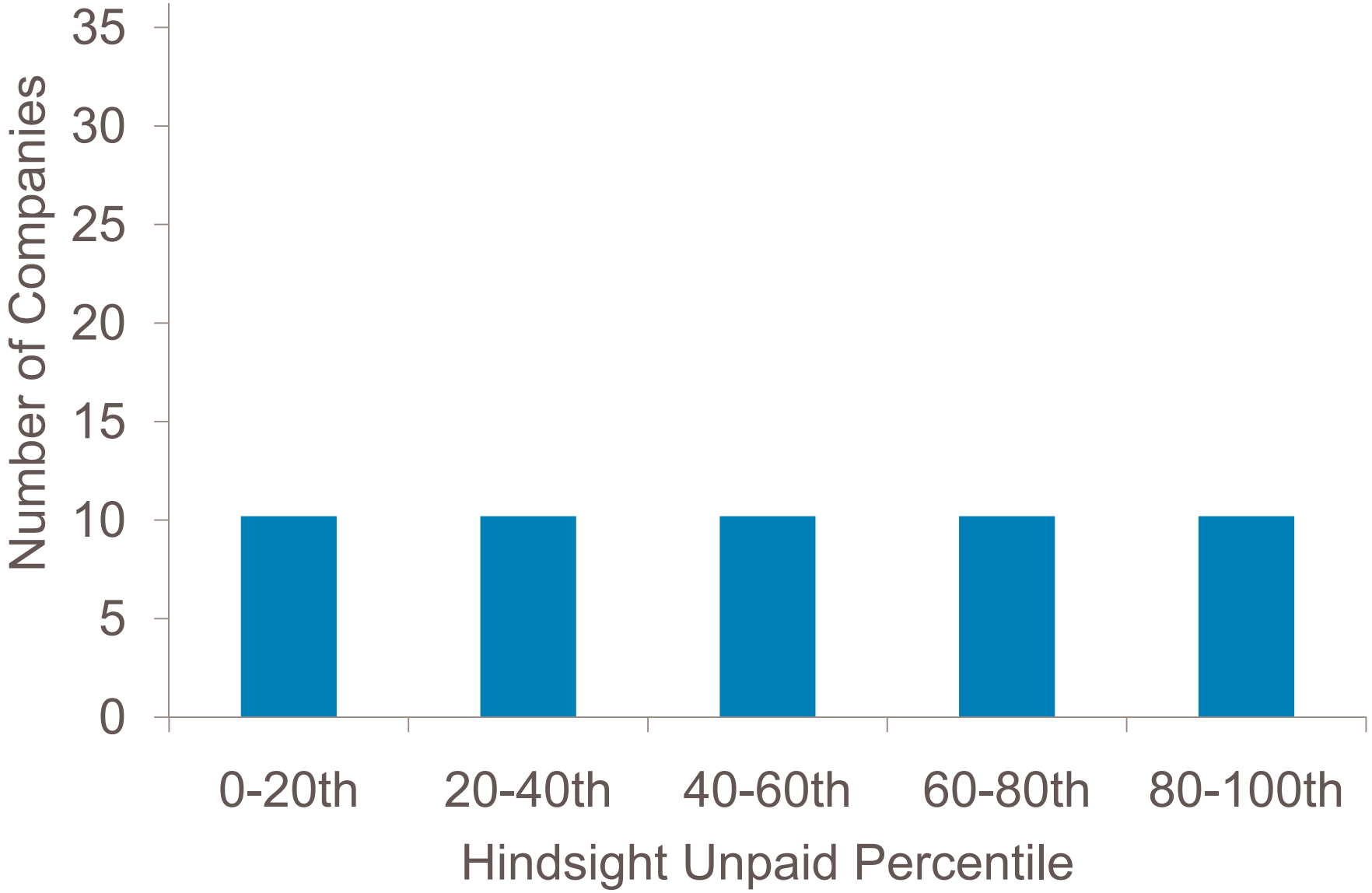


Reserve $m

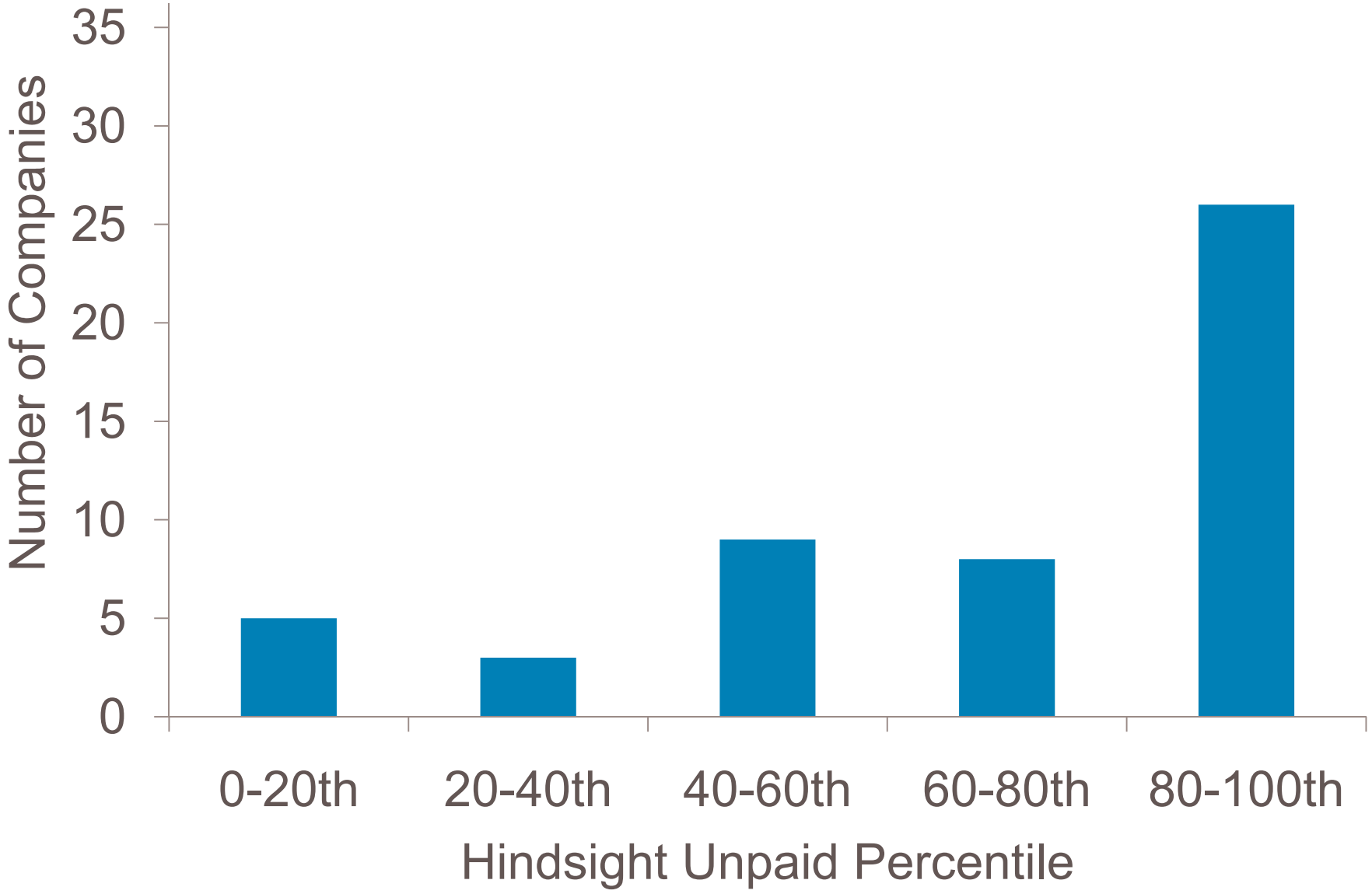
Note that there is no tail factor on the 10x10 year triangle so the $45 million is only the unpaid from 24 to 120 months.

51 Companies	Hindsight Percentile
Company A	91%
Company B	51%
Company C	6%
….	….
….	….
Company AA	85%
Company AB	37%

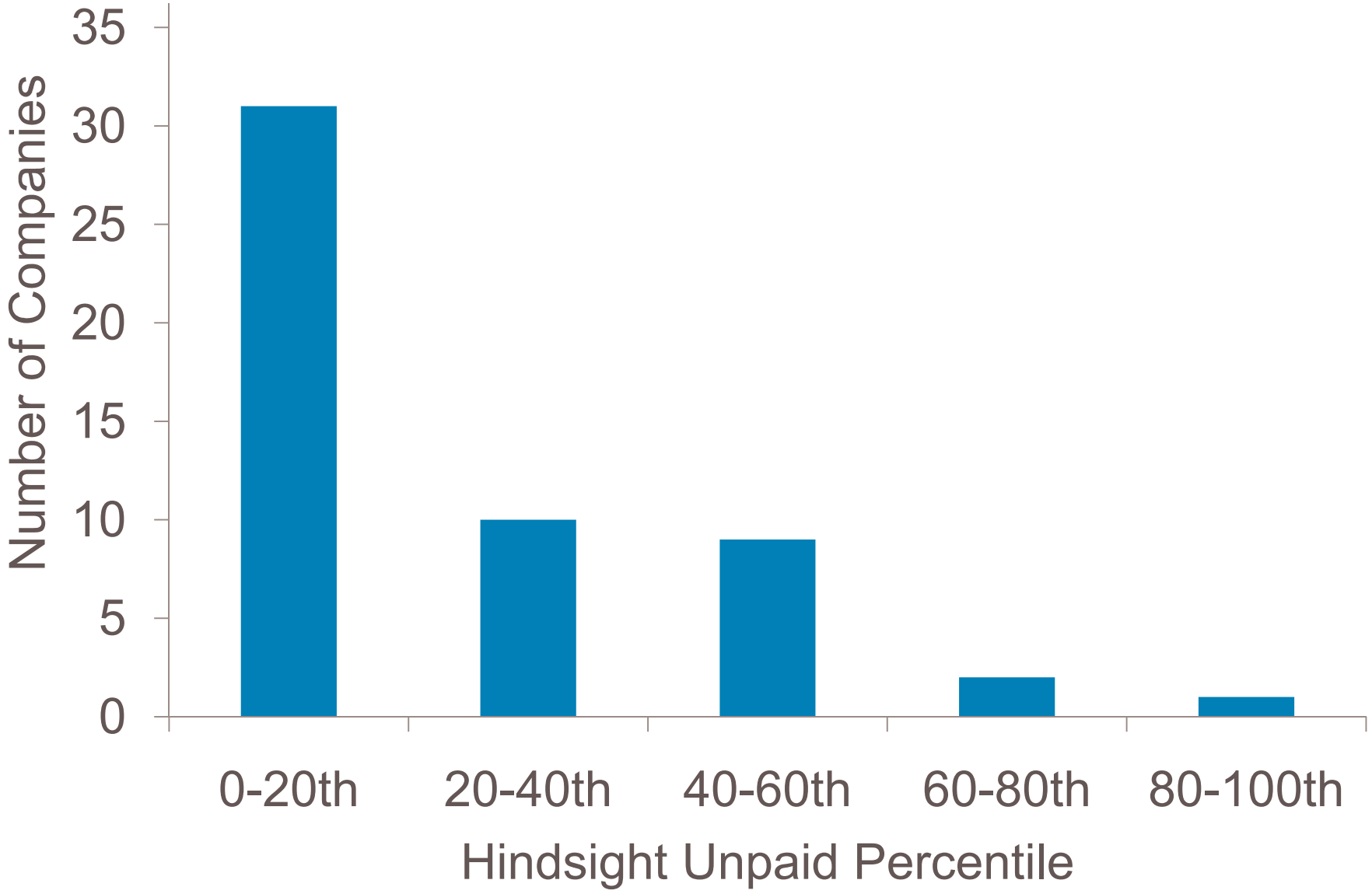
Ideal Histogram of the Hindsight Percentile



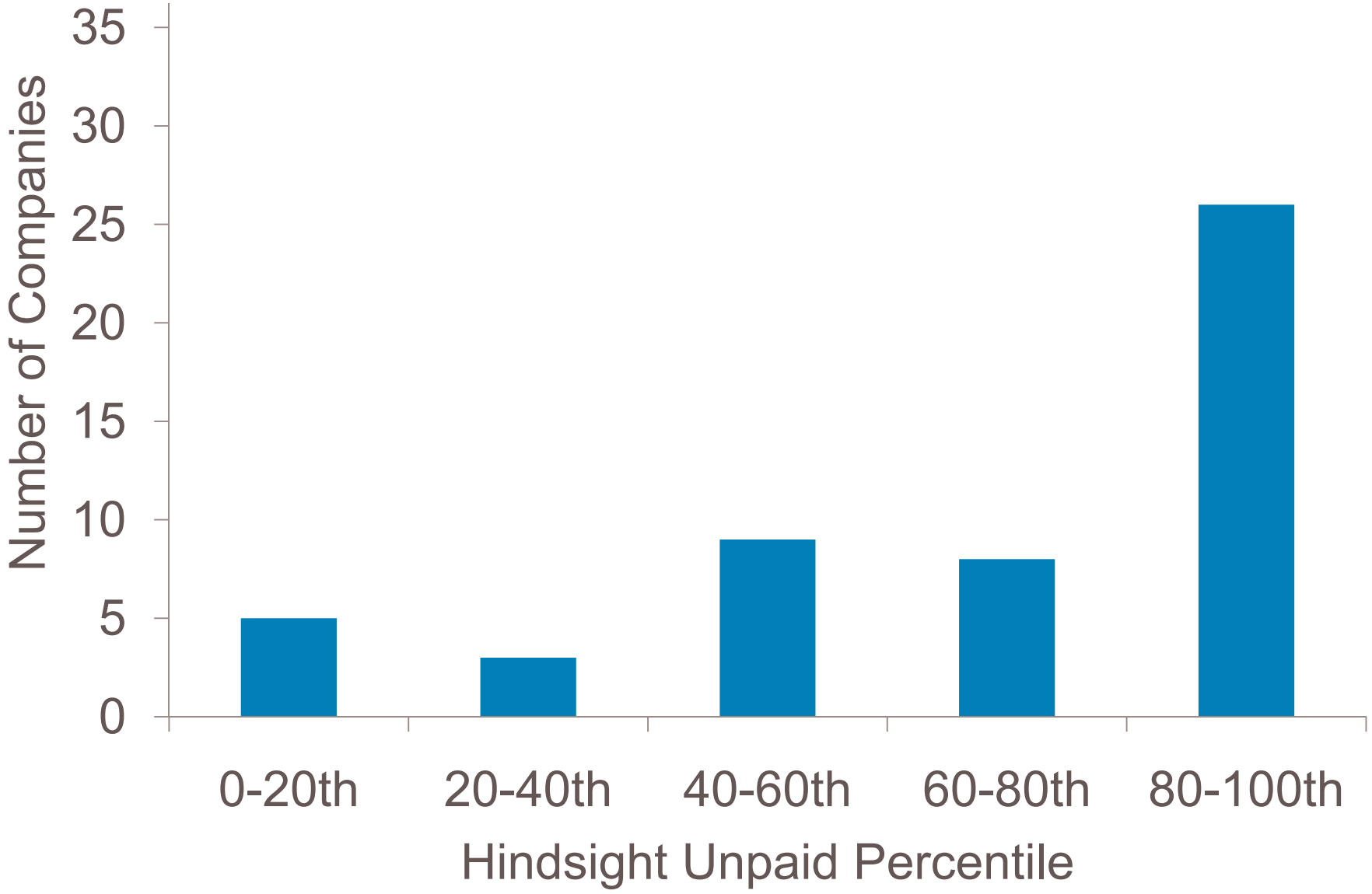
Homeowners as of 12/2000



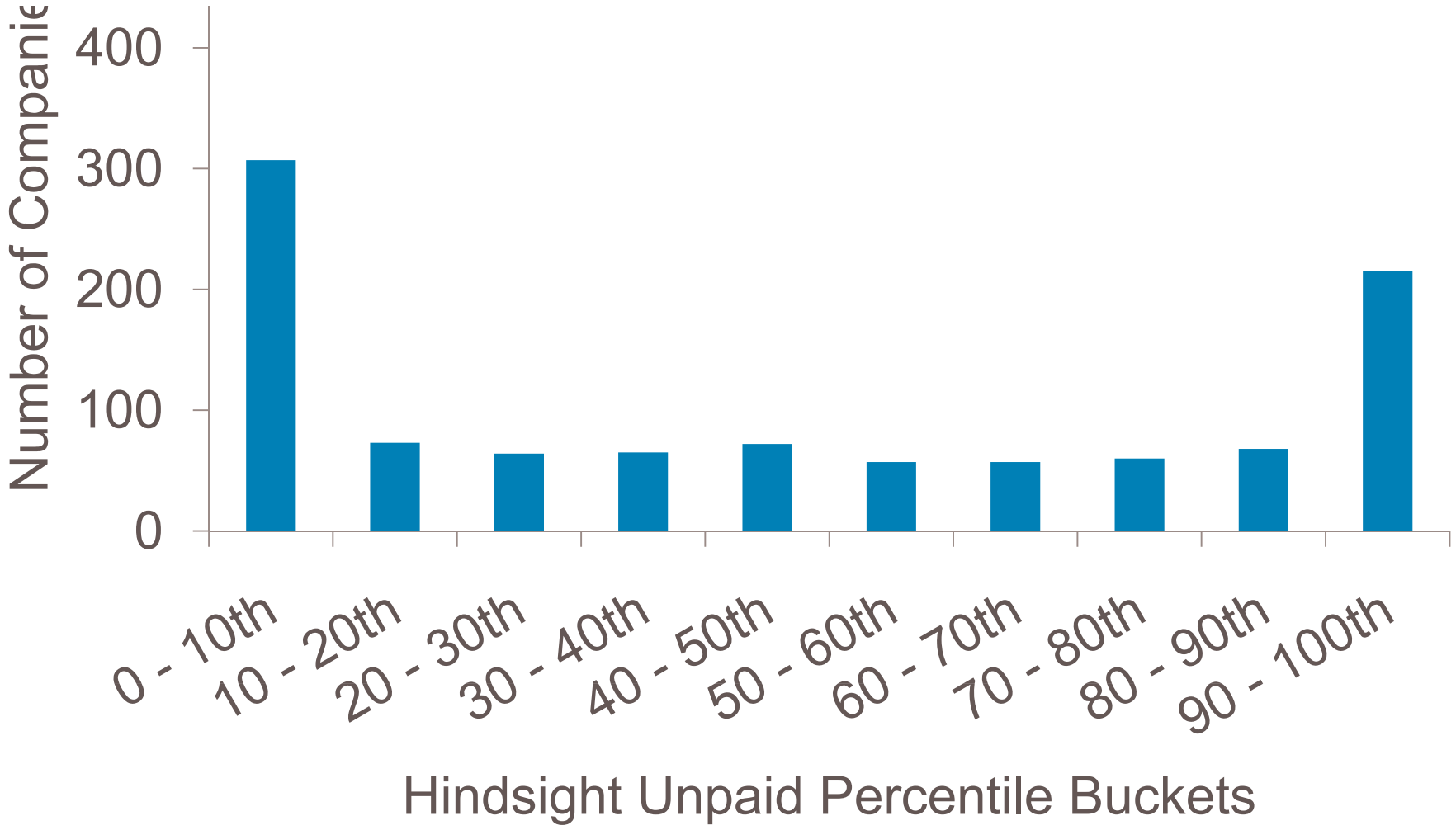
Homeowners as of 12/1996



Homeowners as of 12/2000



Homeowners: Percentiles 1989-2002



From tests done as of 12/1989, 12/1990, …. 12/2002 using Schedule P paid loss & ALAE on 70+ companies for each period (1,038 tests)

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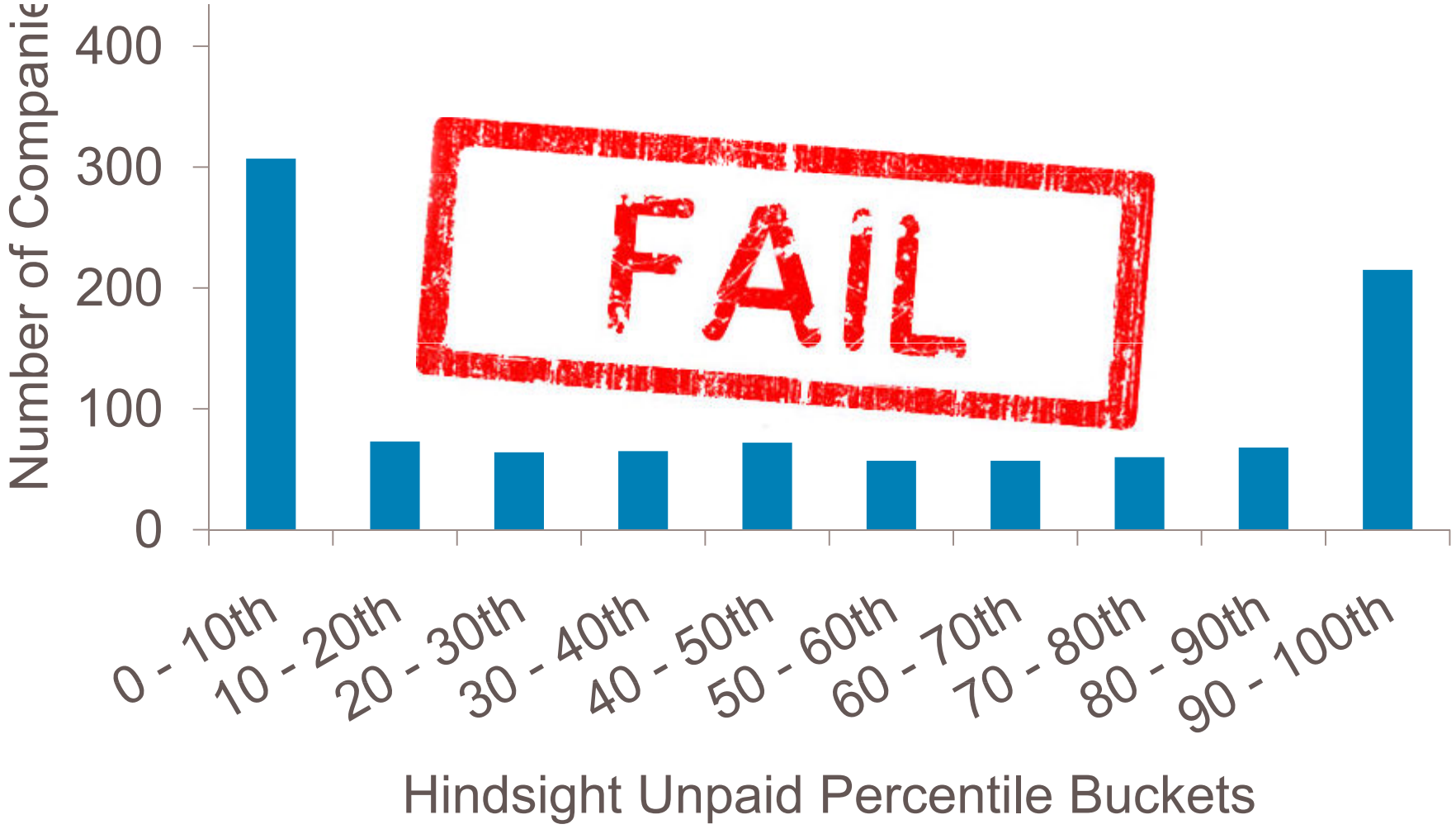
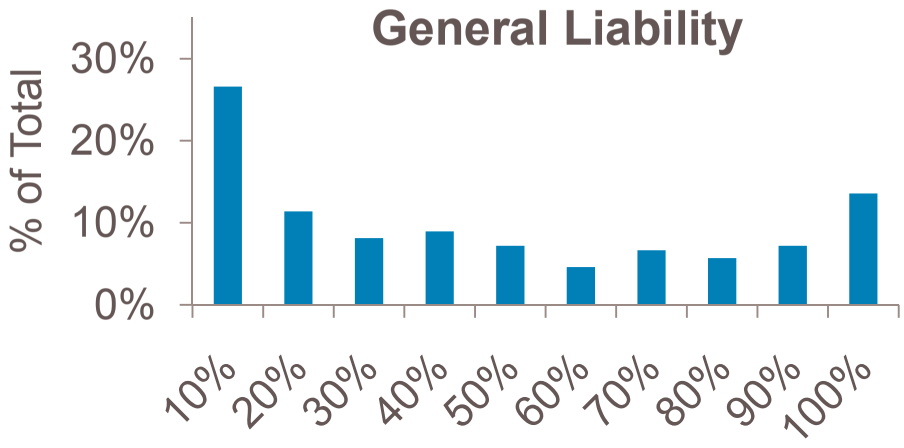
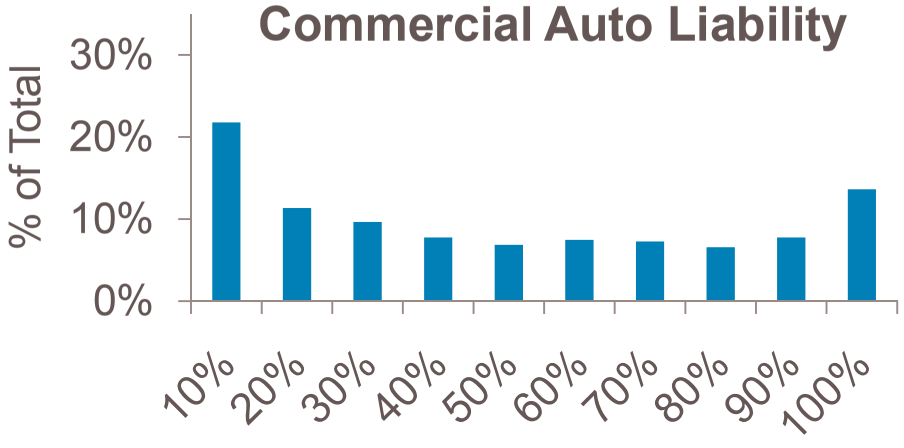
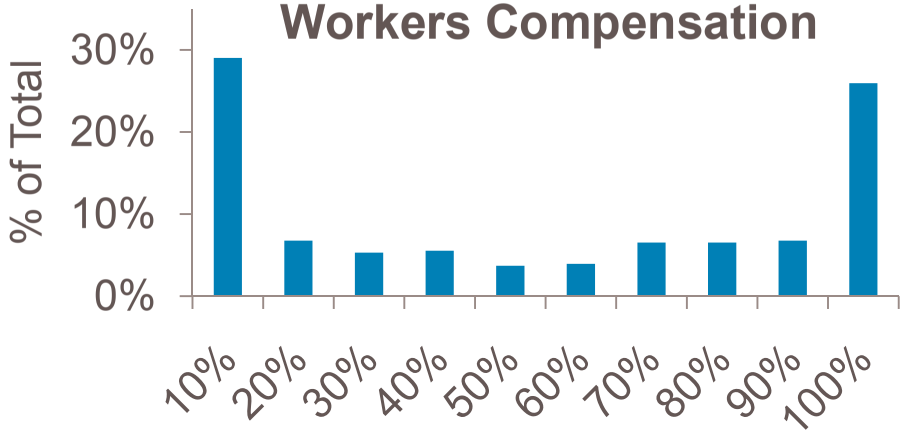
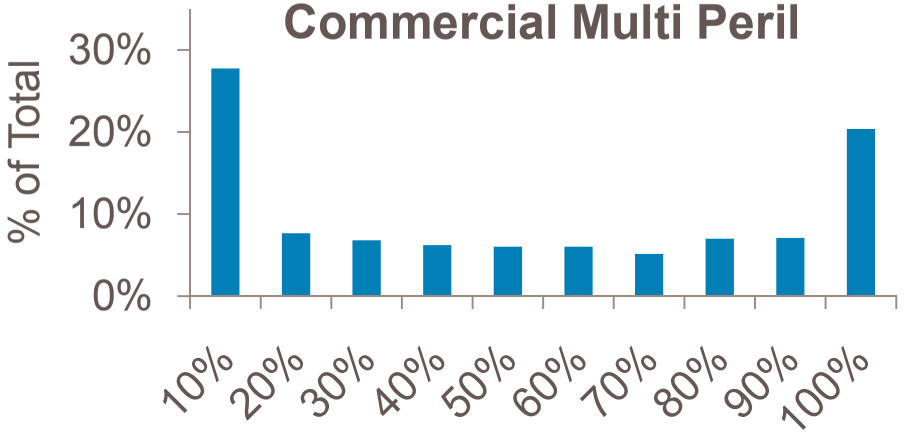


Results for other lines









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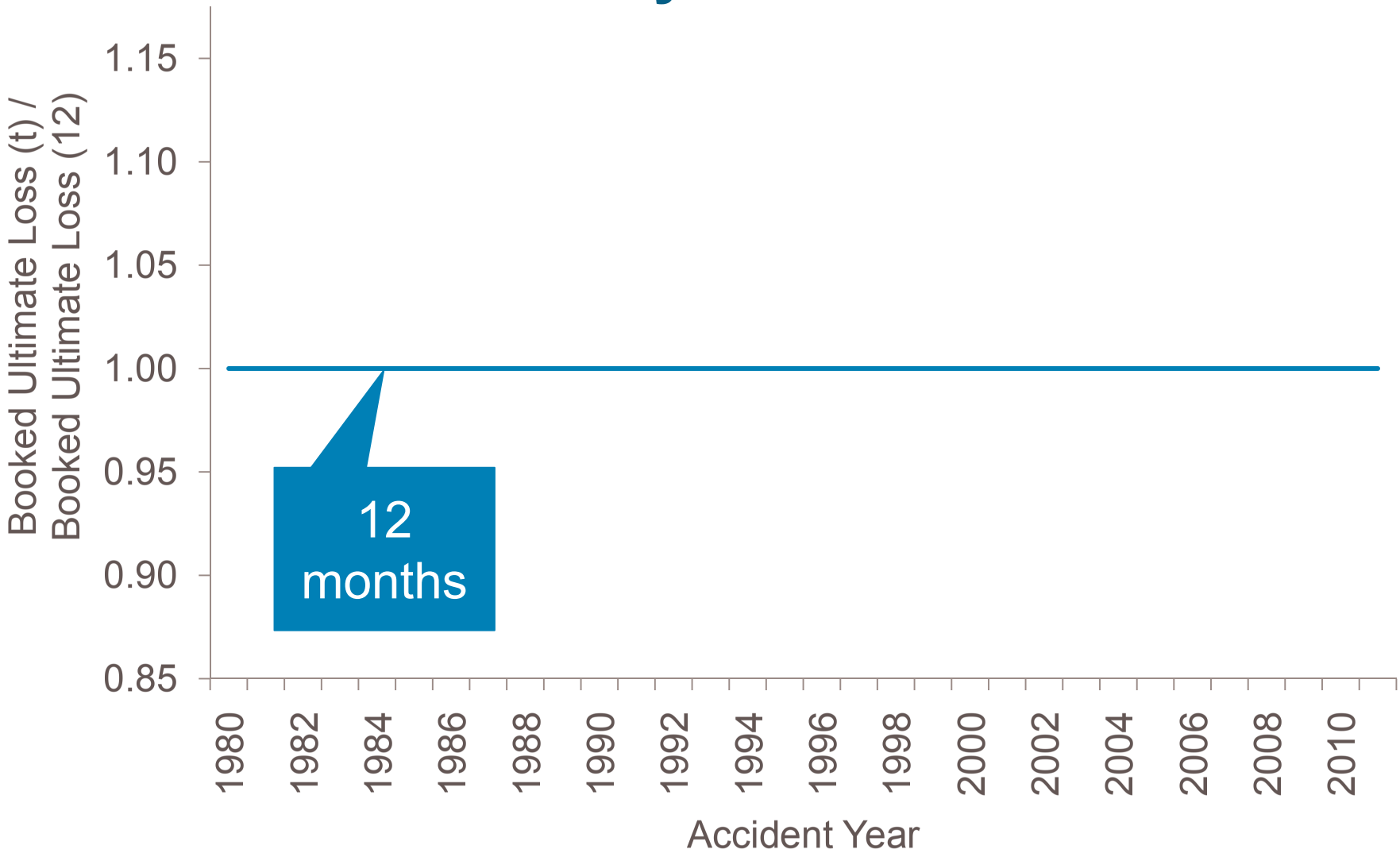

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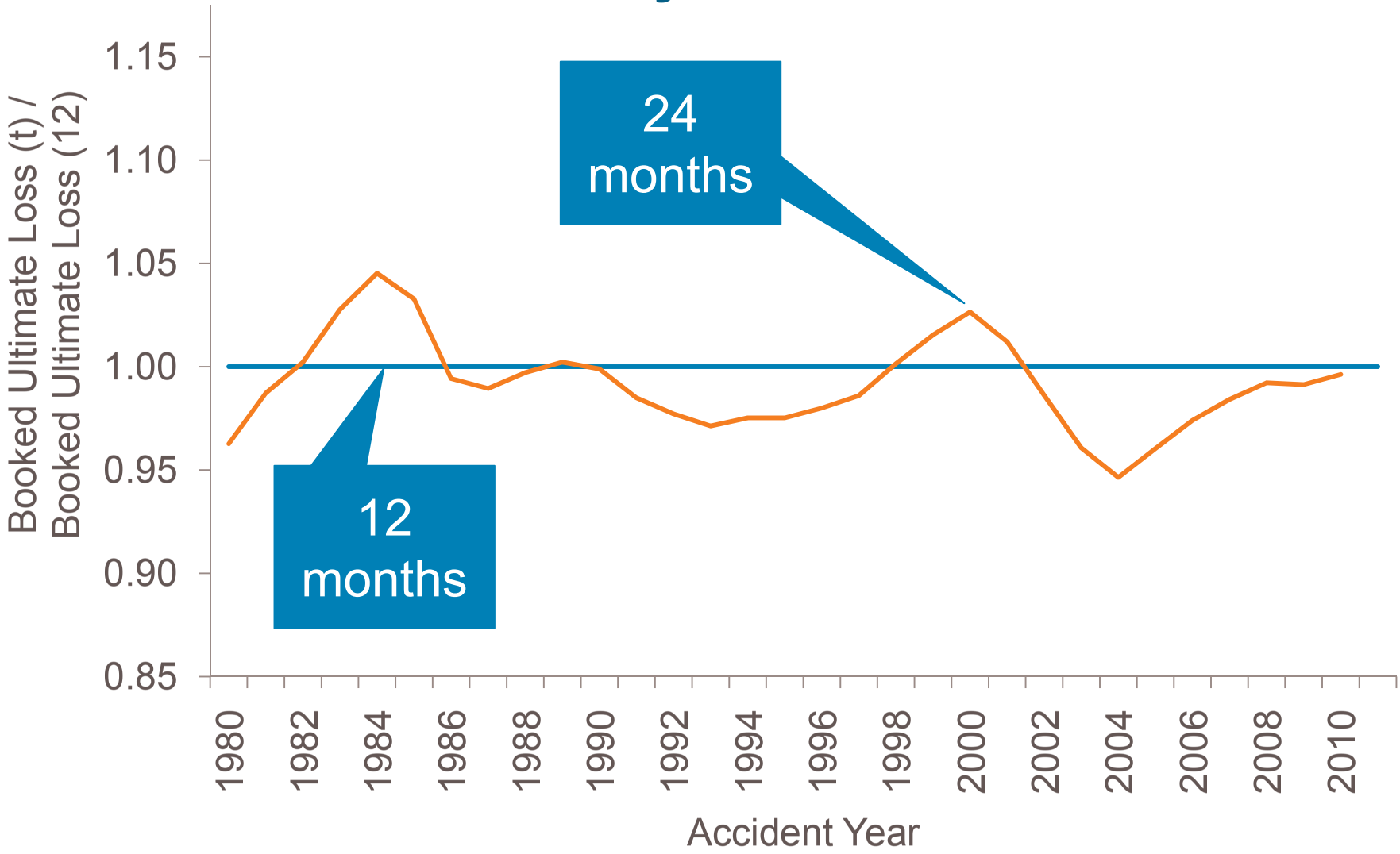

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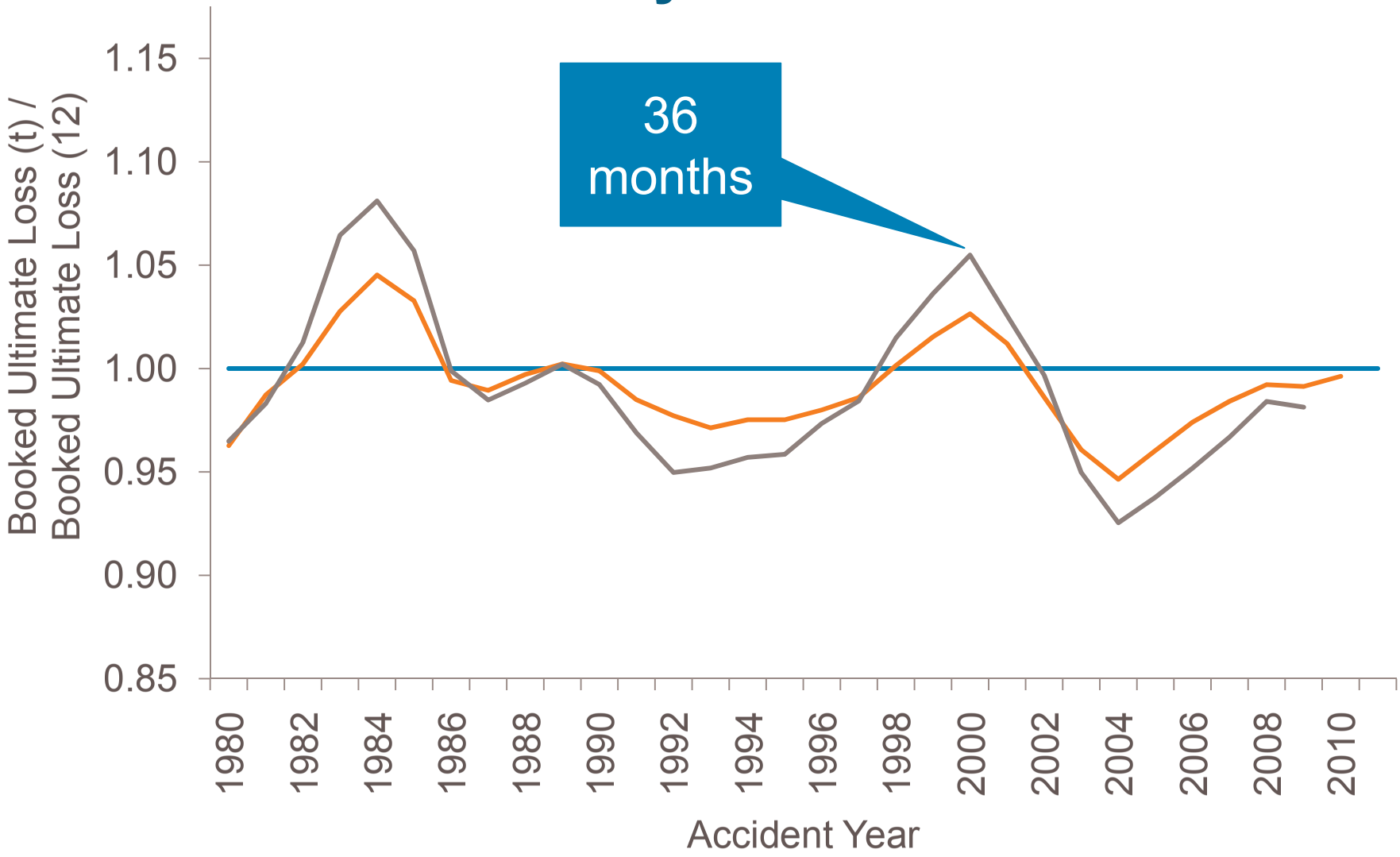

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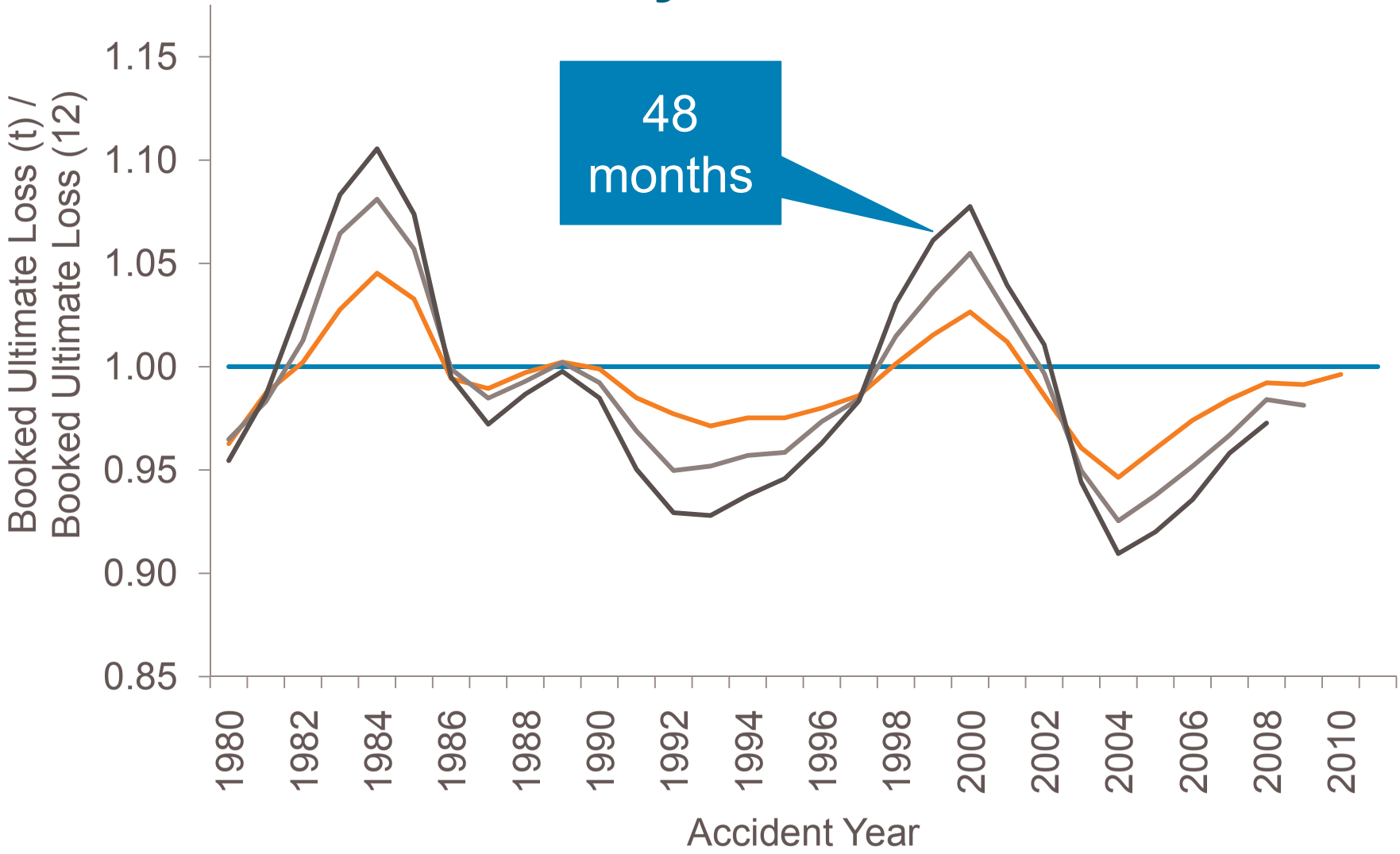

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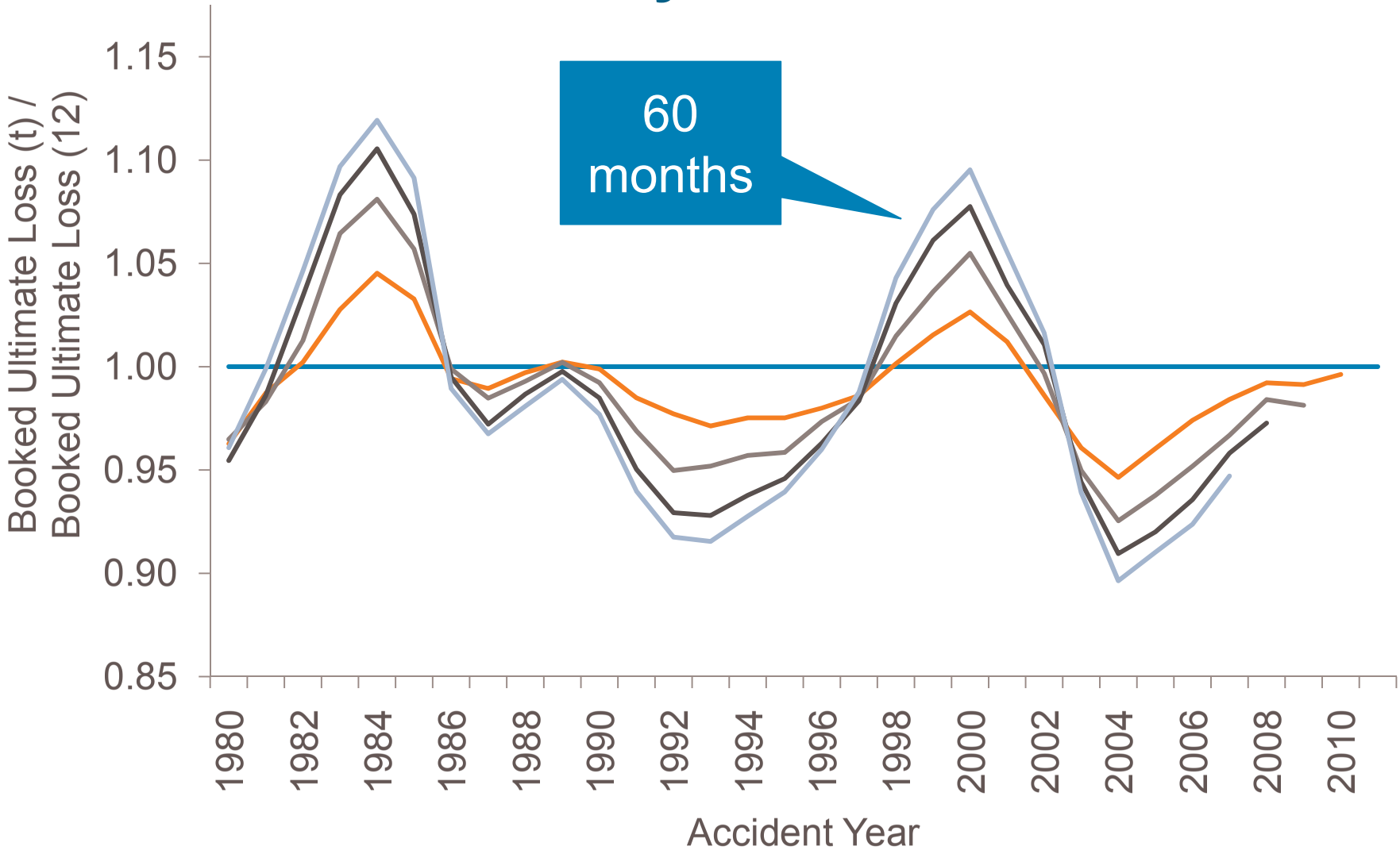

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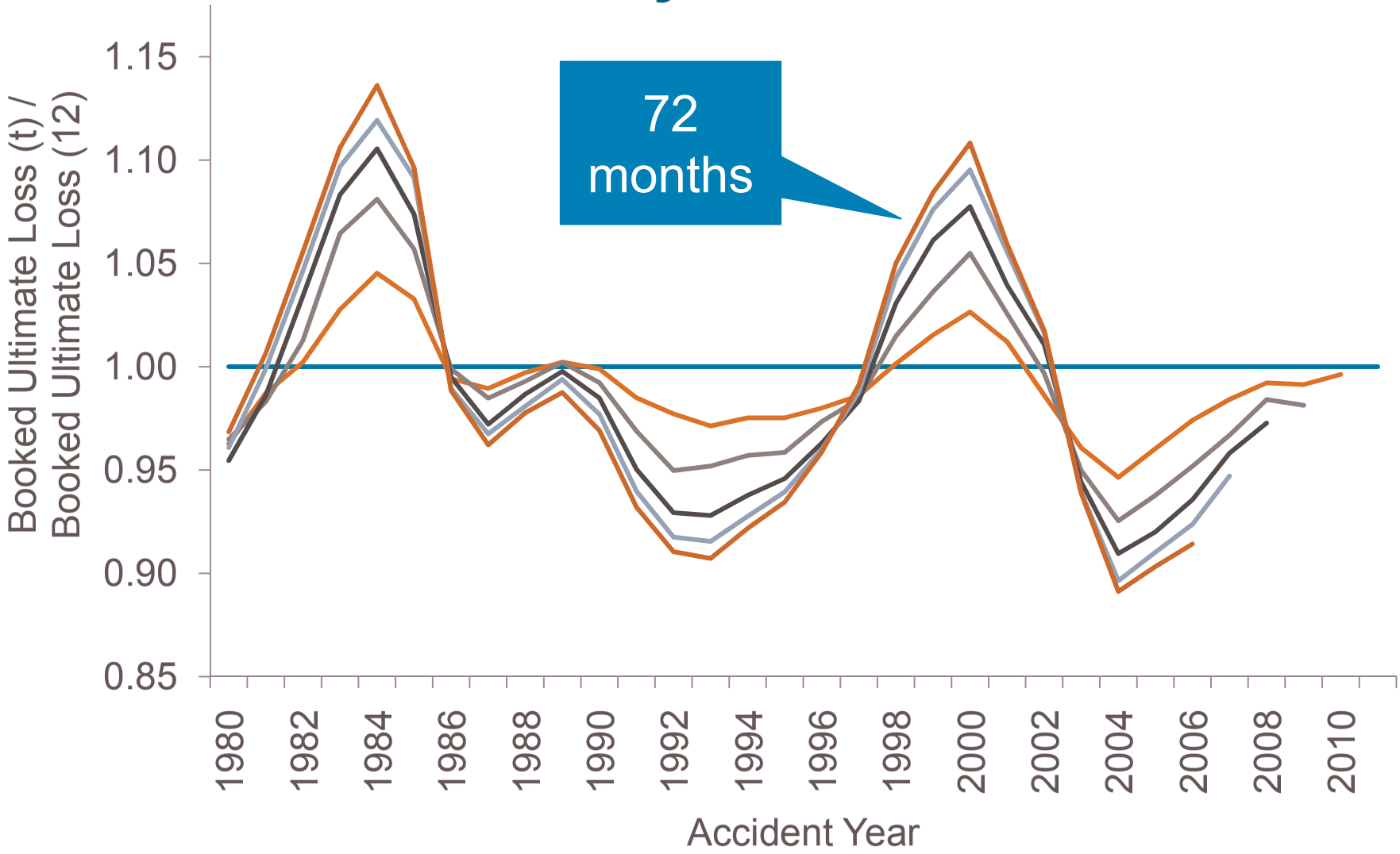

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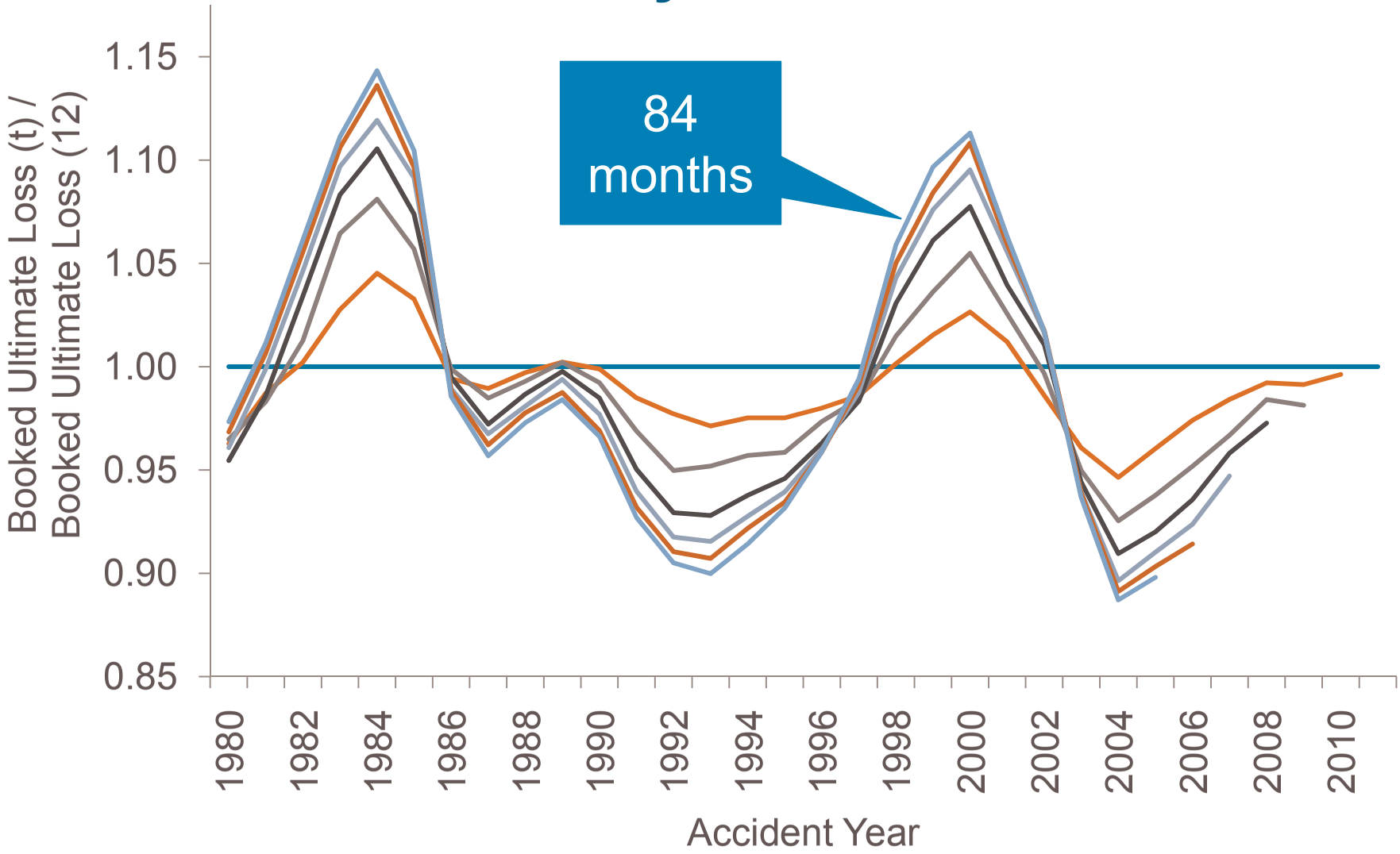

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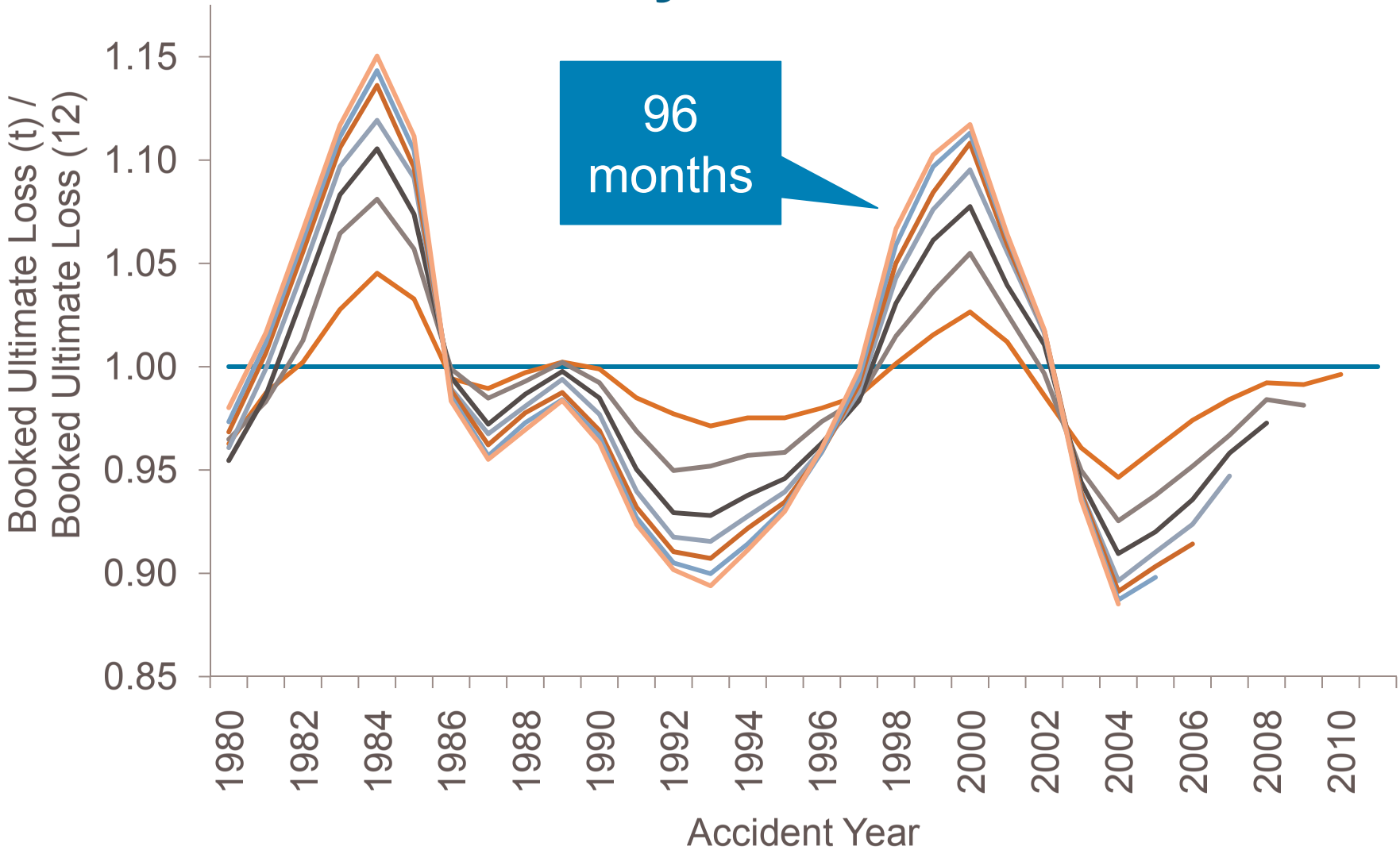

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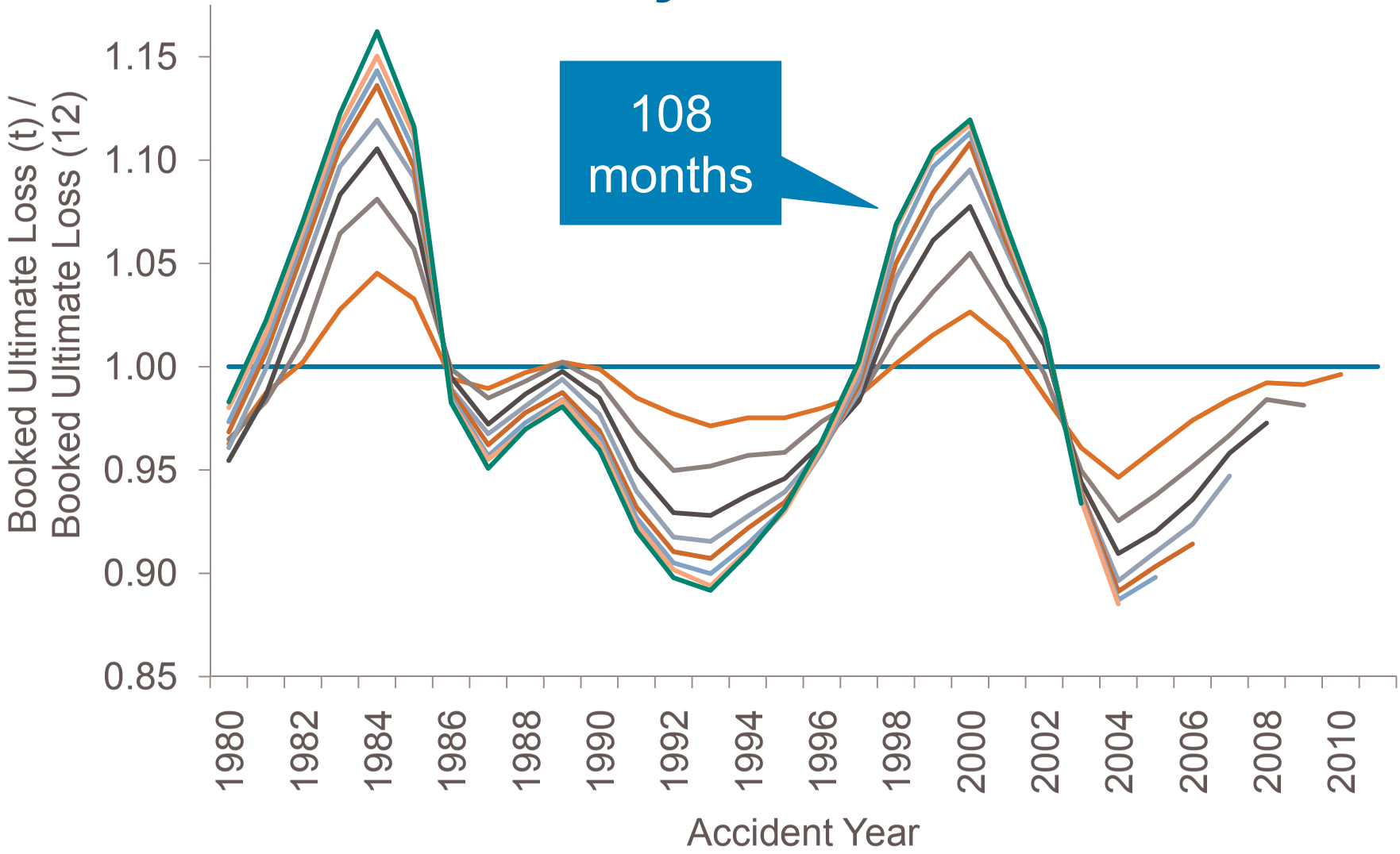

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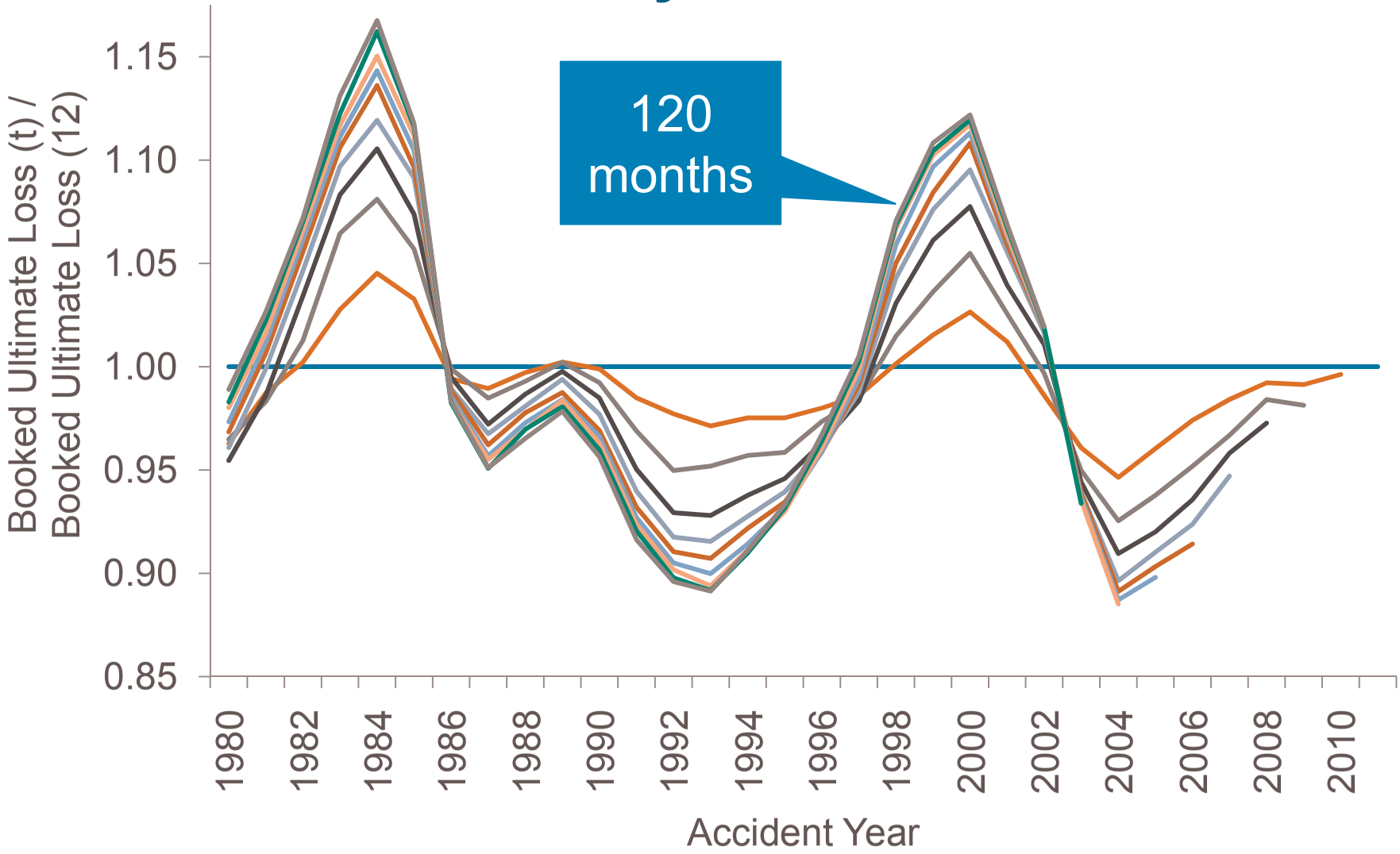

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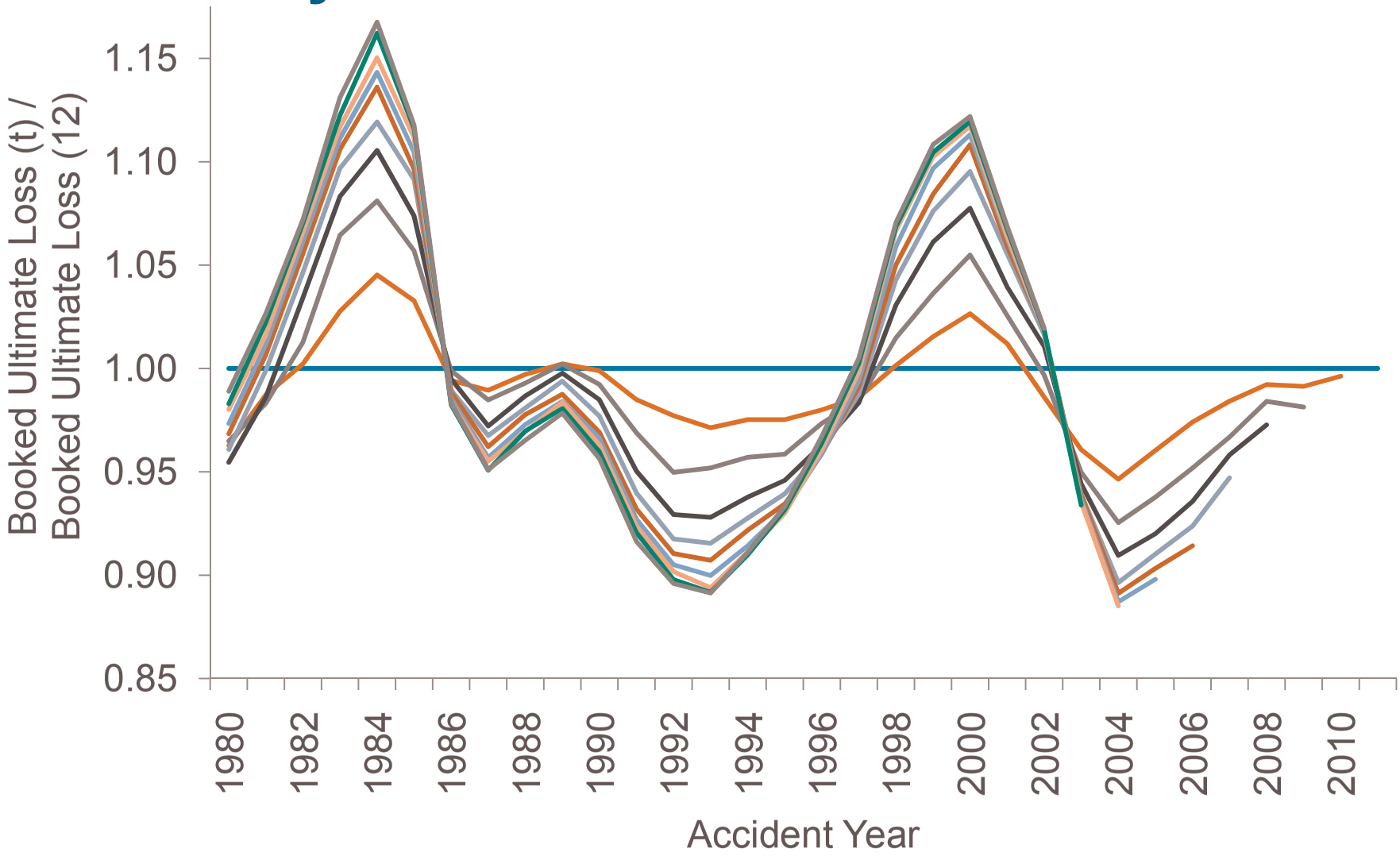
Reserve Cycle



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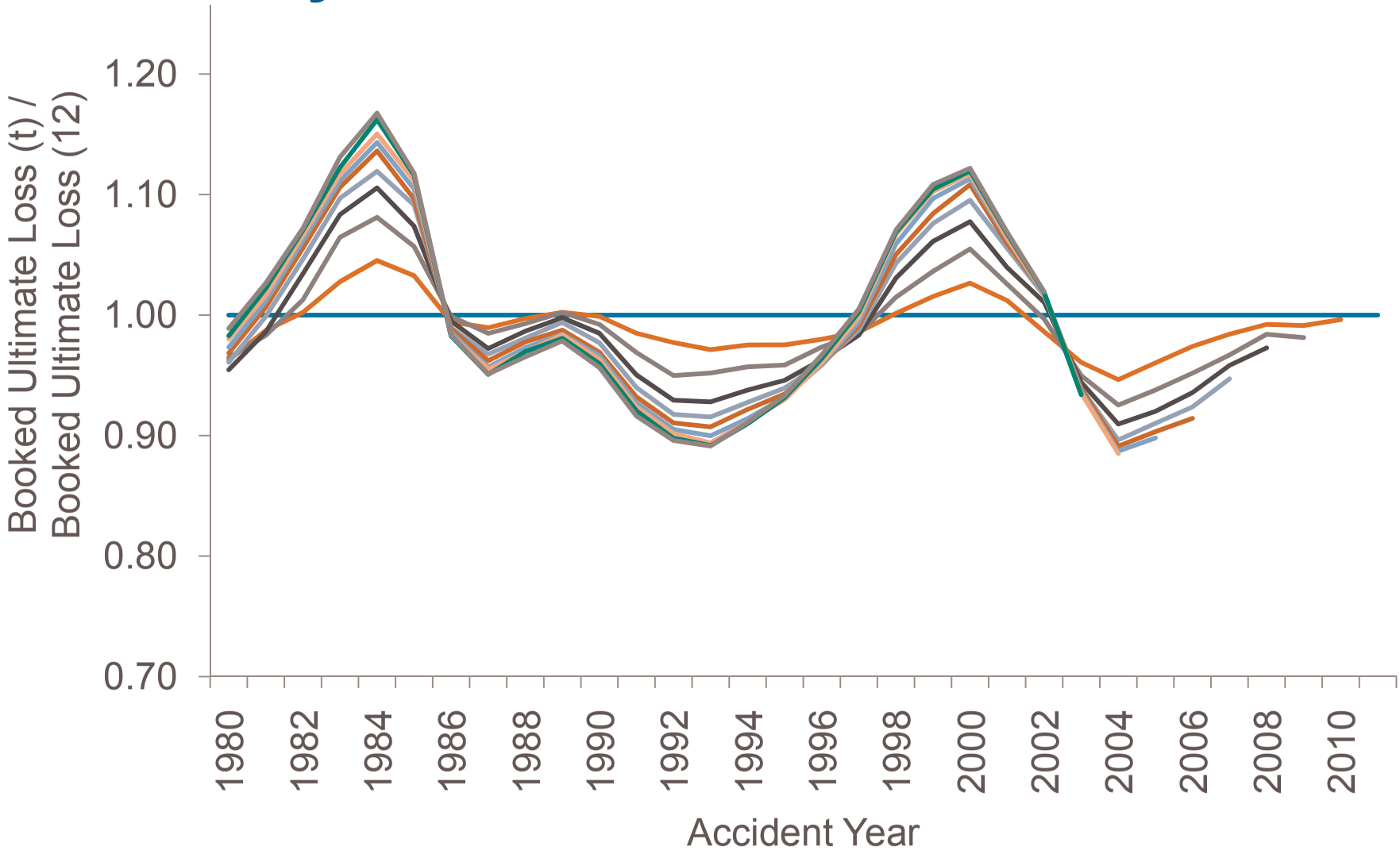

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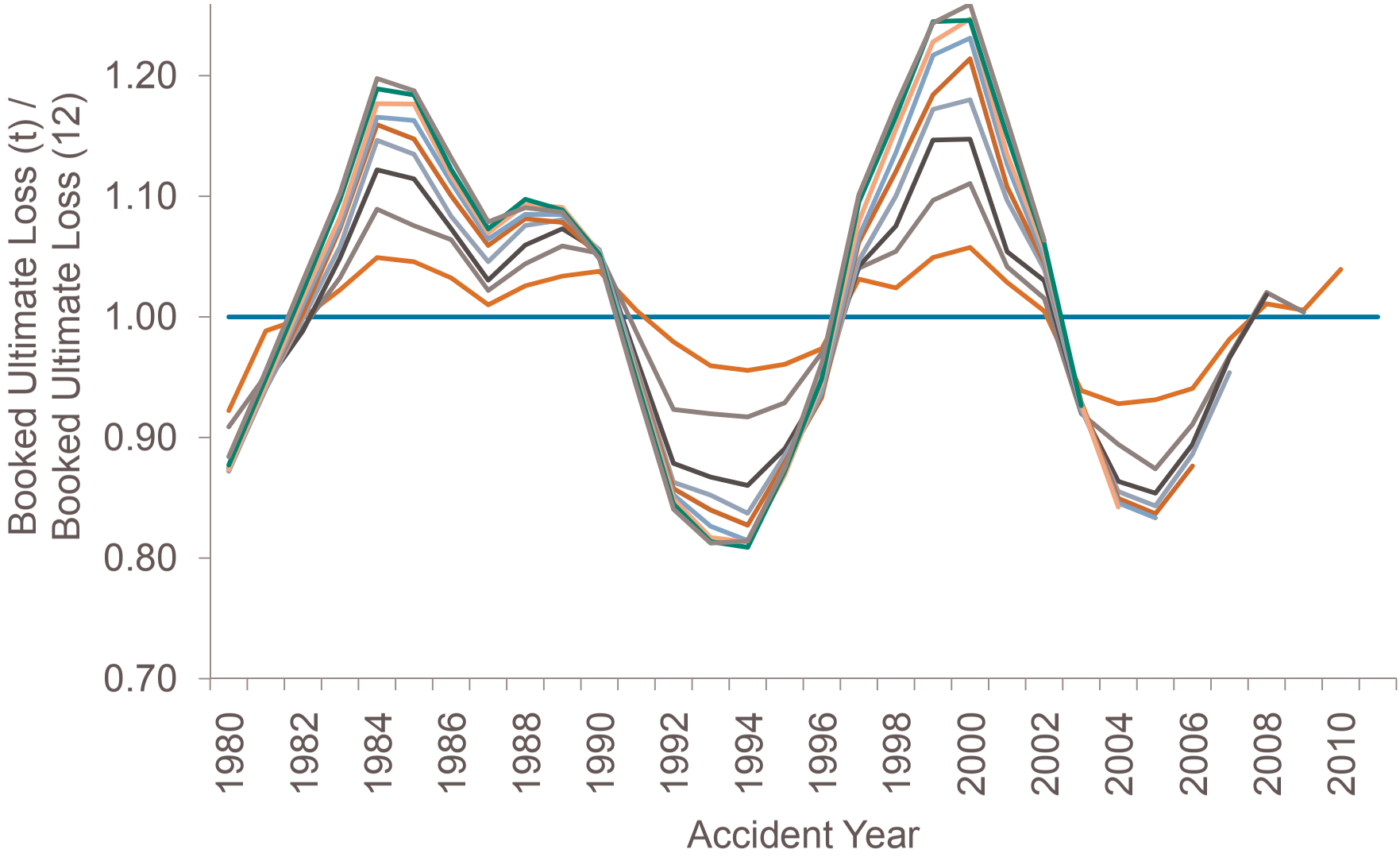
Workers Compensation Cycle



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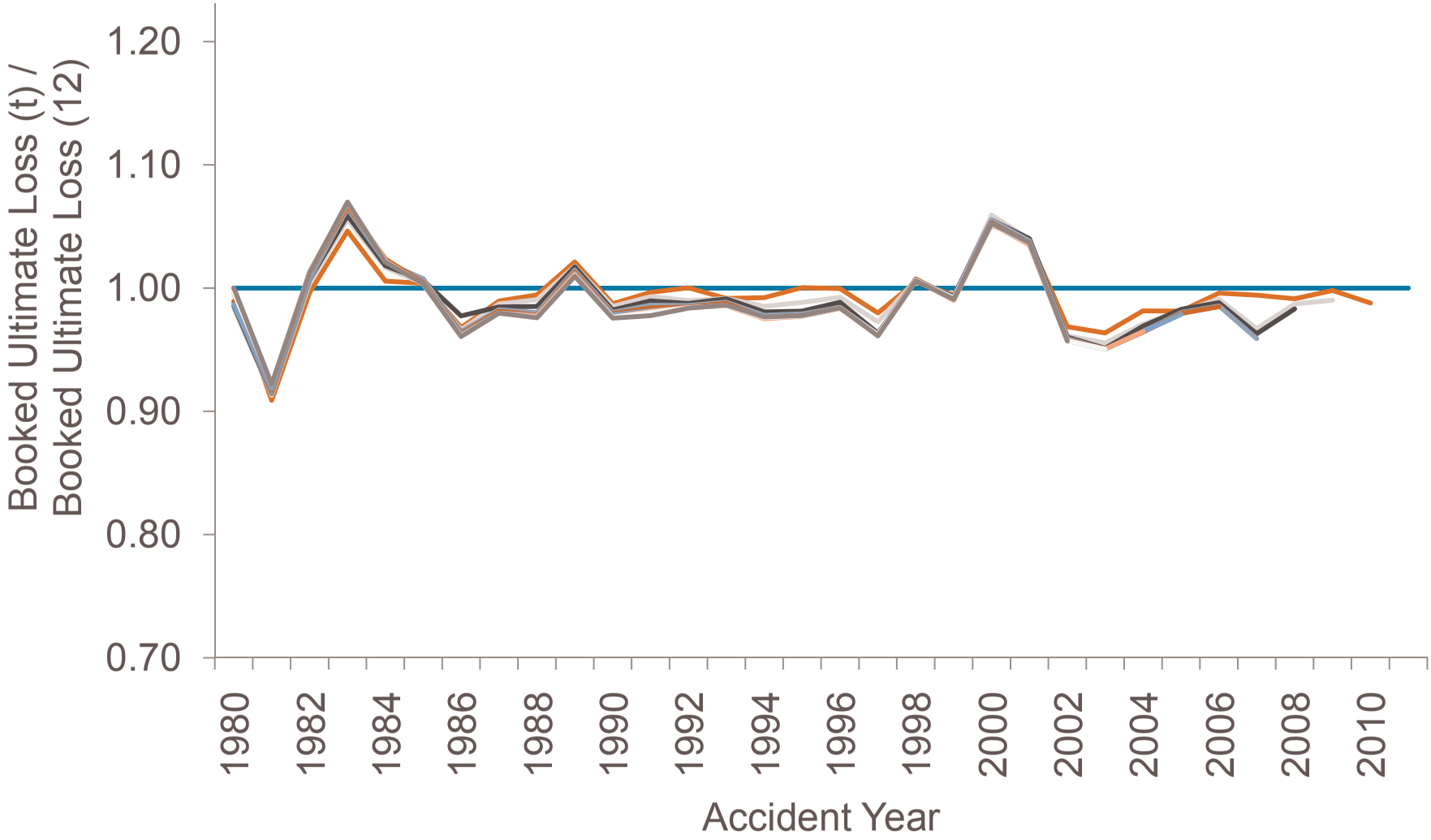
Homeowners Cycle



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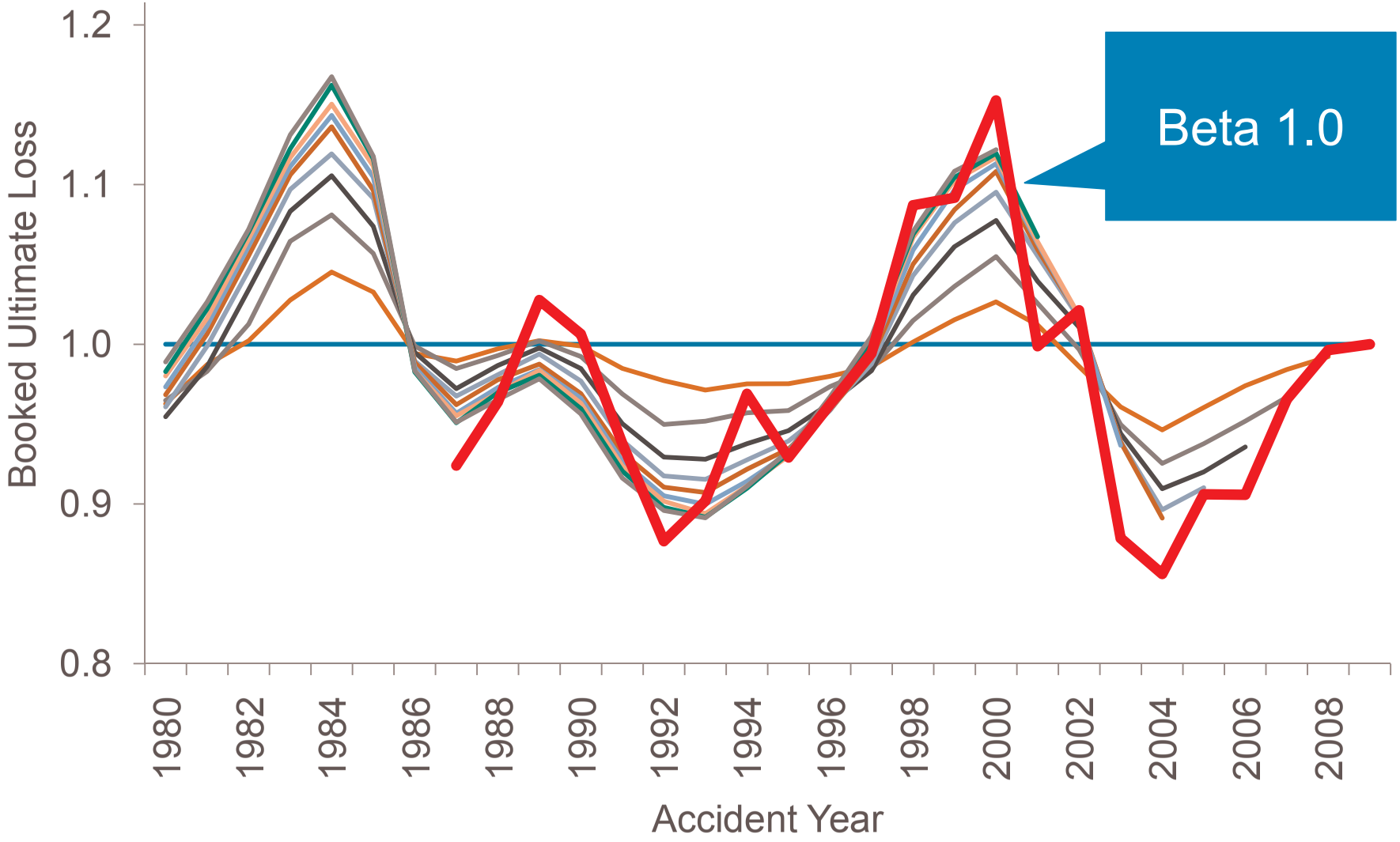
Reserve Cycle – Company A



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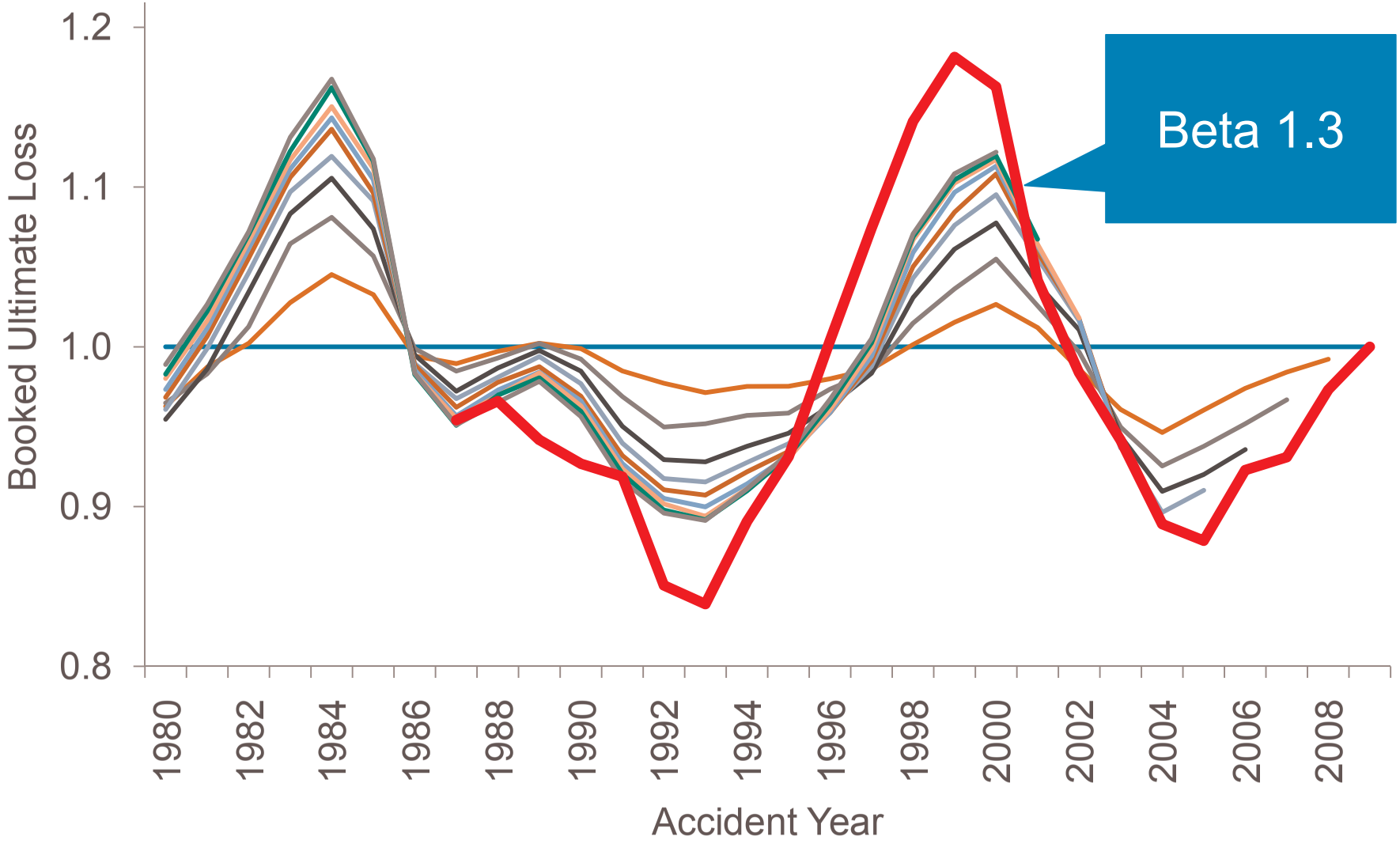
Reserve Cycle – Company B



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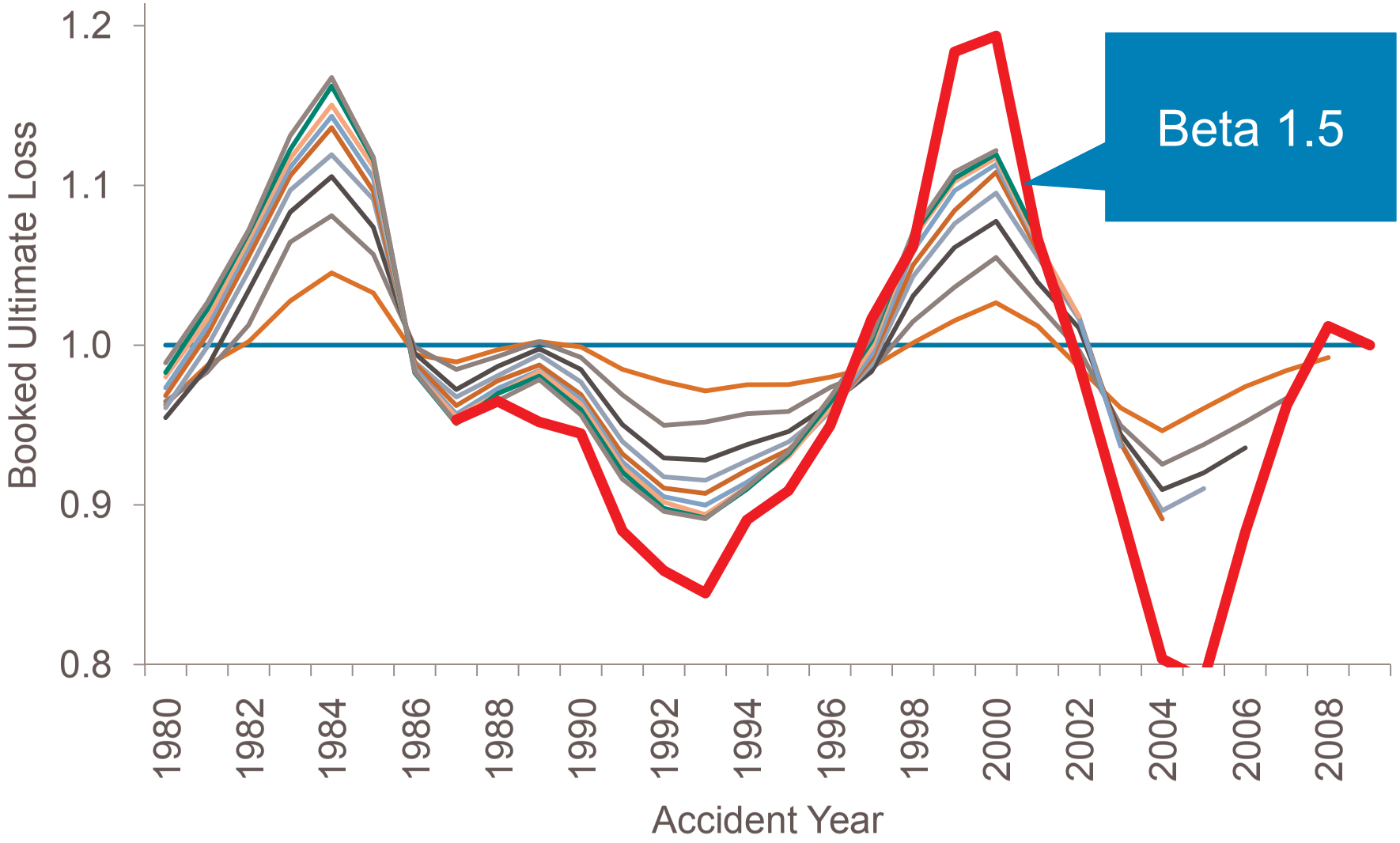

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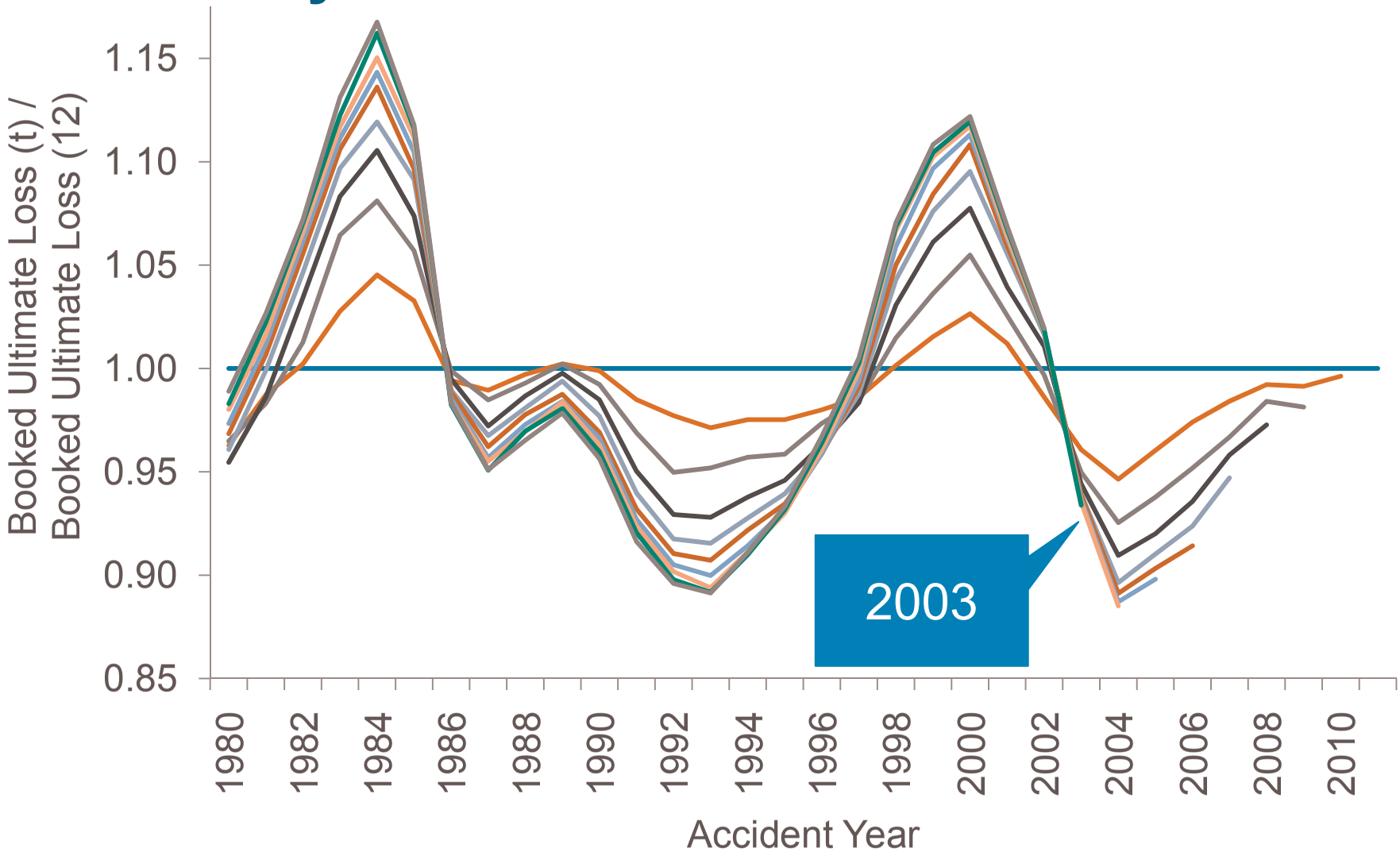

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2. **[L]evel of Reserve Deficiency…**
   - Despite substantial reserve increases by …insurers, during 2003 rating agencies estimate that the non-asbestos reserve shortfall …is between $30 billion and $60 billion.

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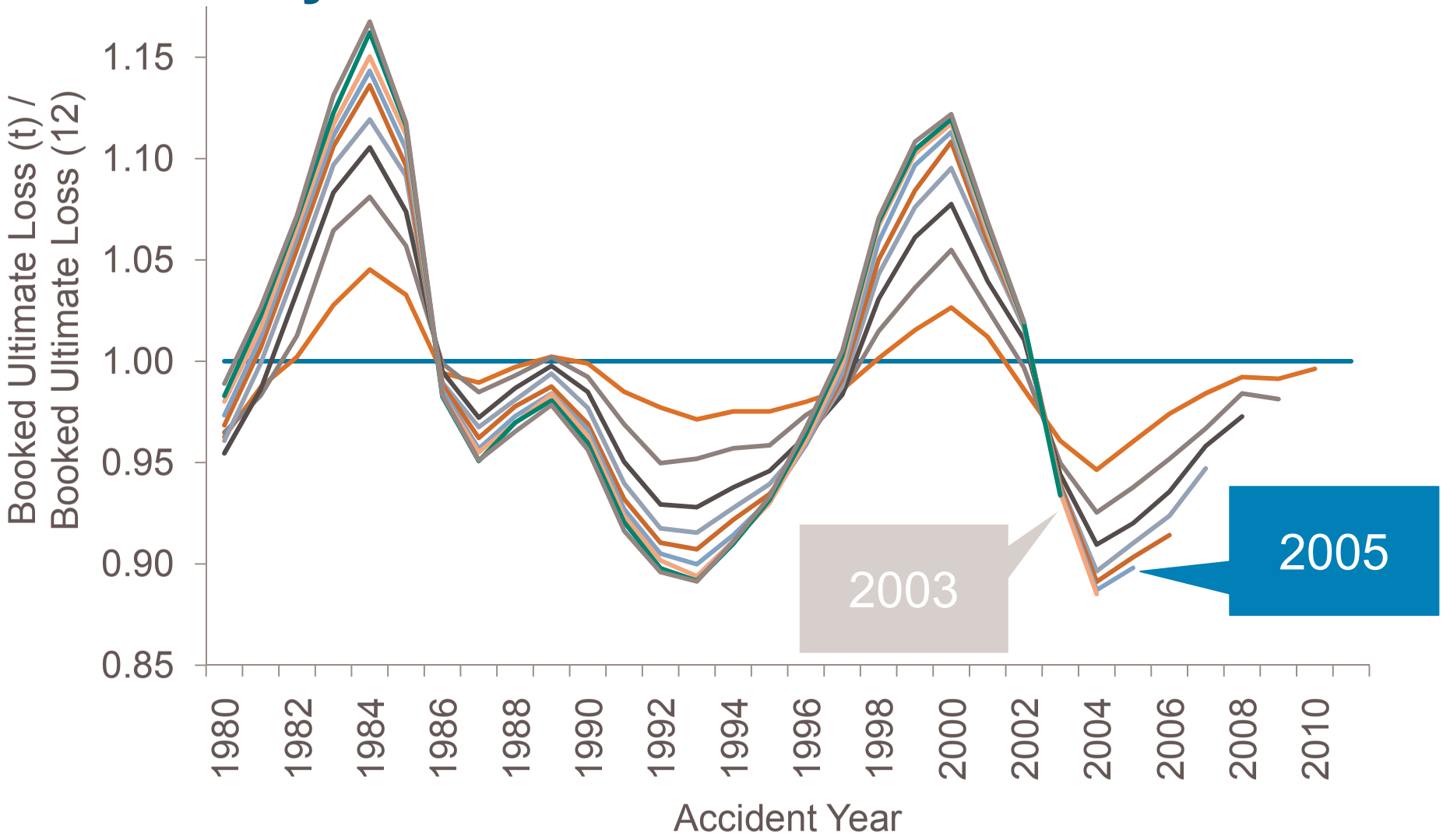
The profession must continue… its self-review, as these issues will not go away on their own.

Reserve Cycle



Sum of: Private Passenger Auto, Comm Auto Liab, CMP, Homeowners, Med Prof Liab, Other Liab, Products Liab, WC. Data to 12/2009 is from cleaned Schedule P database from Guy Carpenter & Risk Lighthouse (representing more than 95% of the industry), and updated for 12/2010 & 12/2011 financials using SNL and subject to change.

Top stories for CAS actuaries 2005:

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- ?

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- ? What reserving problem ?

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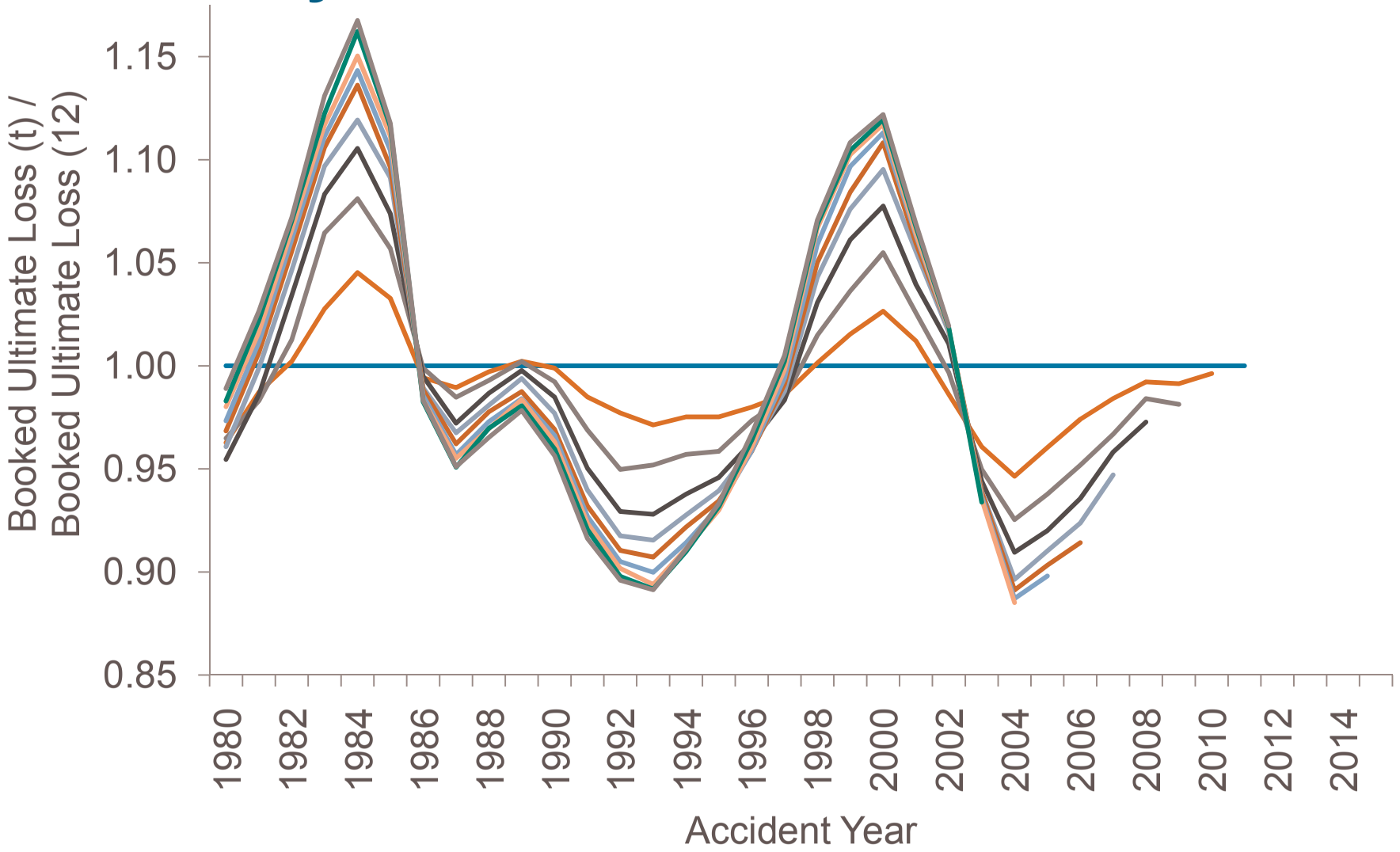

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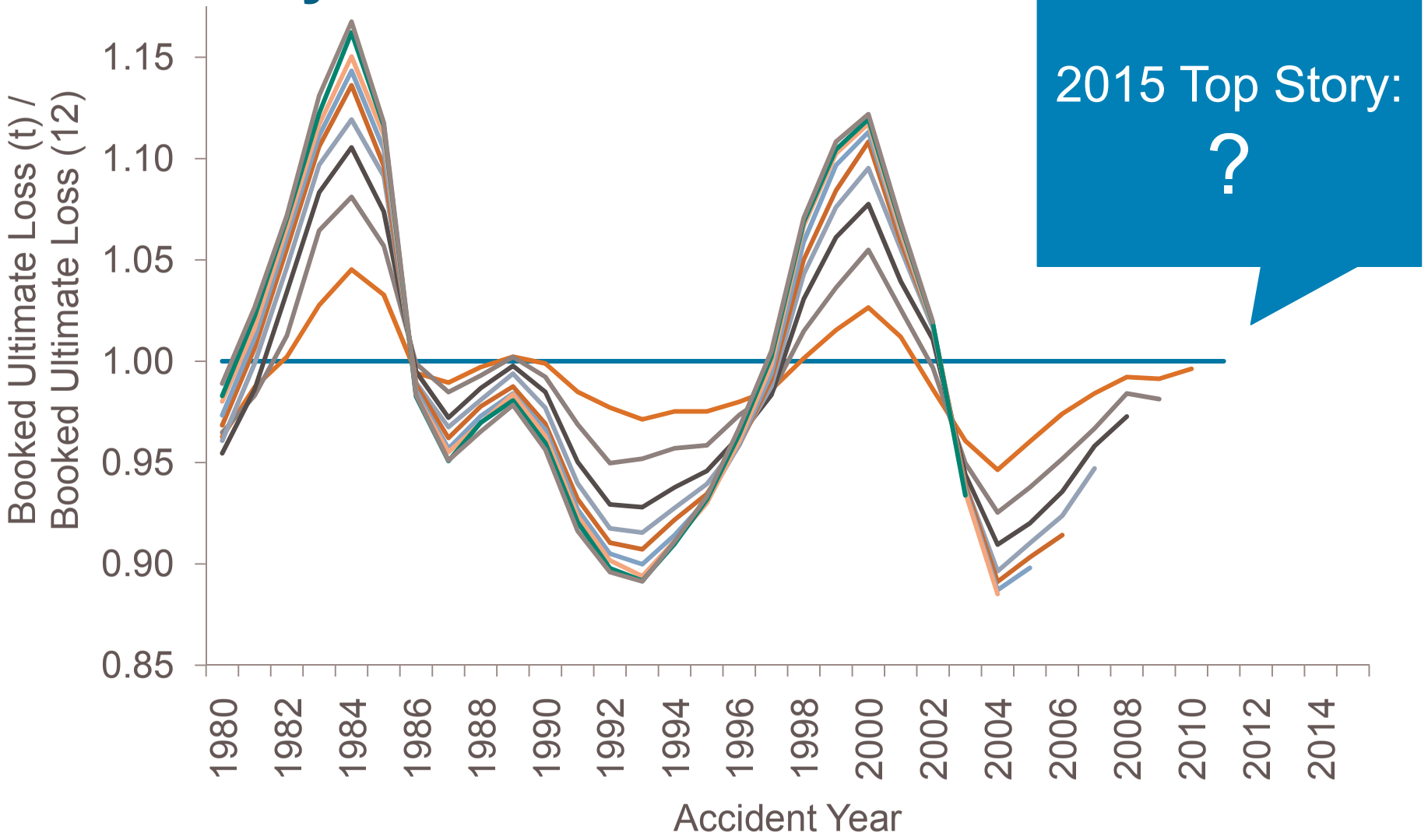

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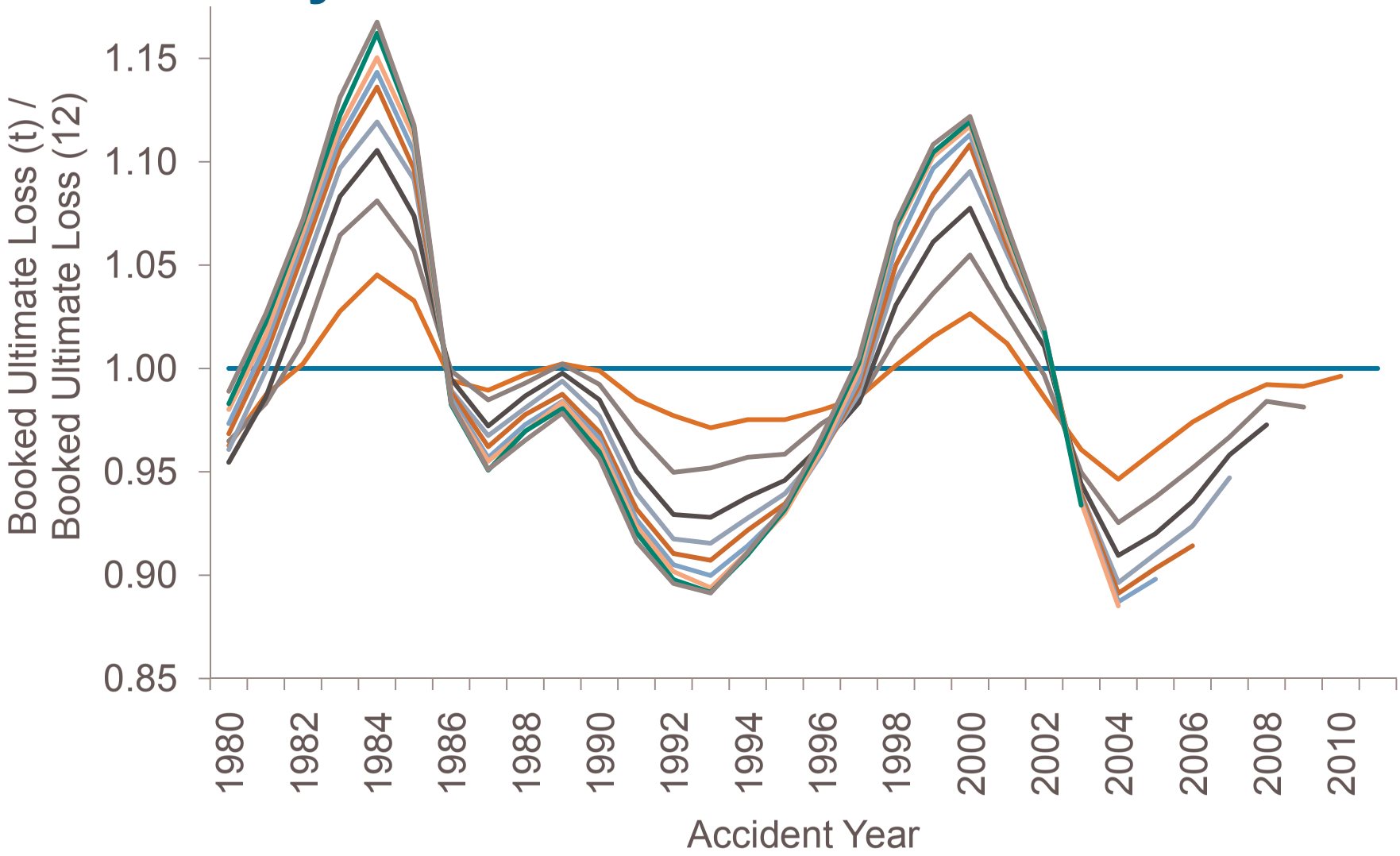

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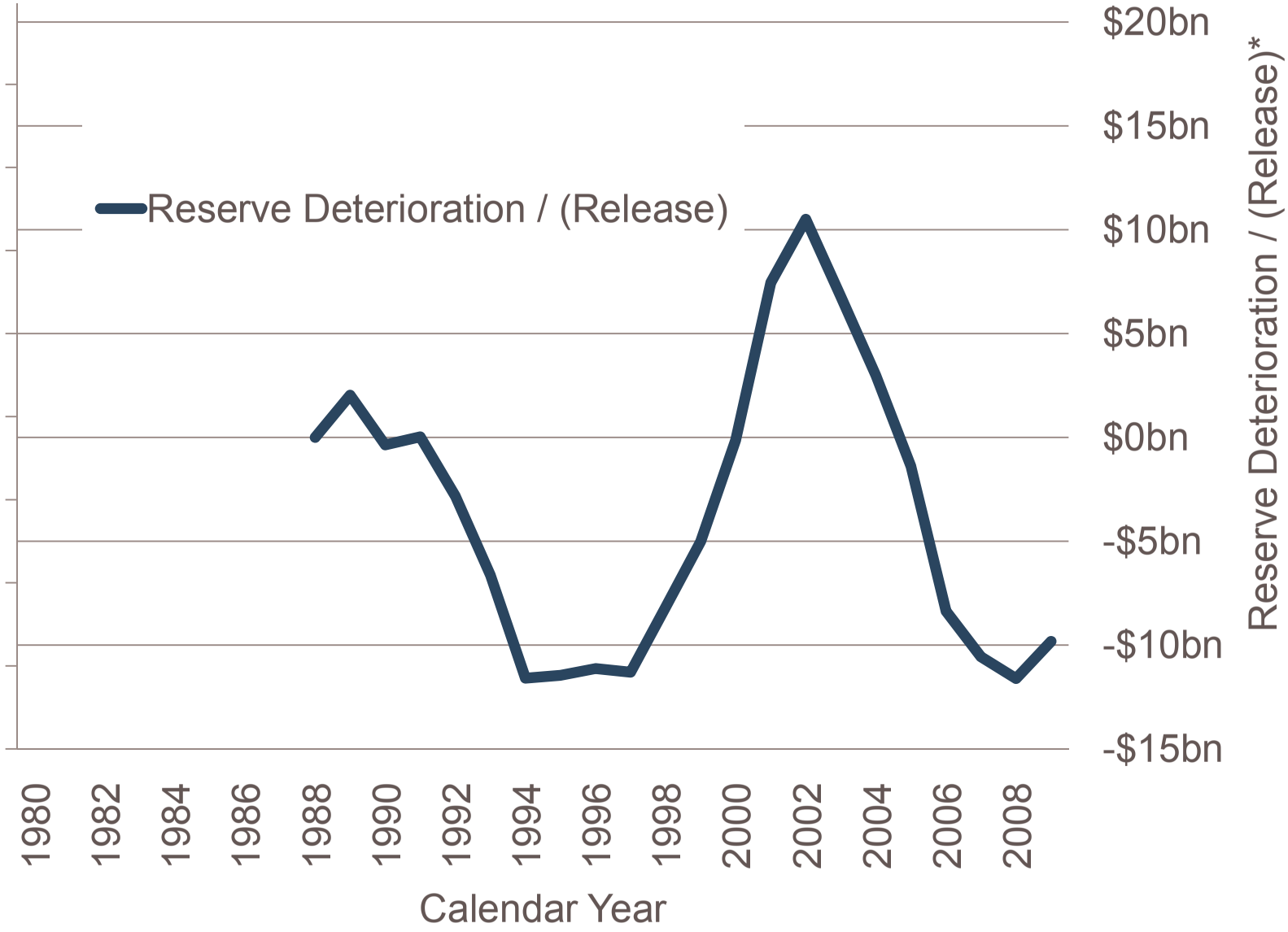
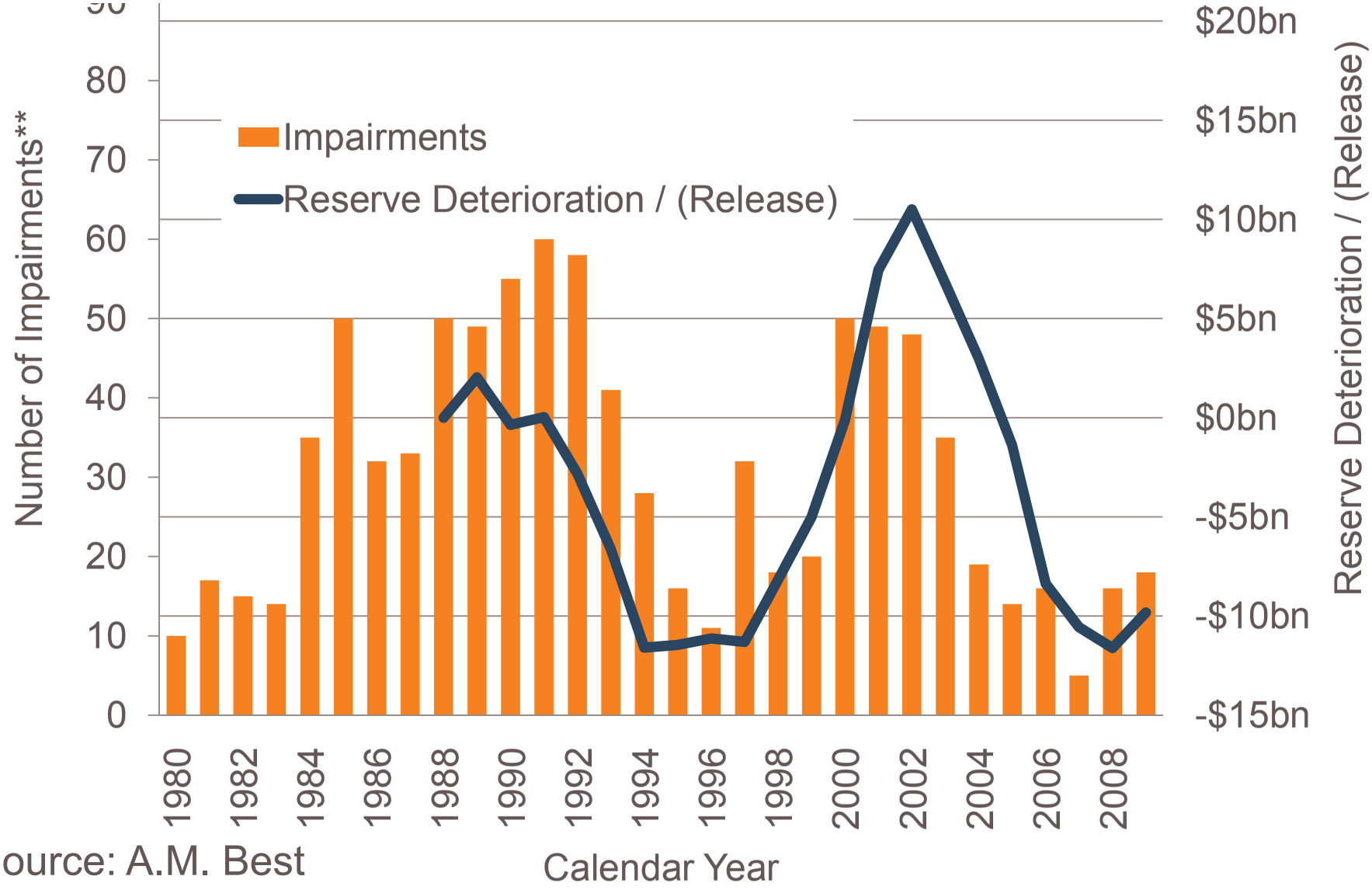
Reserve Deterioration / (Release)*



Reserve Deterioration vs Impairments



**Source: A.M. Best

“No reality please, we’re actuaries”

1. Empirical test of a reserve risk model
2. Let’s start again:

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   (ii) How has reserve risk affected us in the past?

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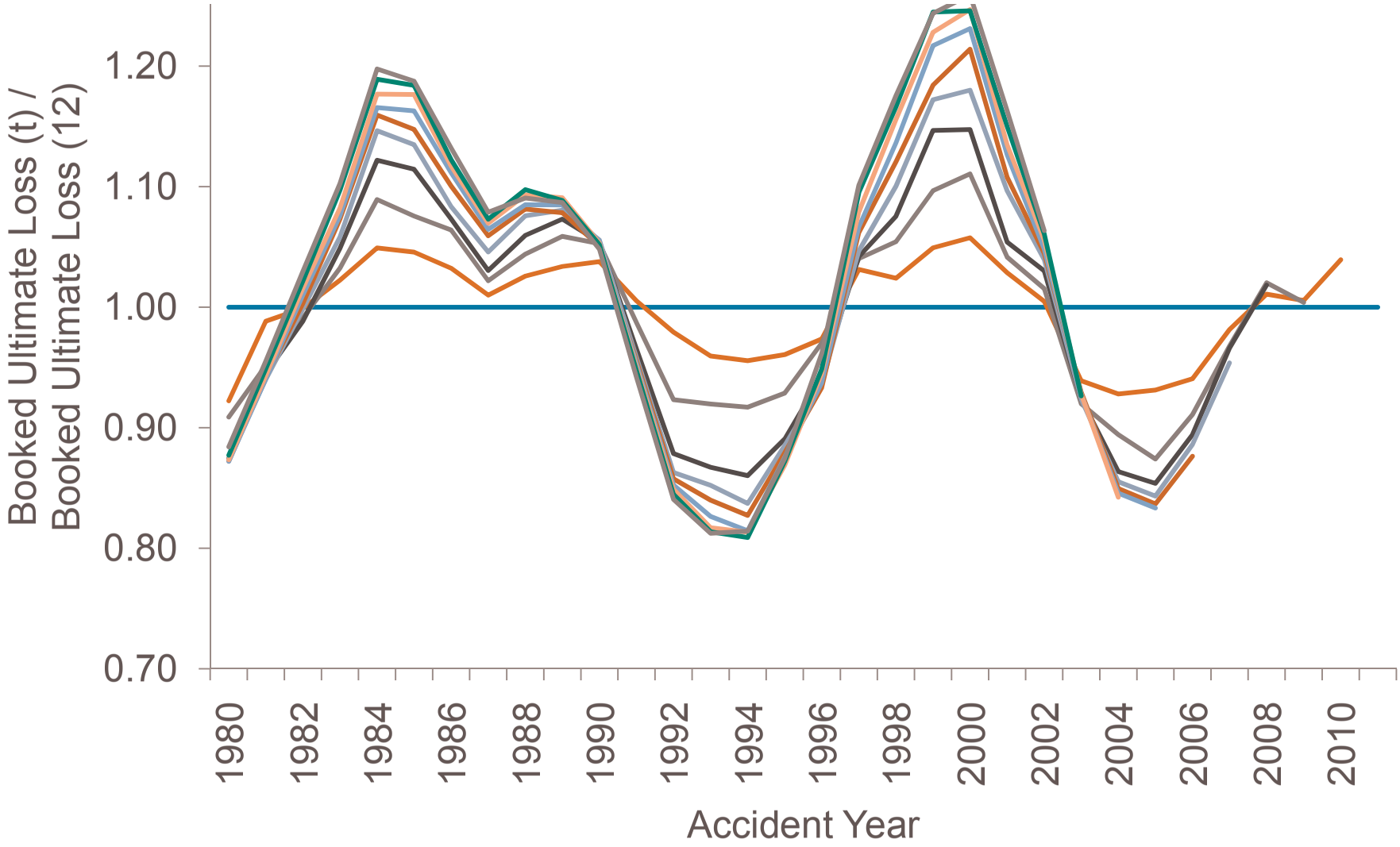
H = Hypothesis

WC Cycle



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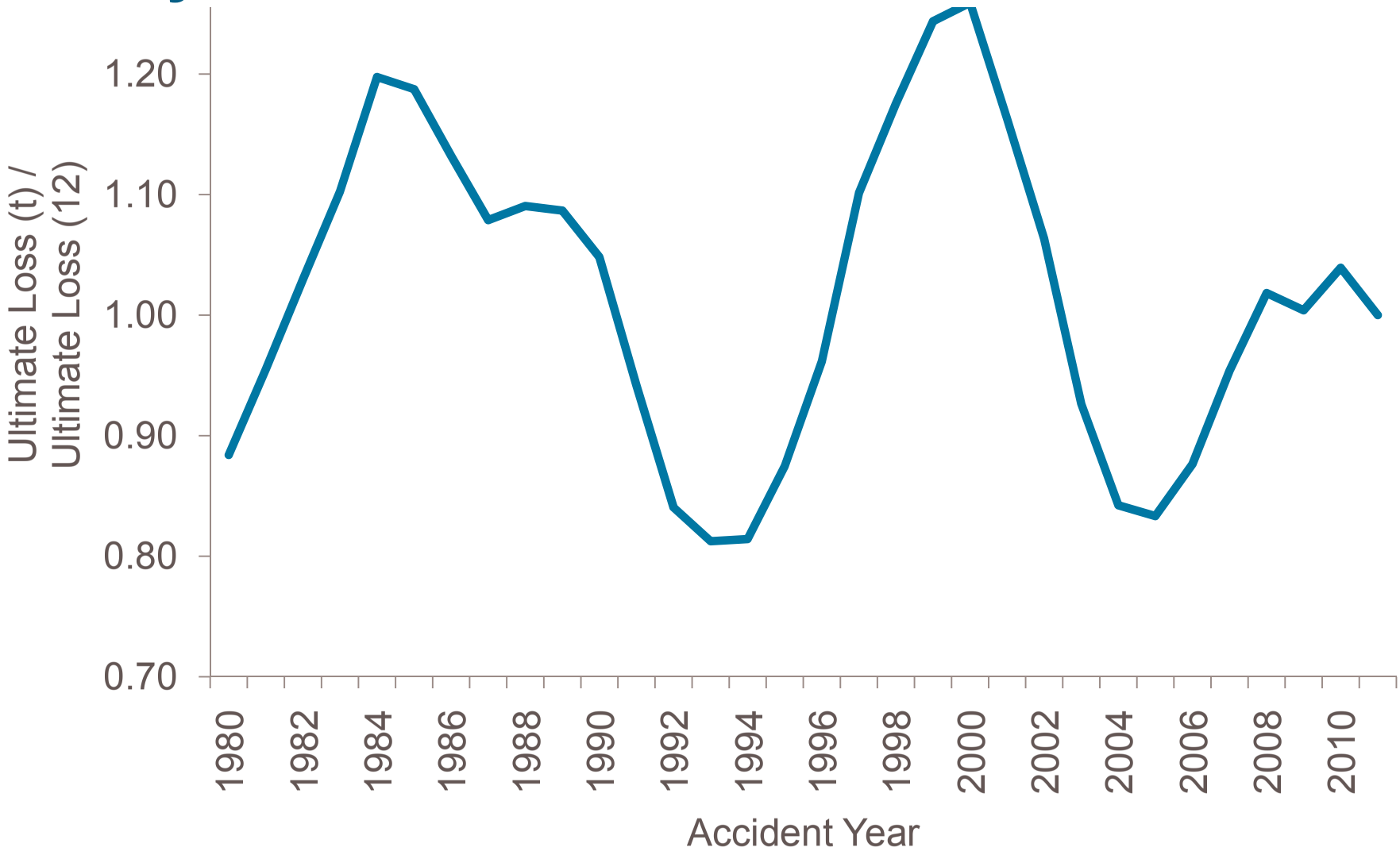
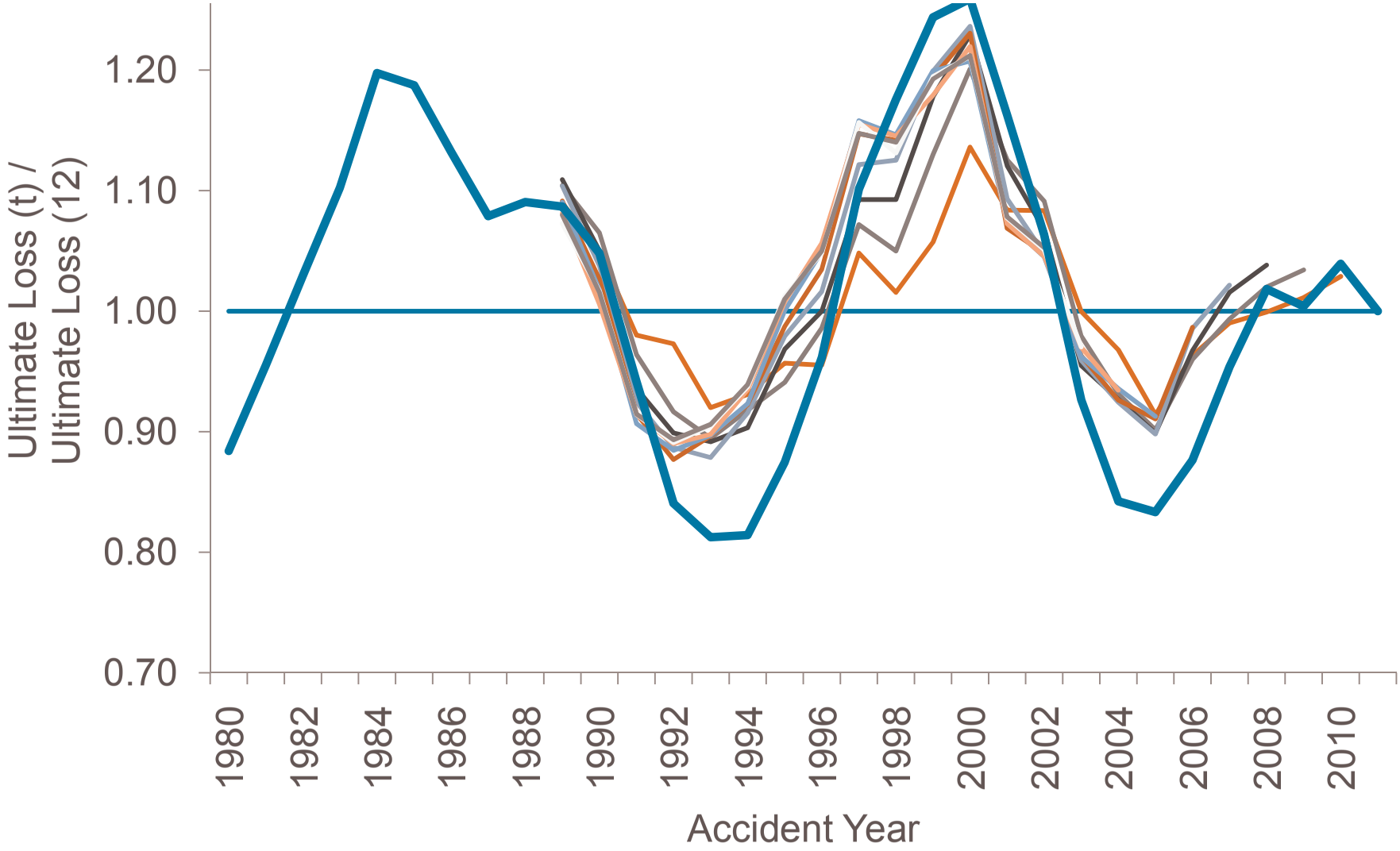
WC Cycle outline



WC Cycle outline + Incurred chain-ladder cycle



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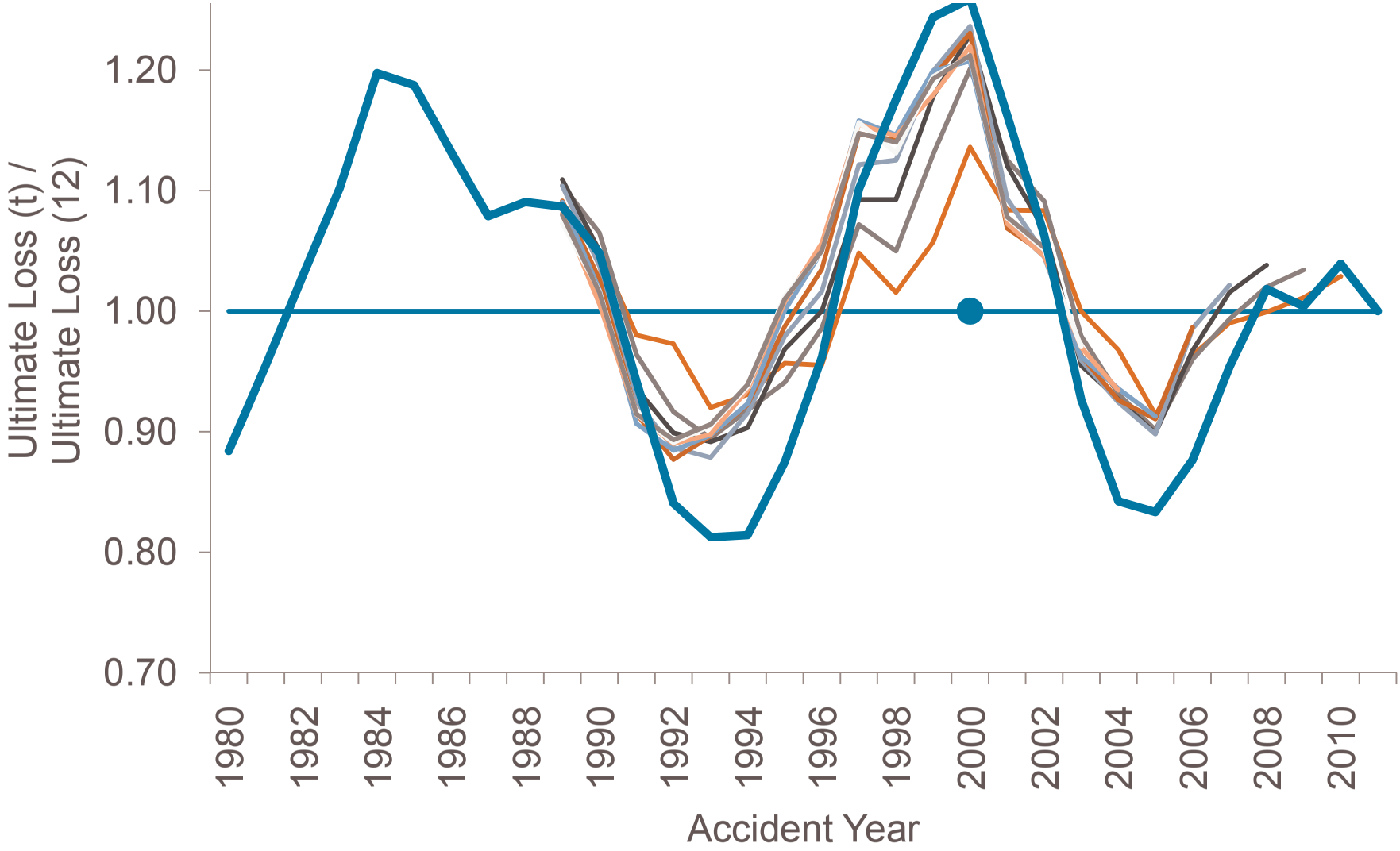

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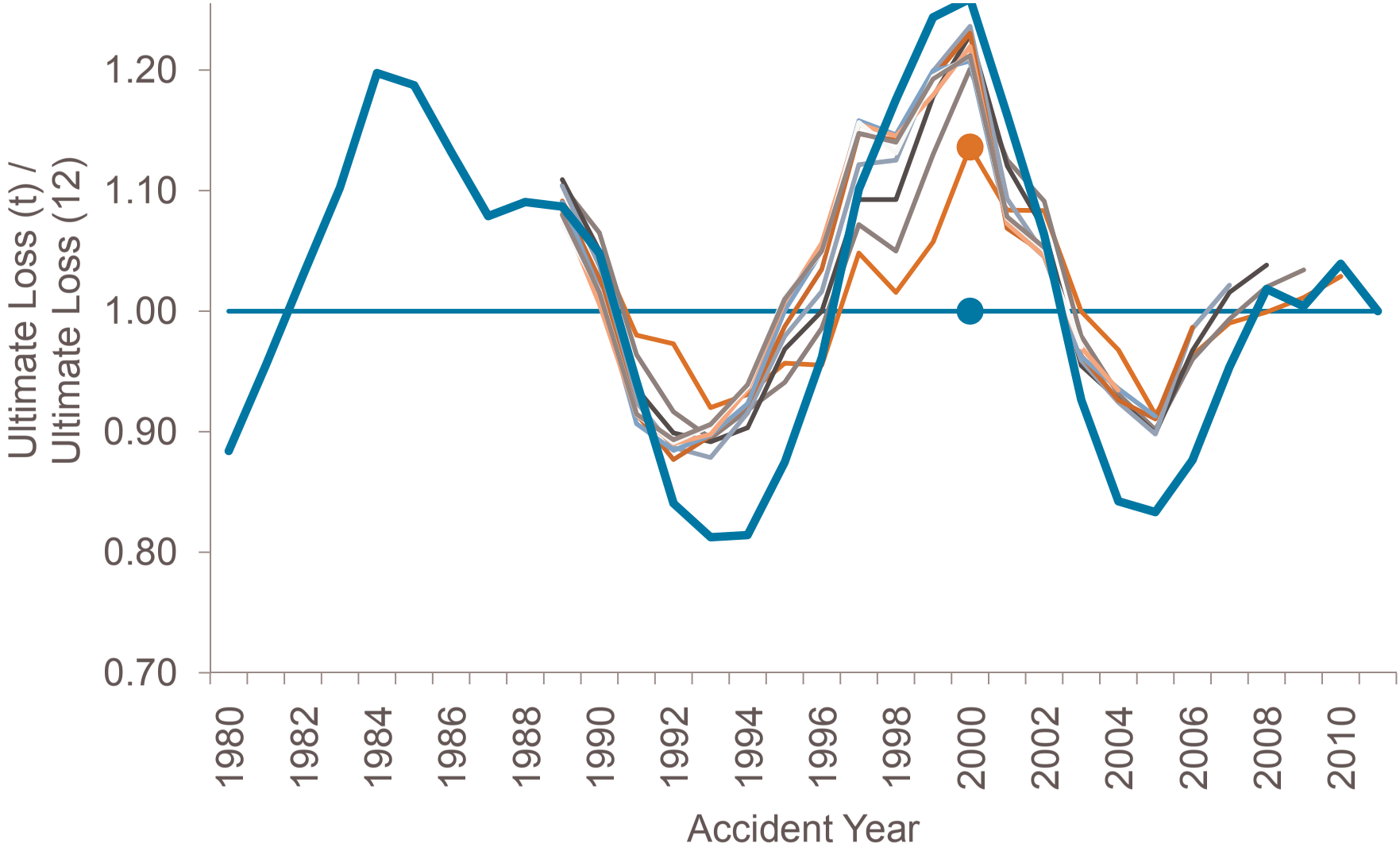

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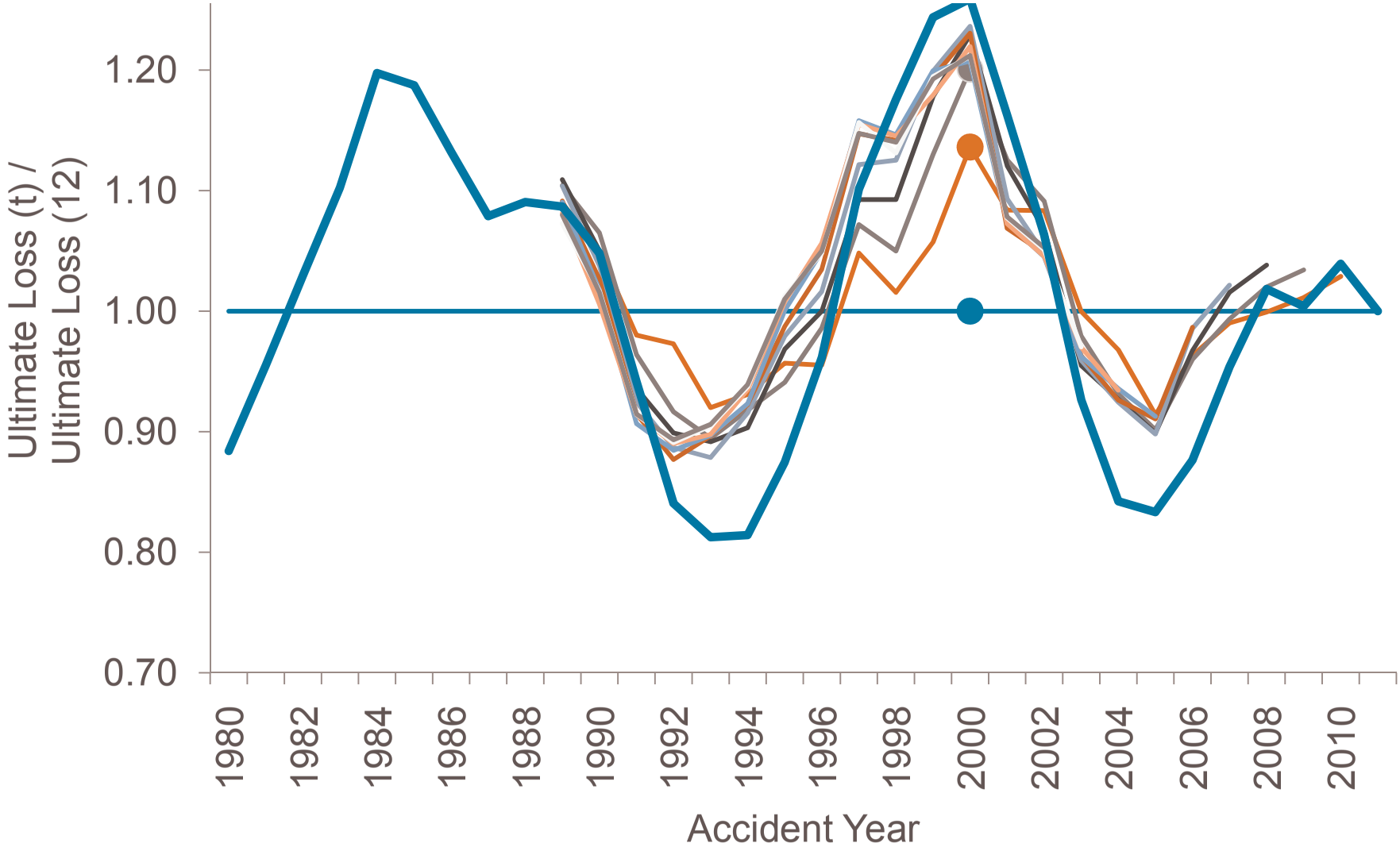

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H = Hypothesis

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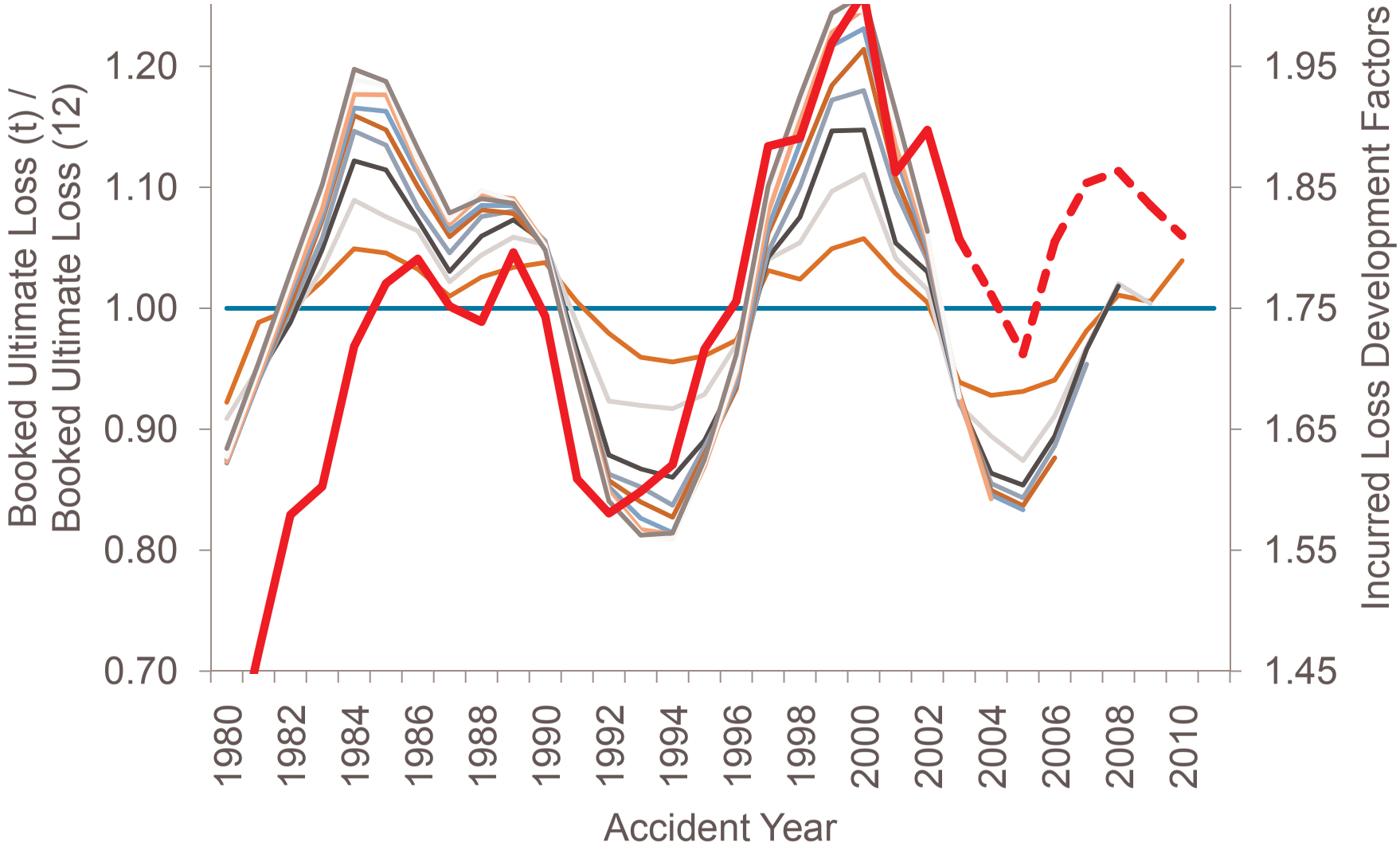
WC Cycle and 12-120 Incurred CDF



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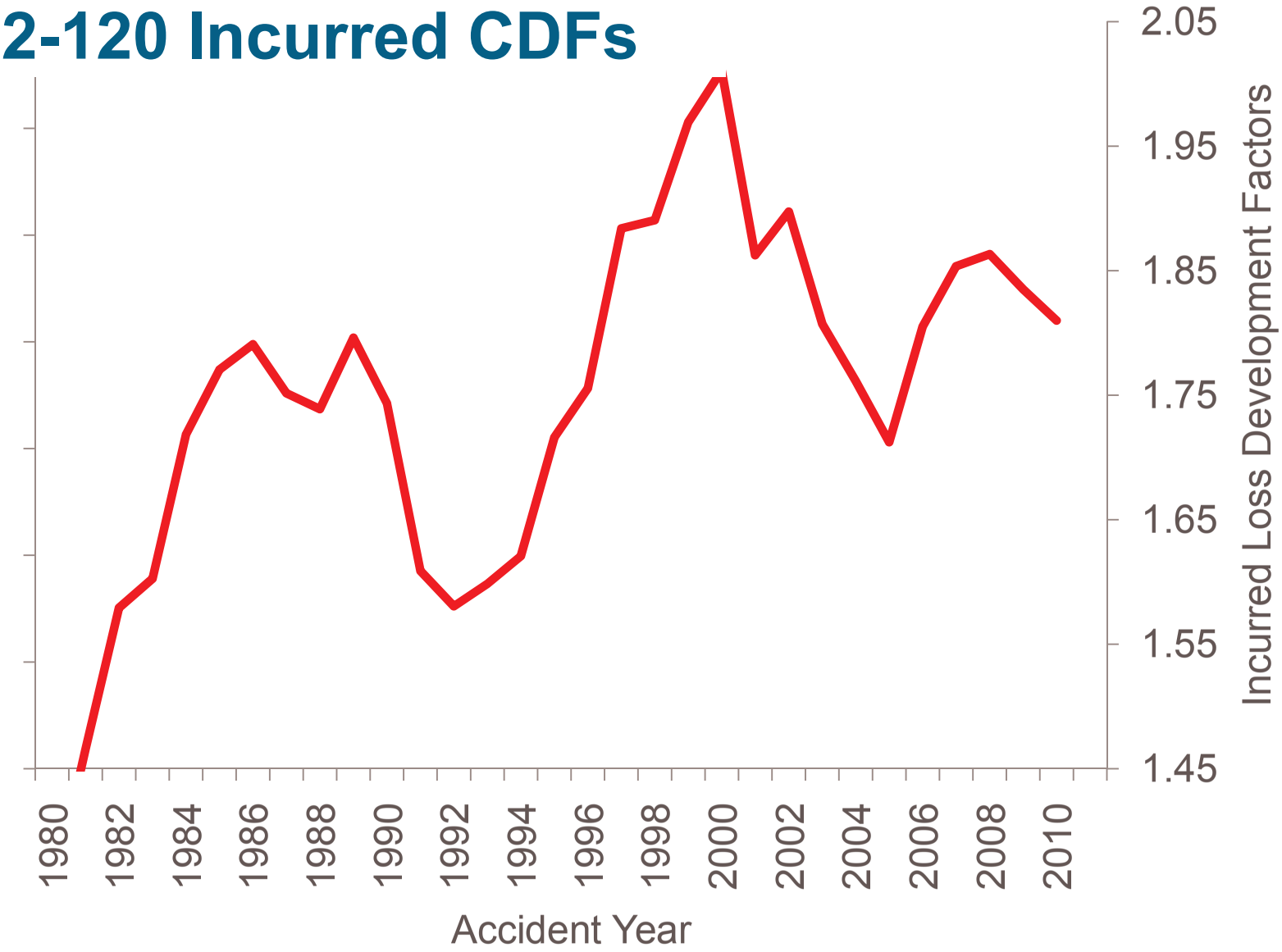
WC 12-120 Incurred CDFs



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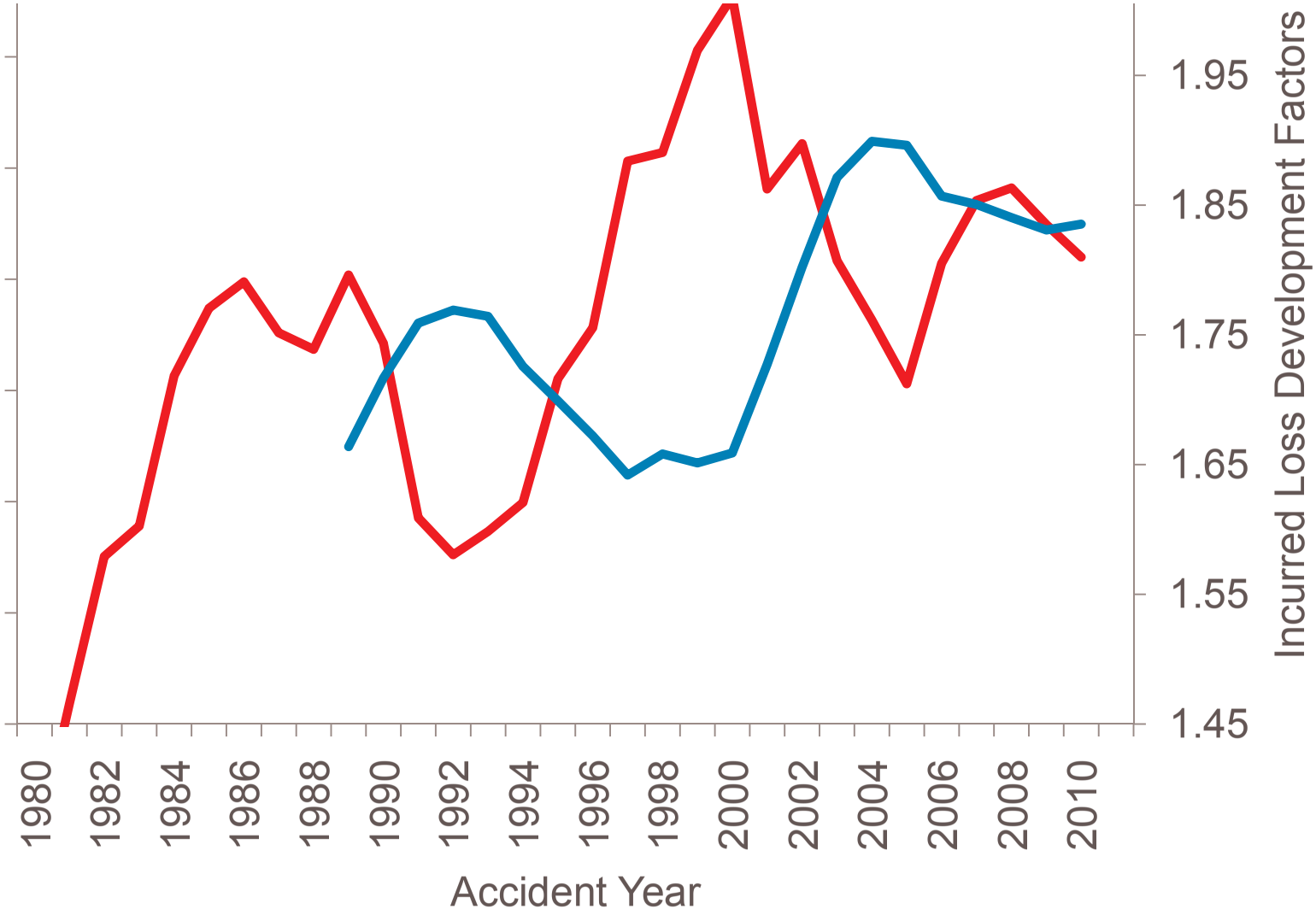
WC 12-120 Incurred CDFs & All yr weighted av



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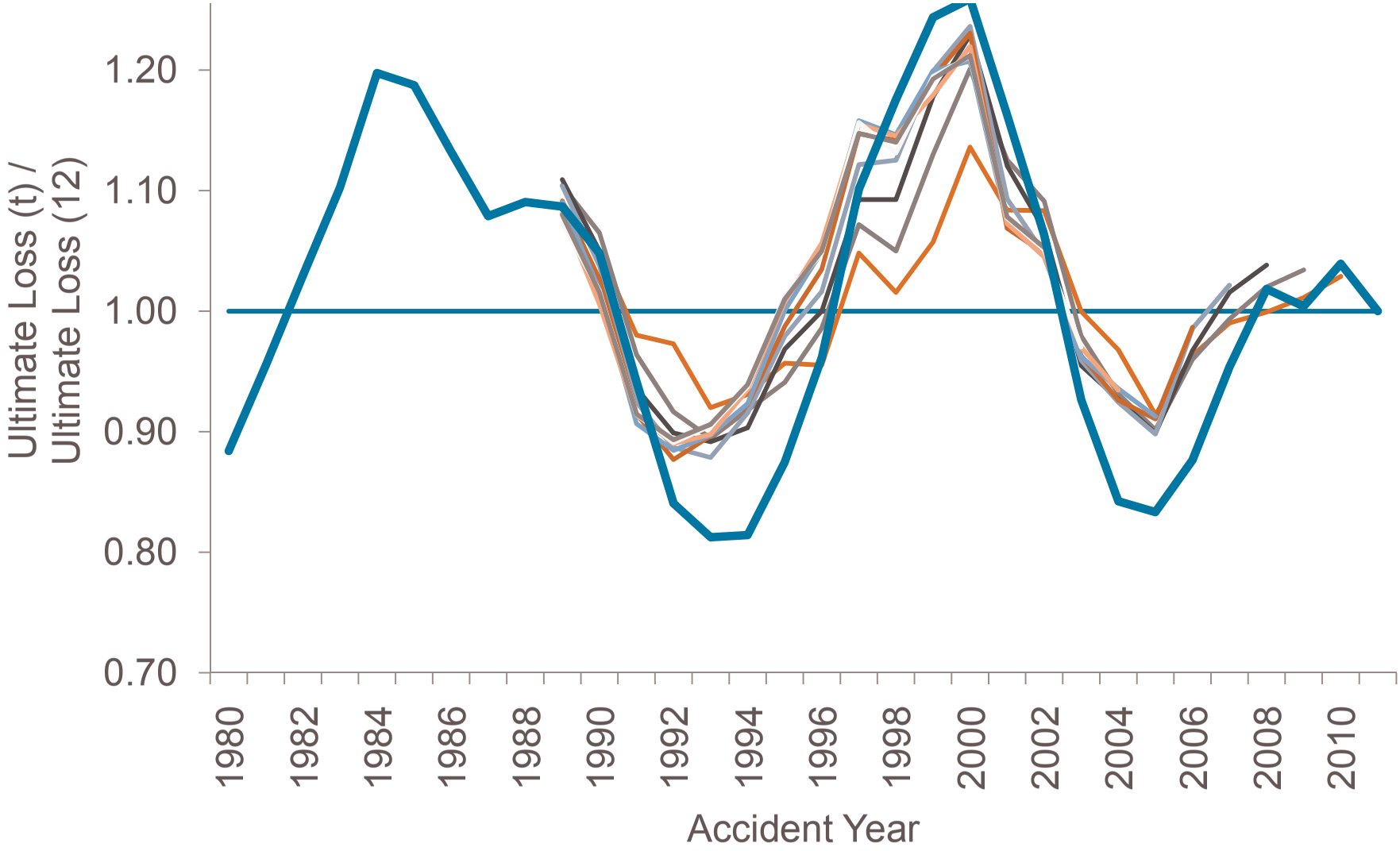
Blue line = All-year weighted LDFs for a 10x10 year incurred loss & ALAE triangle were cumulated for 12-120 month CDF estimate

WC Cycle outline + Incurred CL cycle (All yr av)



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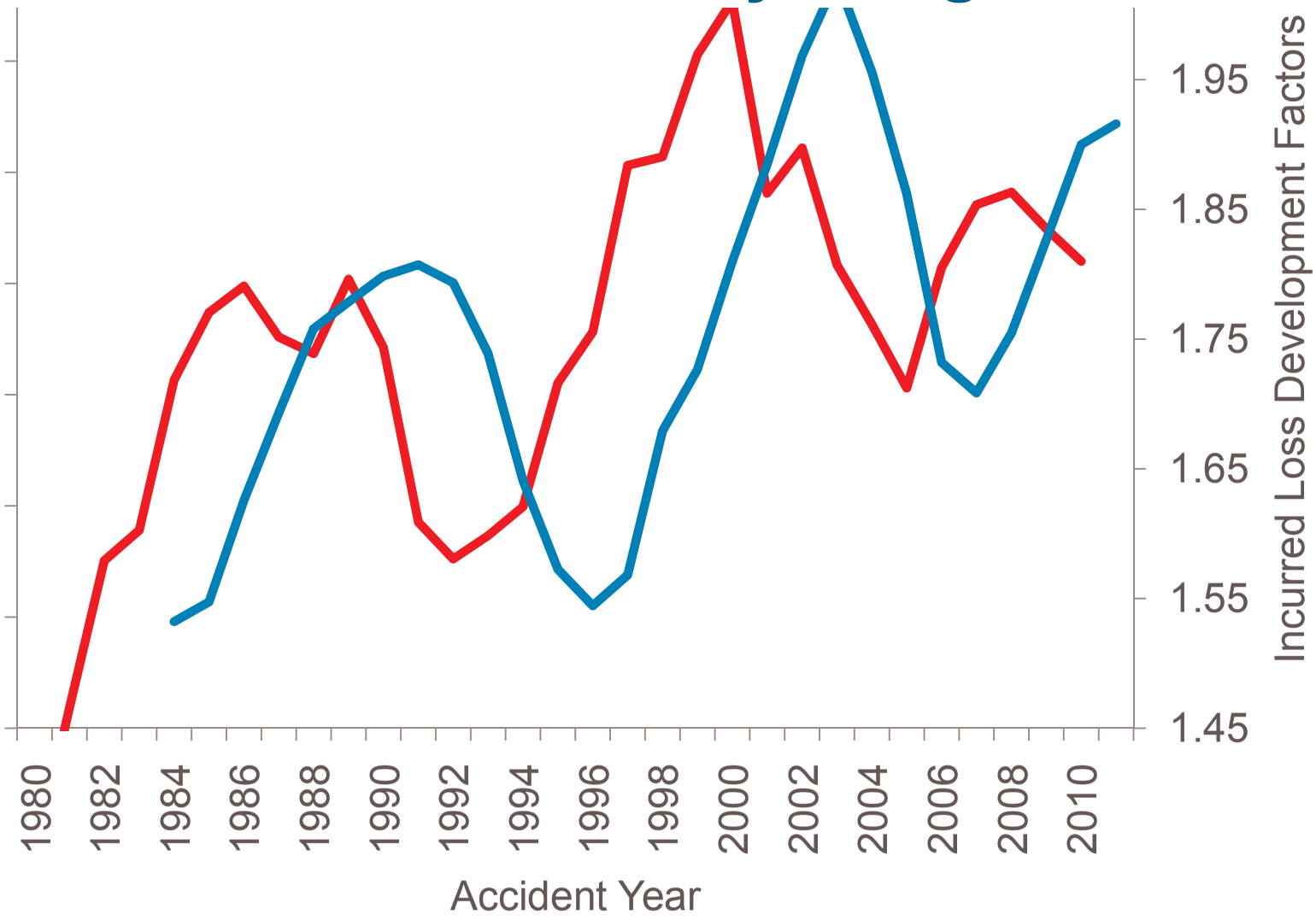
WC 12-24 Incurred LDFs & 3 yr weighted av



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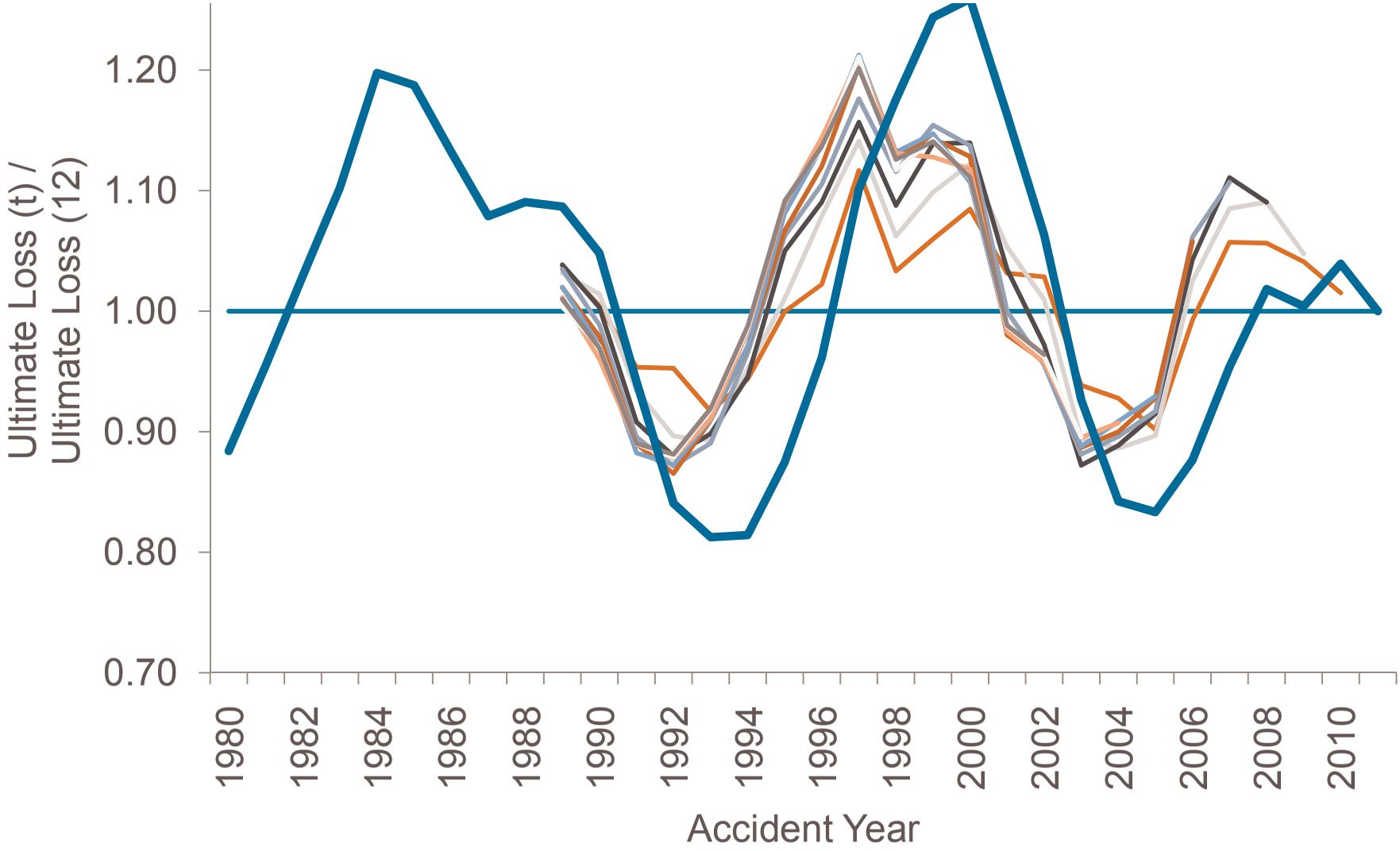

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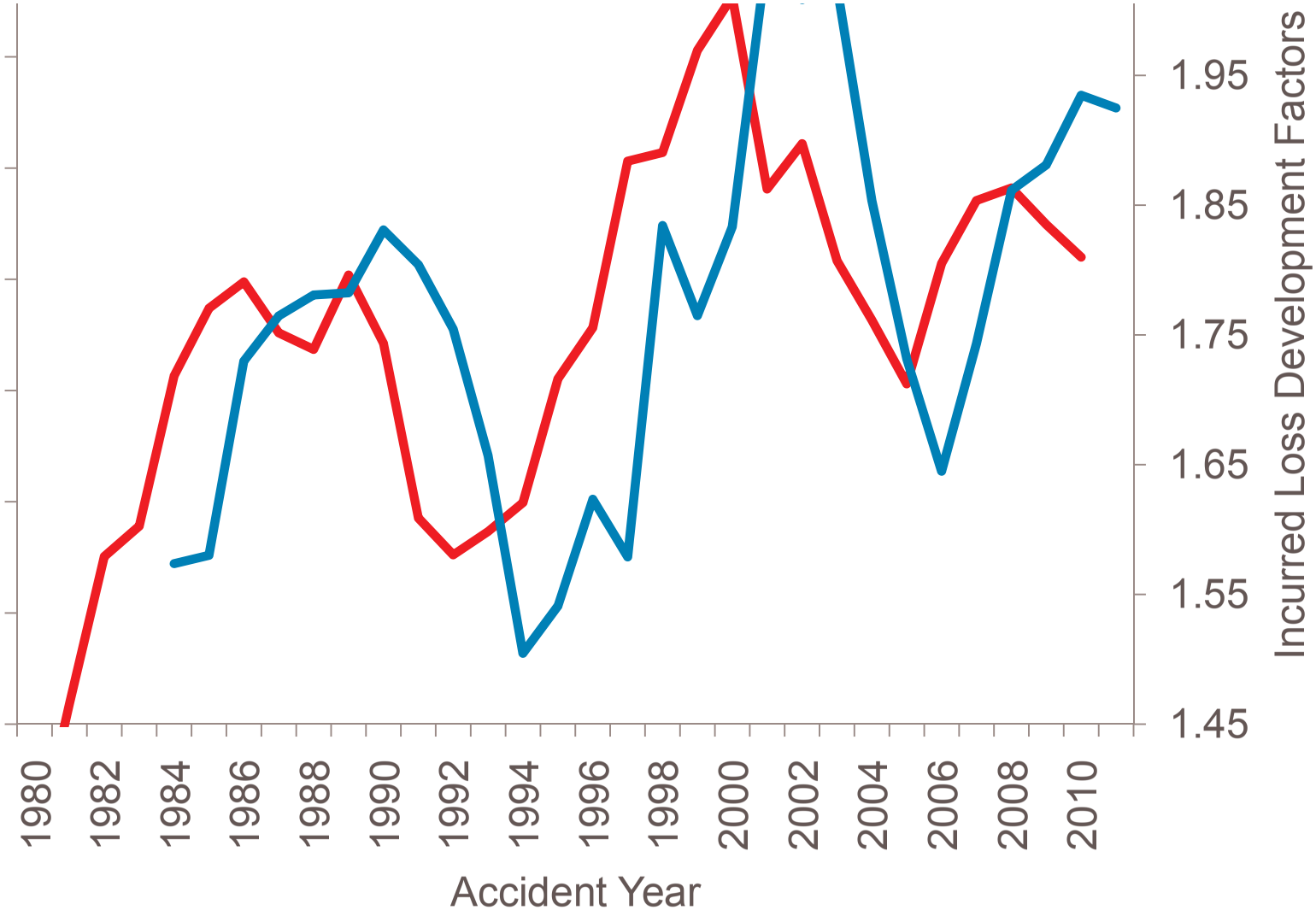
WC 12-24 Incurred LDFs & 1 yr weighted av



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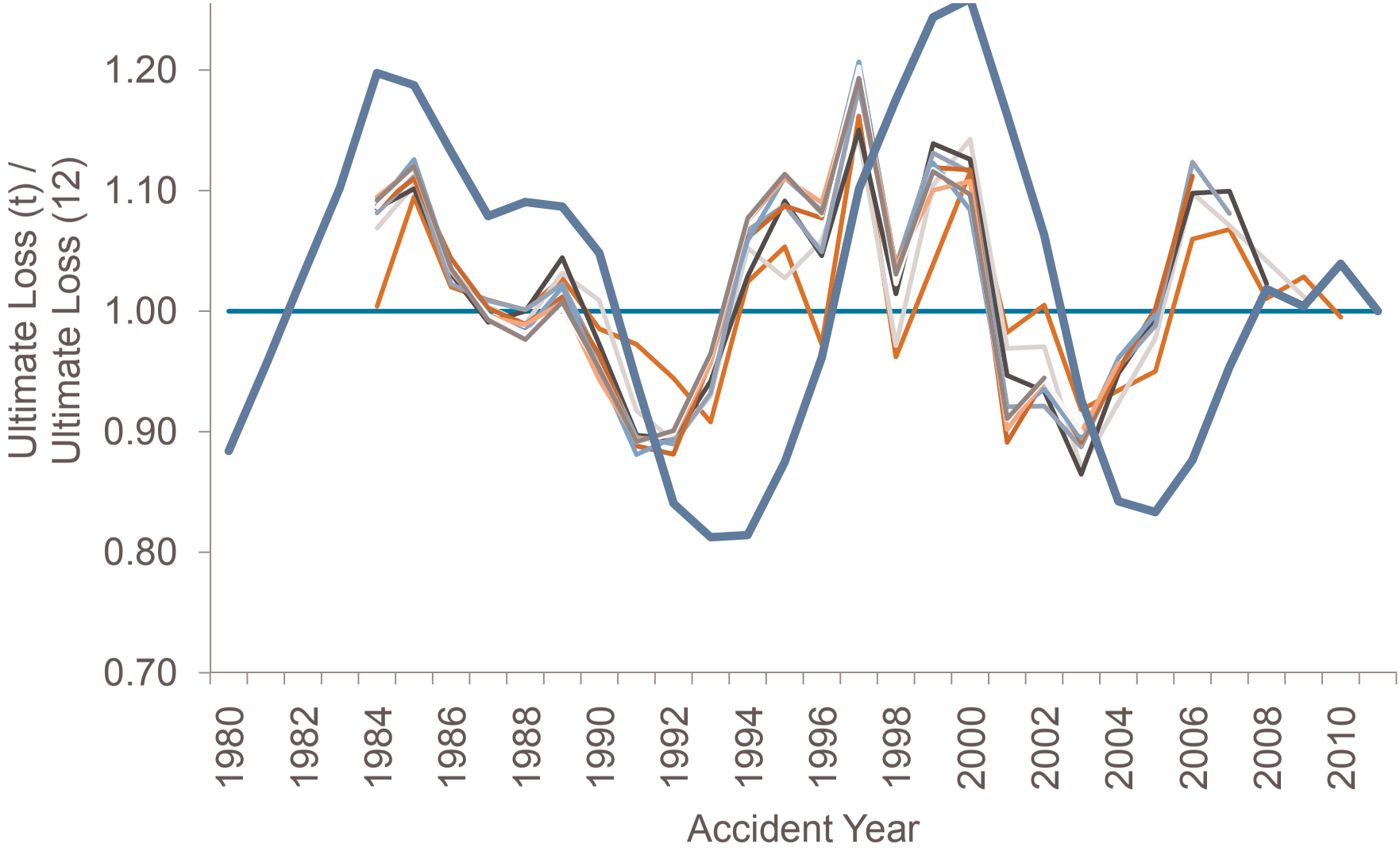

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Why does reserve risk behave like this?

Q: What causes the cycle?

H: Incurred chain-ladder method + judgment to smooth it out

Q: Why does the incurred chain-ladder method have a cycle?

H: The actual LDFs have a cycle and a multi-year average expected LDF is flat or counter-cyclical.

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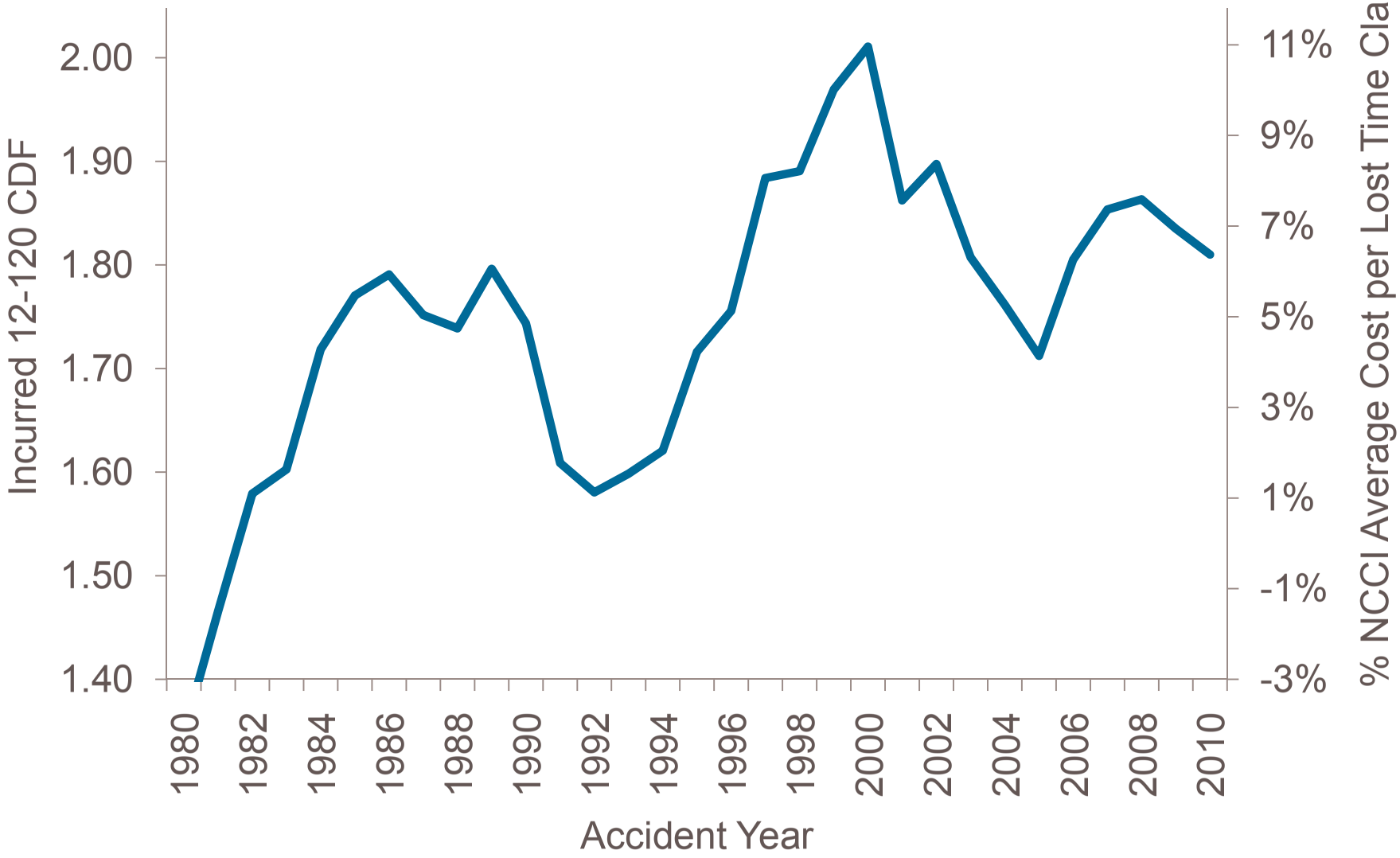
WC 12-120 Incd CDFs



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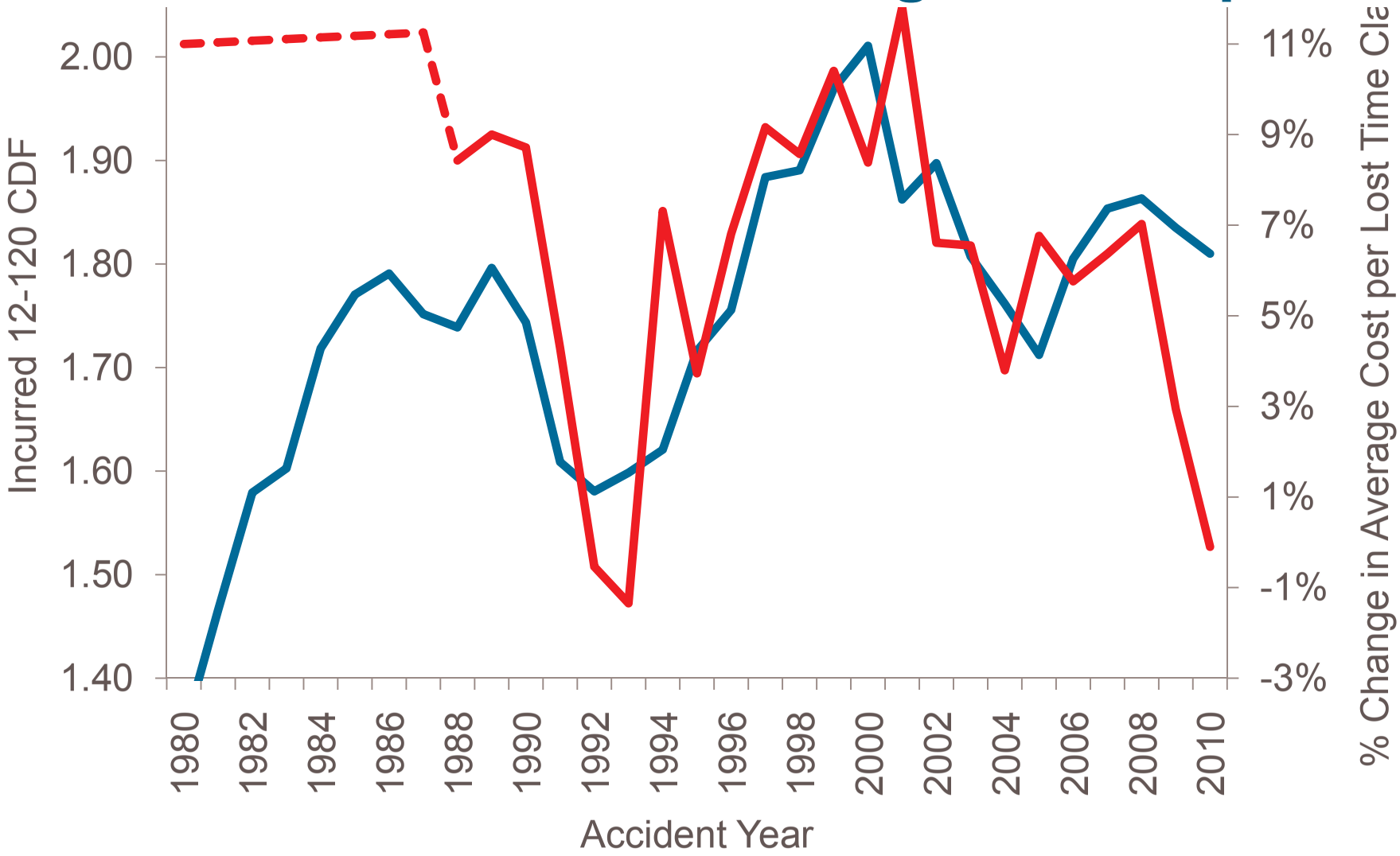
WC 12-120 Incd CDFs & Change in Cost per claim



NCCI Average cost per lost time claim is by accident year. A combination of 50% of the medical and 50% of the indemnity average cost per lost time claim. 2011 is a preliminary value based on data as of 12/31/2011.1991 to 2010 is based on data through 12/31/2010, developed to ultimate. Dotted red line is 11%, which is the average of WC claims inflation quotes from various sources for the decade of the 1980's.

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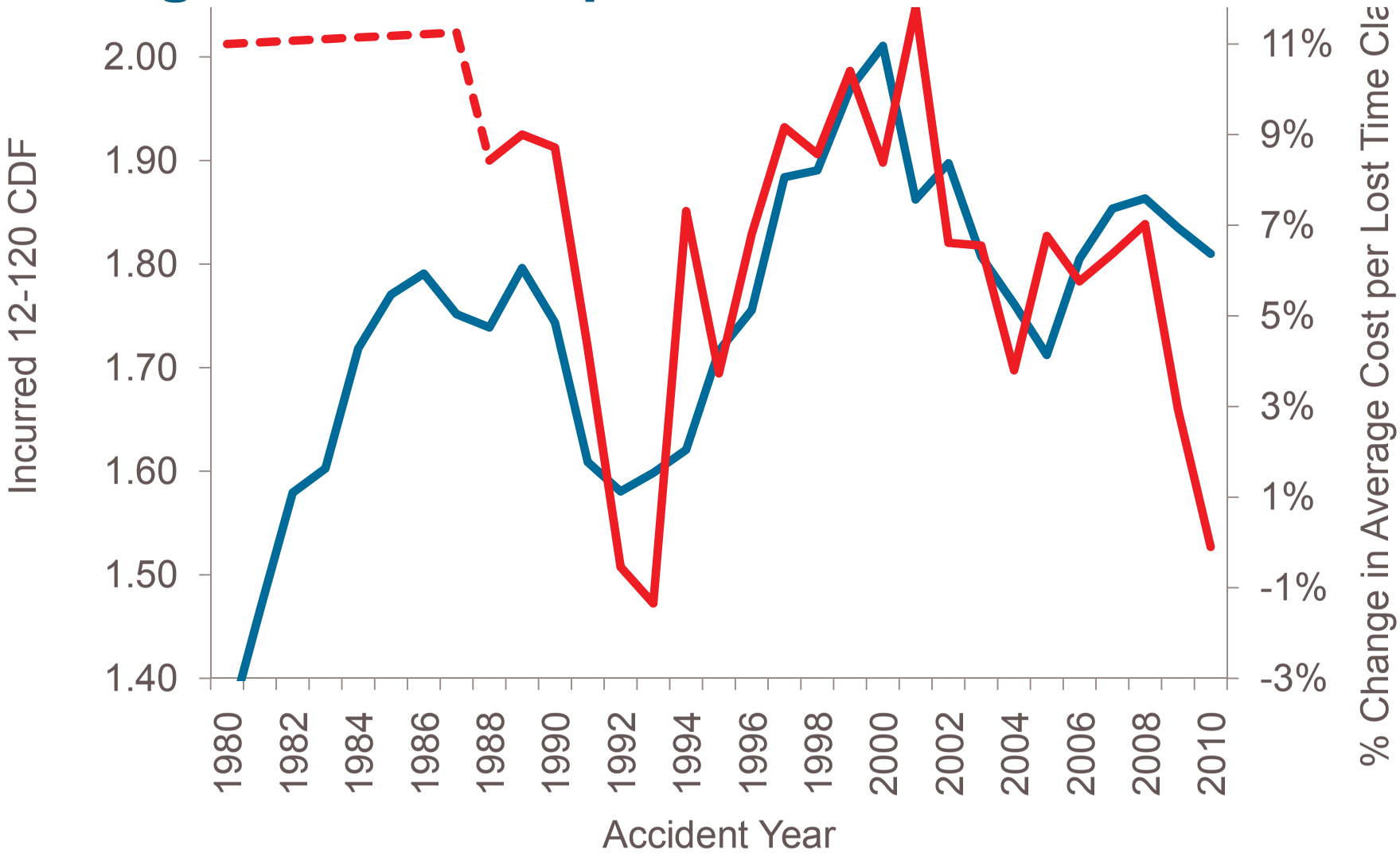
Change in Av Cost per claim & 12-120 Incd CDF



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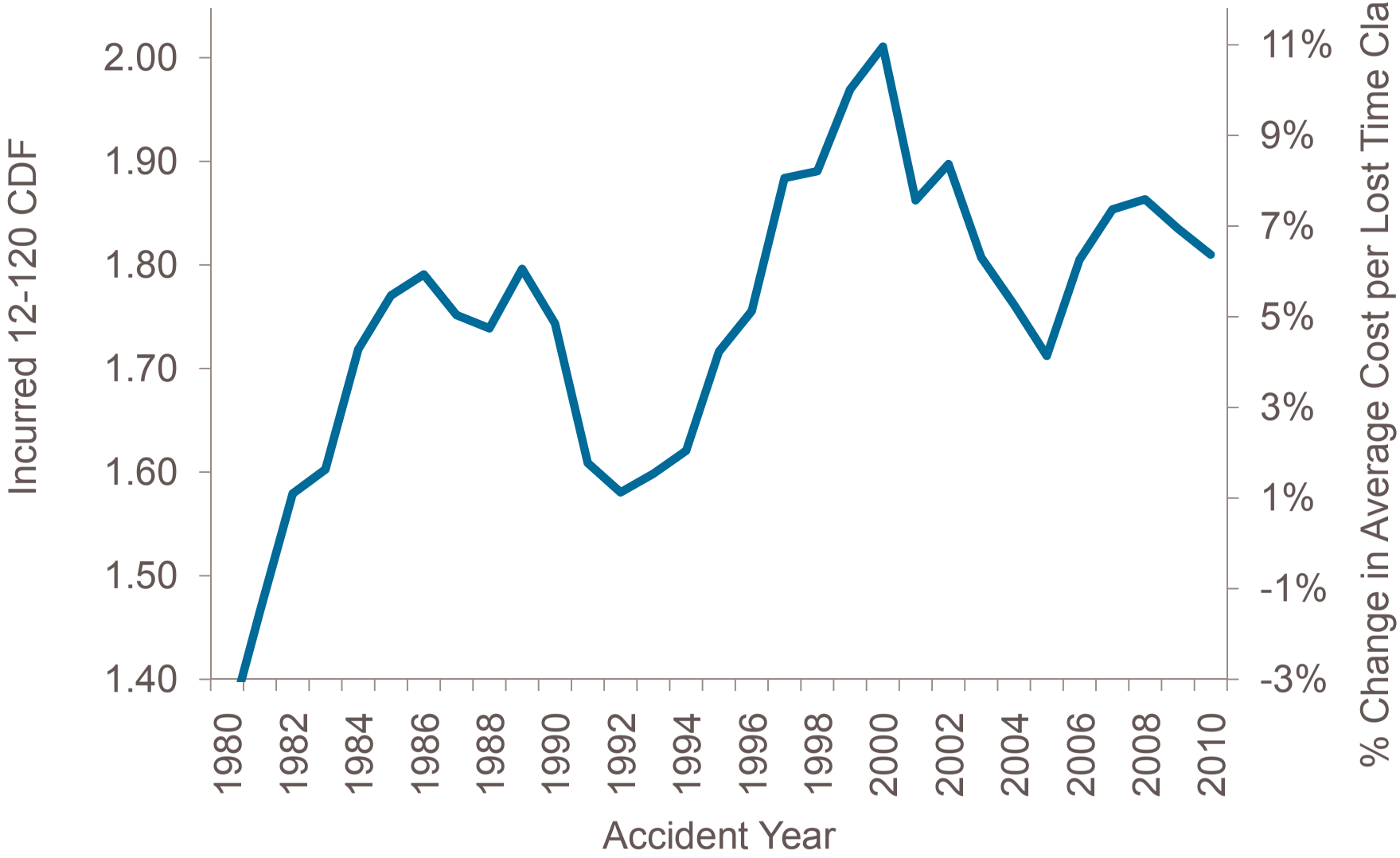

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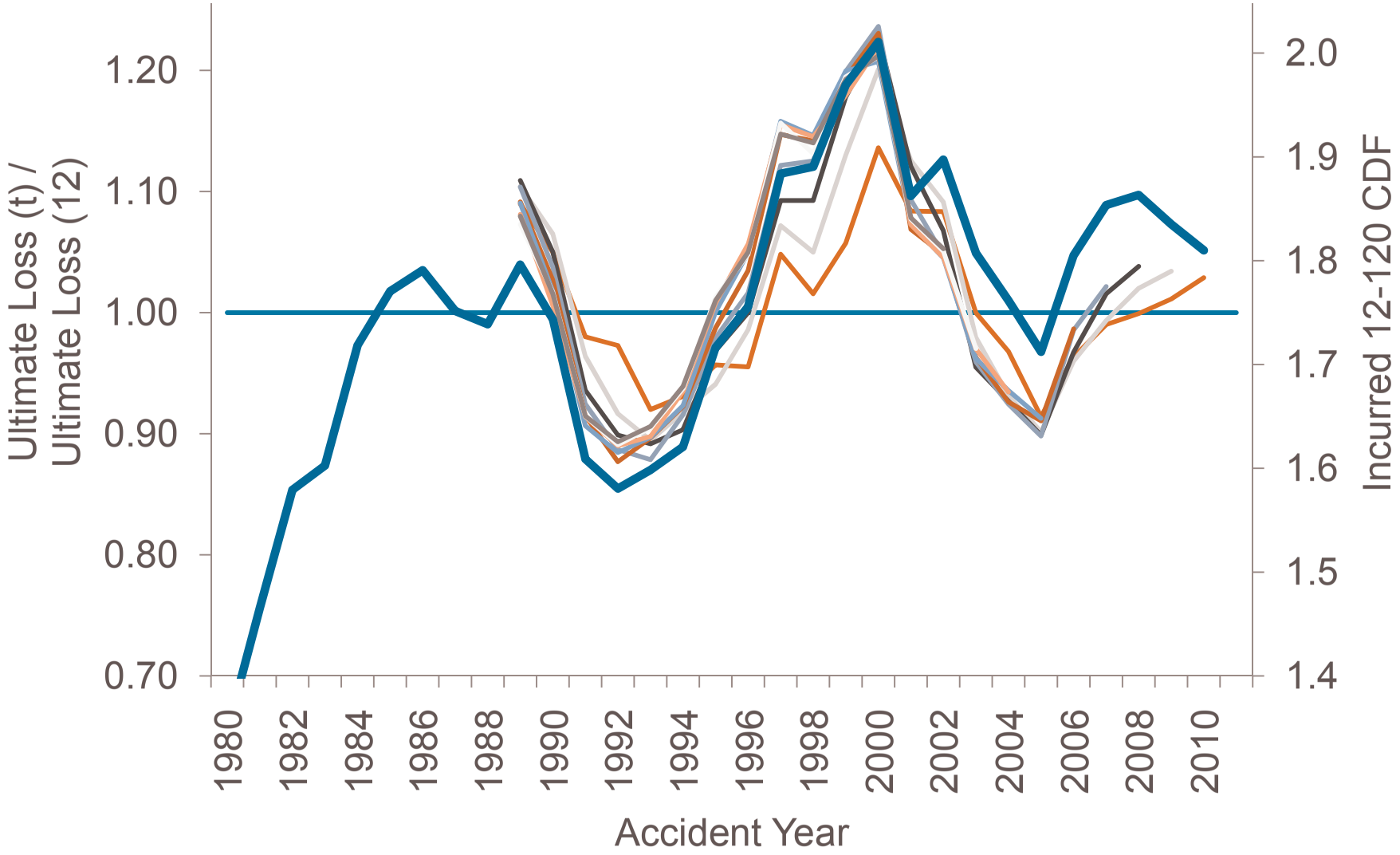
12-120 Incd CDF + Incurred CL cycle (All yr av)



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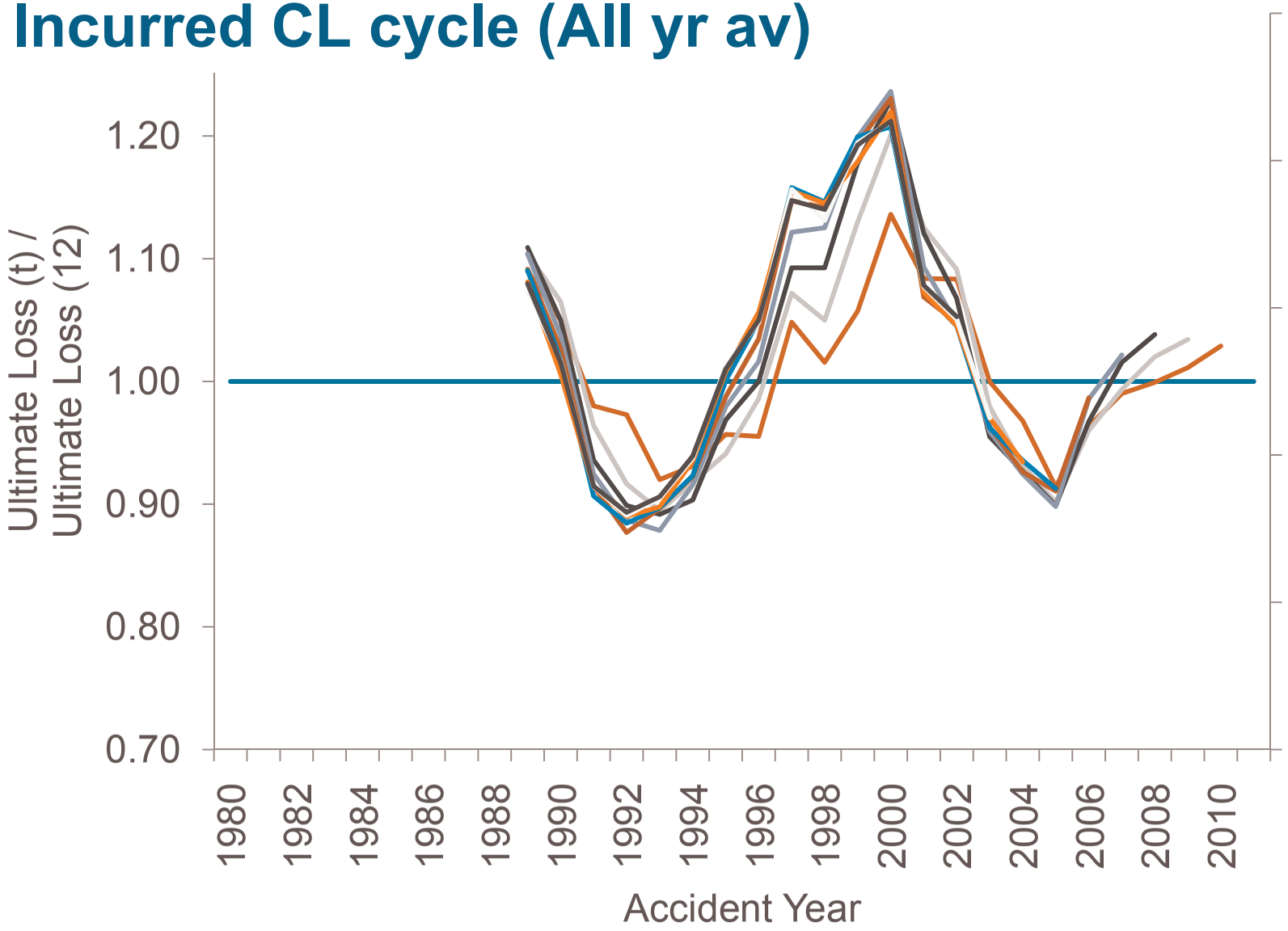
Incurred CL cycle (All yr av)



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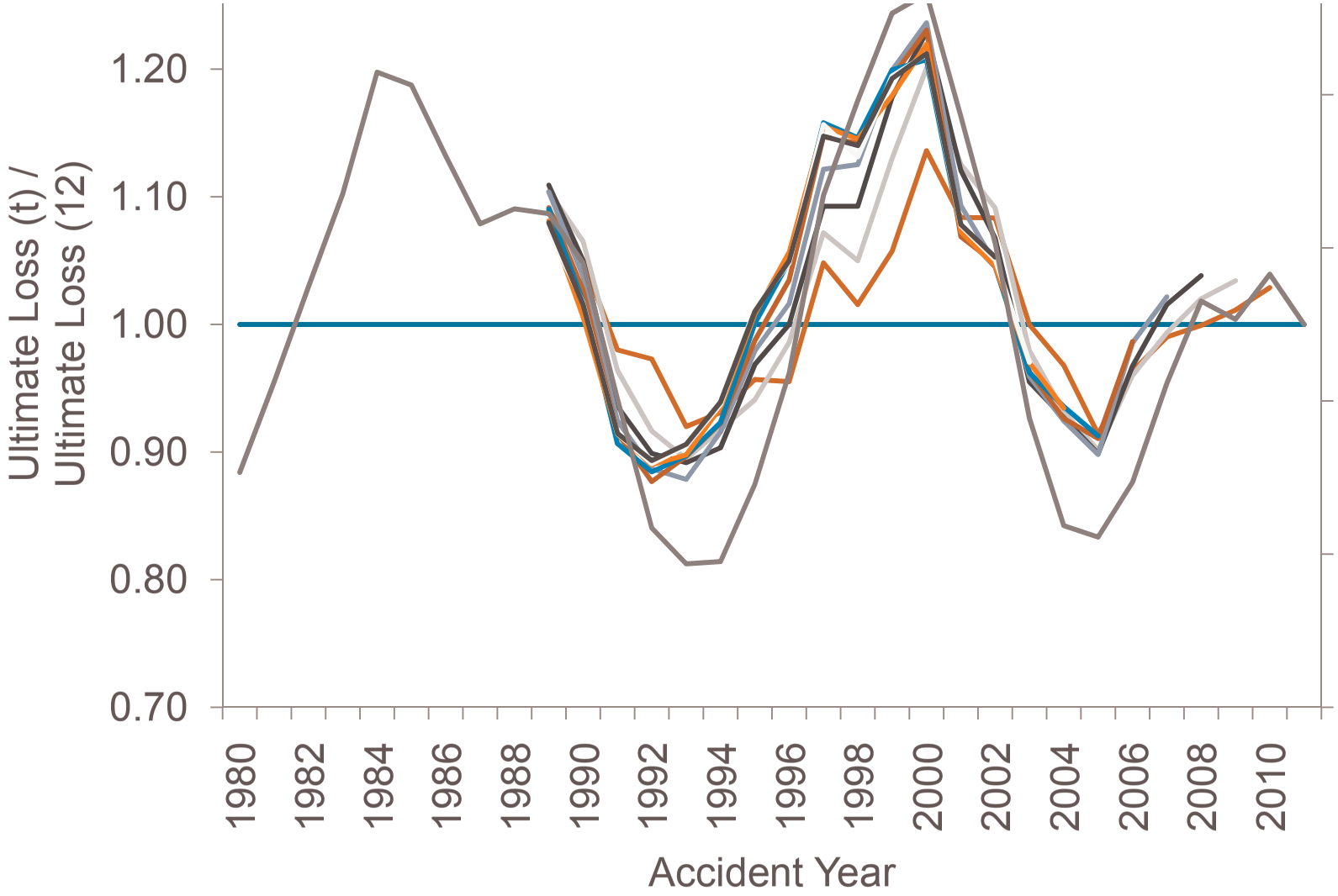
Incurred CL cycle (All yr av) & Reserve Cycle outline



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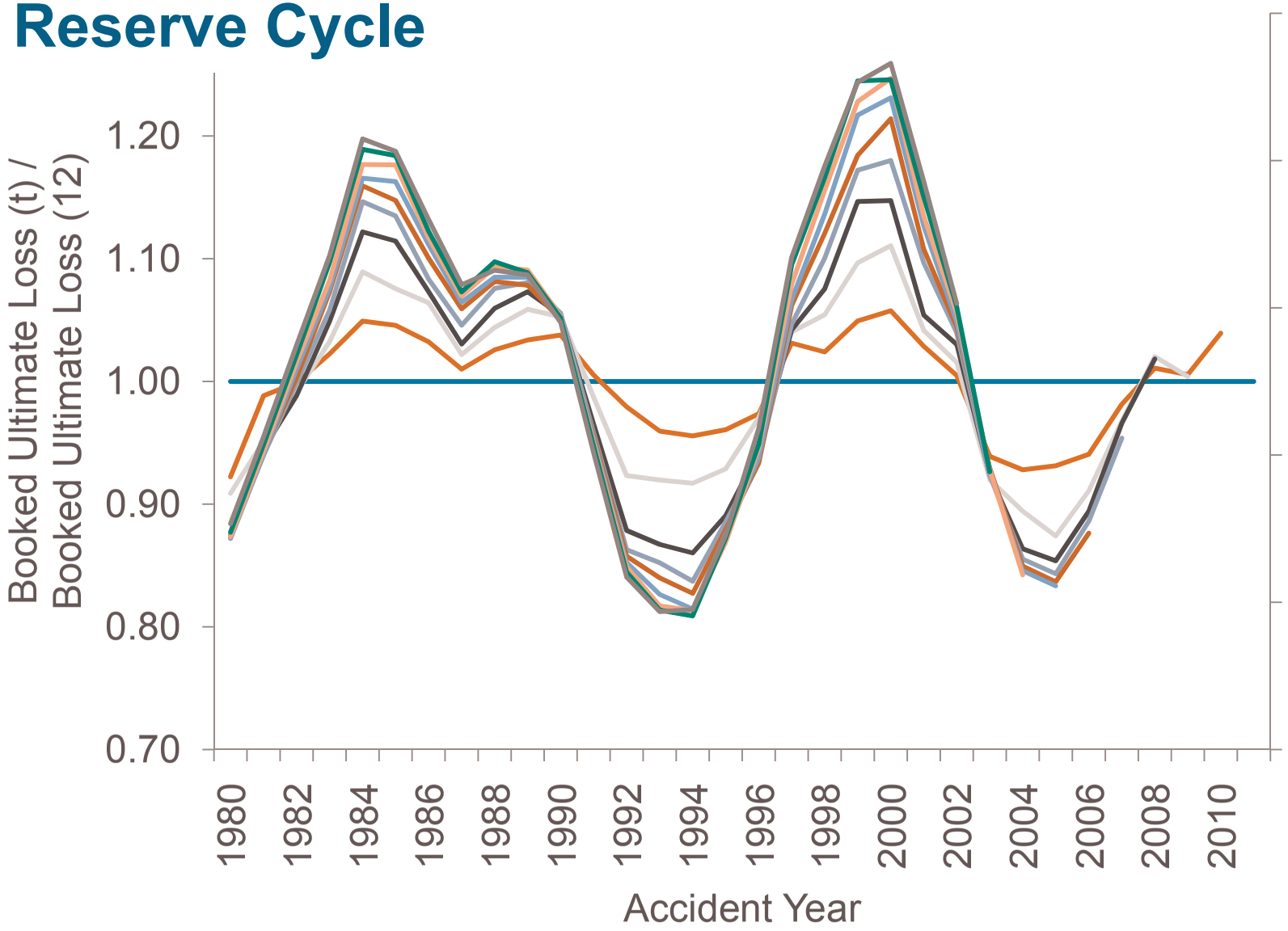

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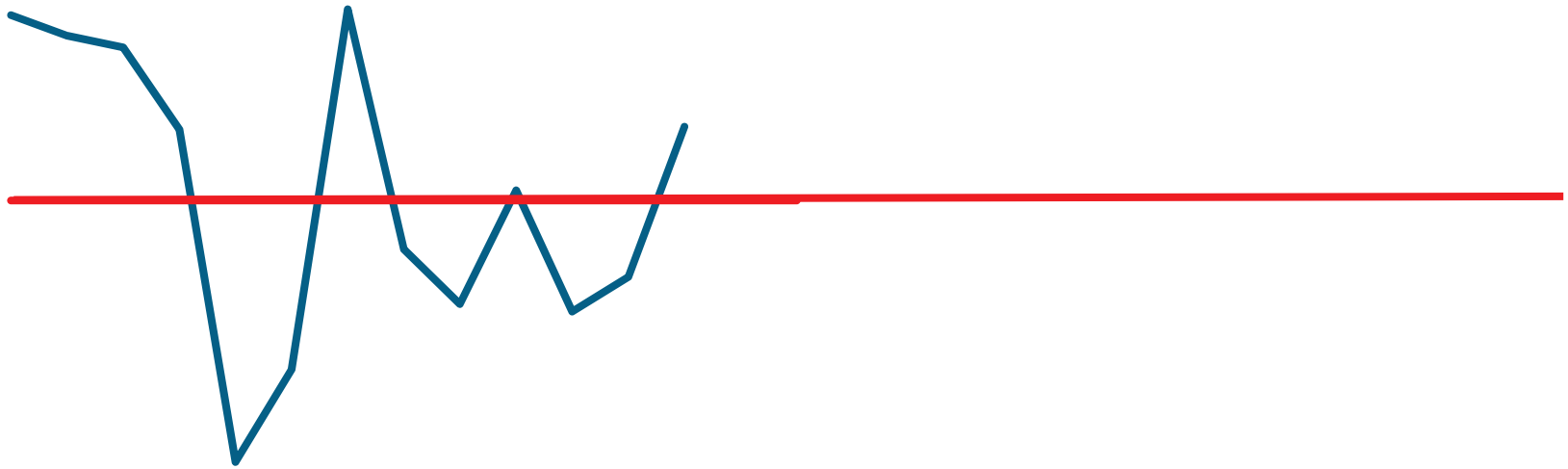
How the bootstrap model works



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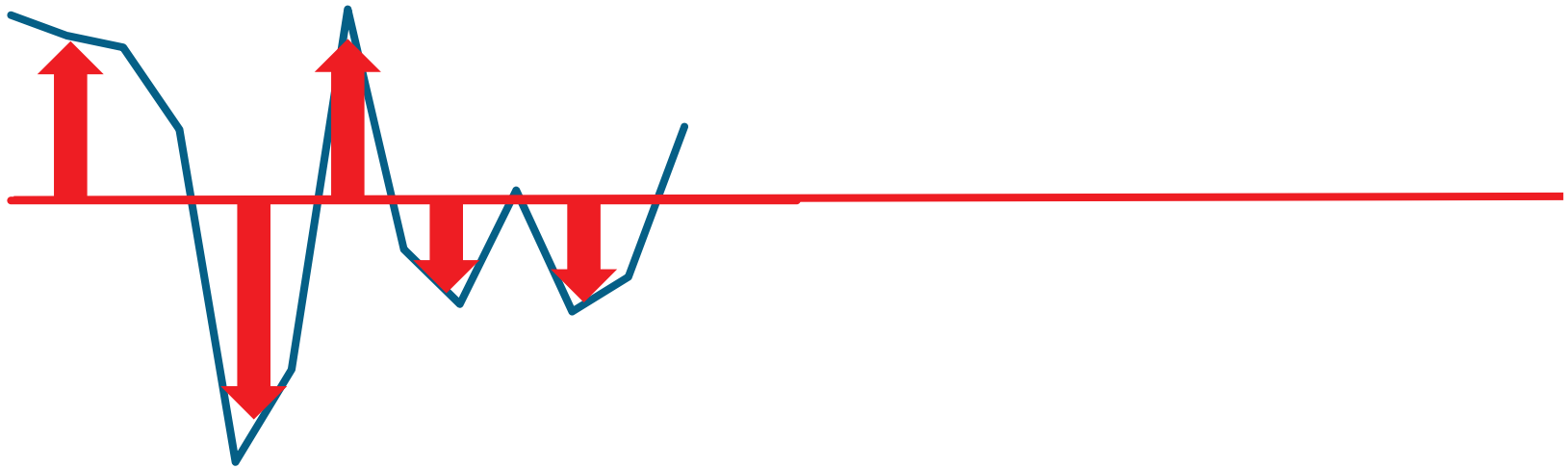

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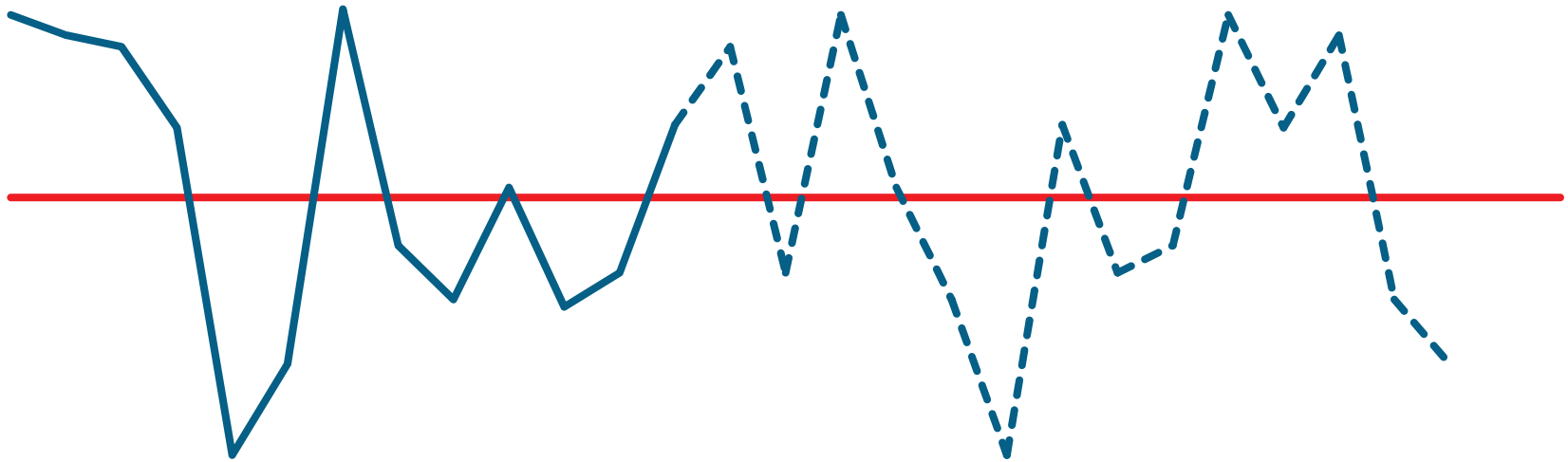

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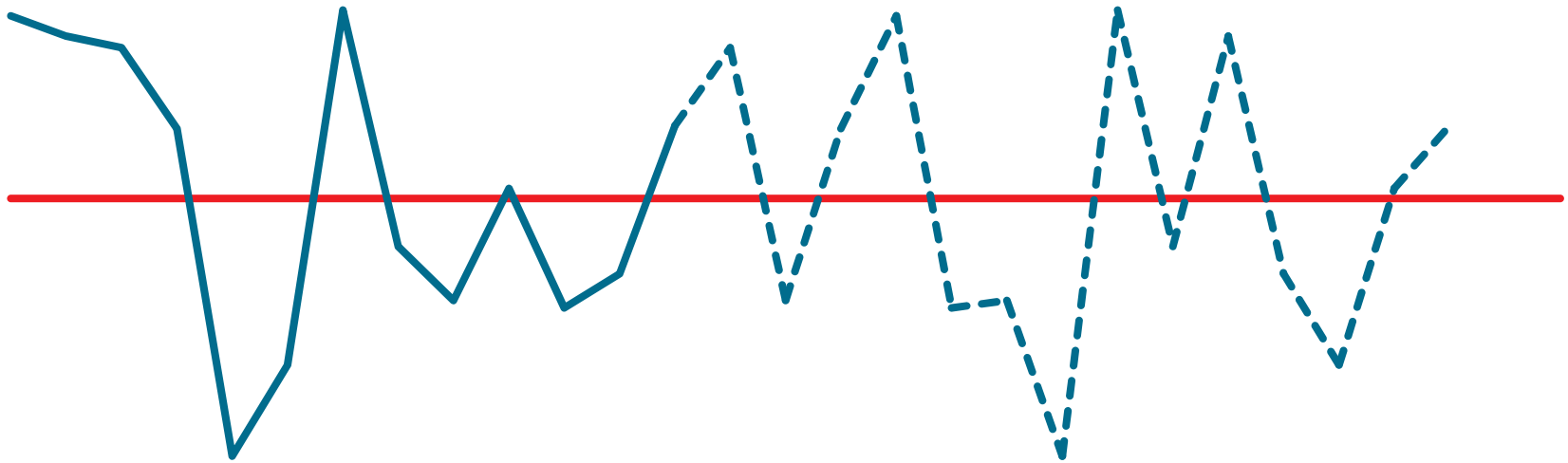

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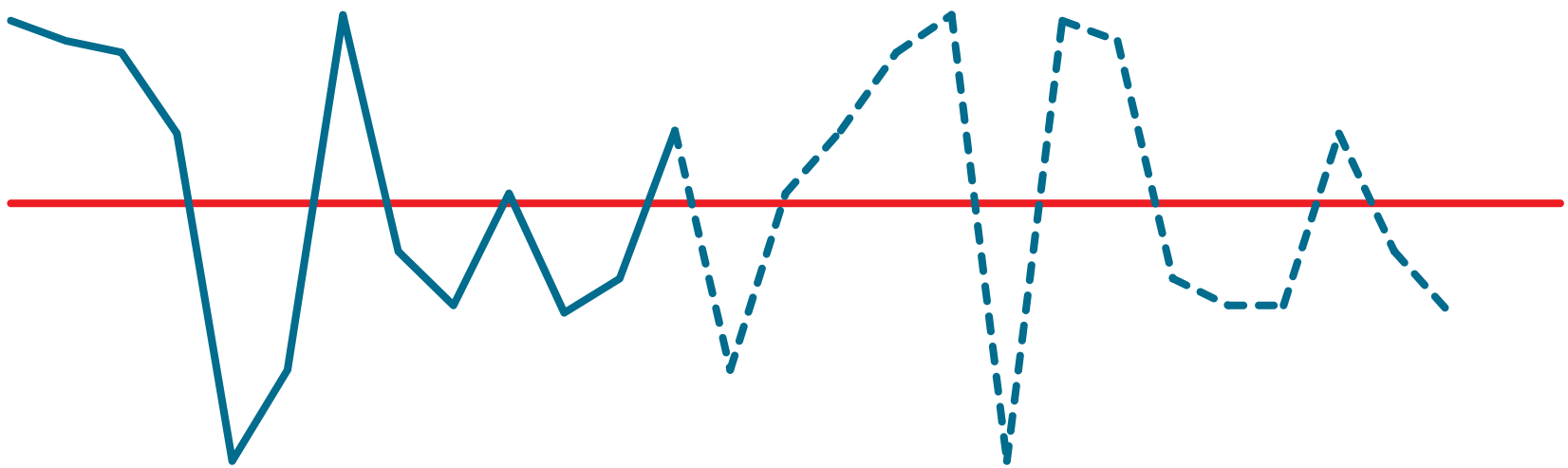

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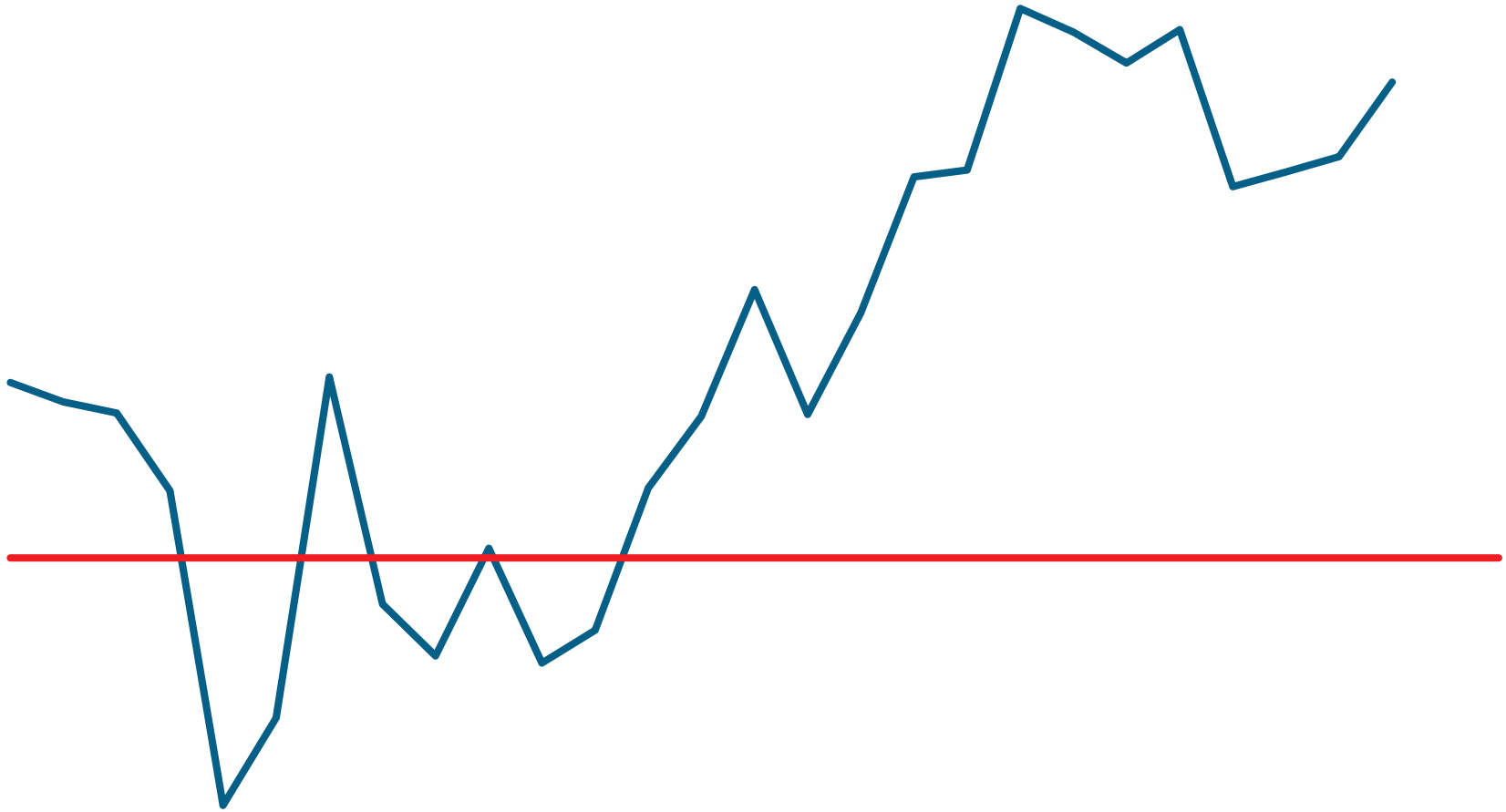

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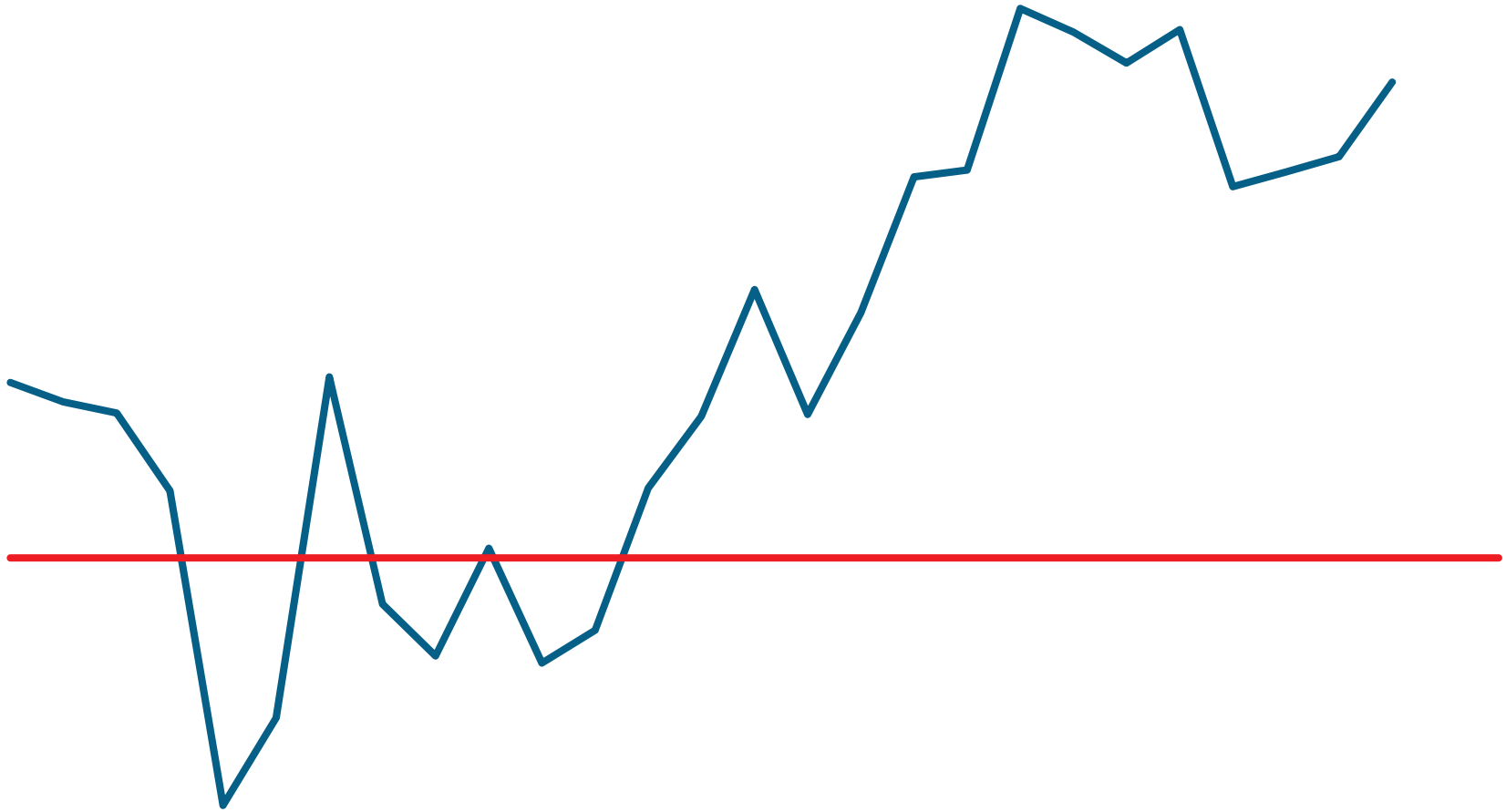
- Trying a GLM that measures AY, DY and CY trends with future CY trends modeled as inflationary random walk

…systemic risk!



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Yoda
Grand Master of the Jedi Order
& member of the Jedi High Council of the Galactic Republic

Source: Wookieepedia