

convex risk

When is Premium Riskier Than Loss?

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2022 Update

Question 1: Background

When did the hardest market of the last one hundred years occur?

- a. 1929-31 during the great depression
- b. 1939-45 during WW2
- c. 1973-74 during “stagflation”
- d. 1984-86 during the liability crisis and LMX spiral
- e. 2000-02 during WTC, the dot com bust, etc.

Question 2: Background

Historically, hard markets have coincided with which of the following?

Answers

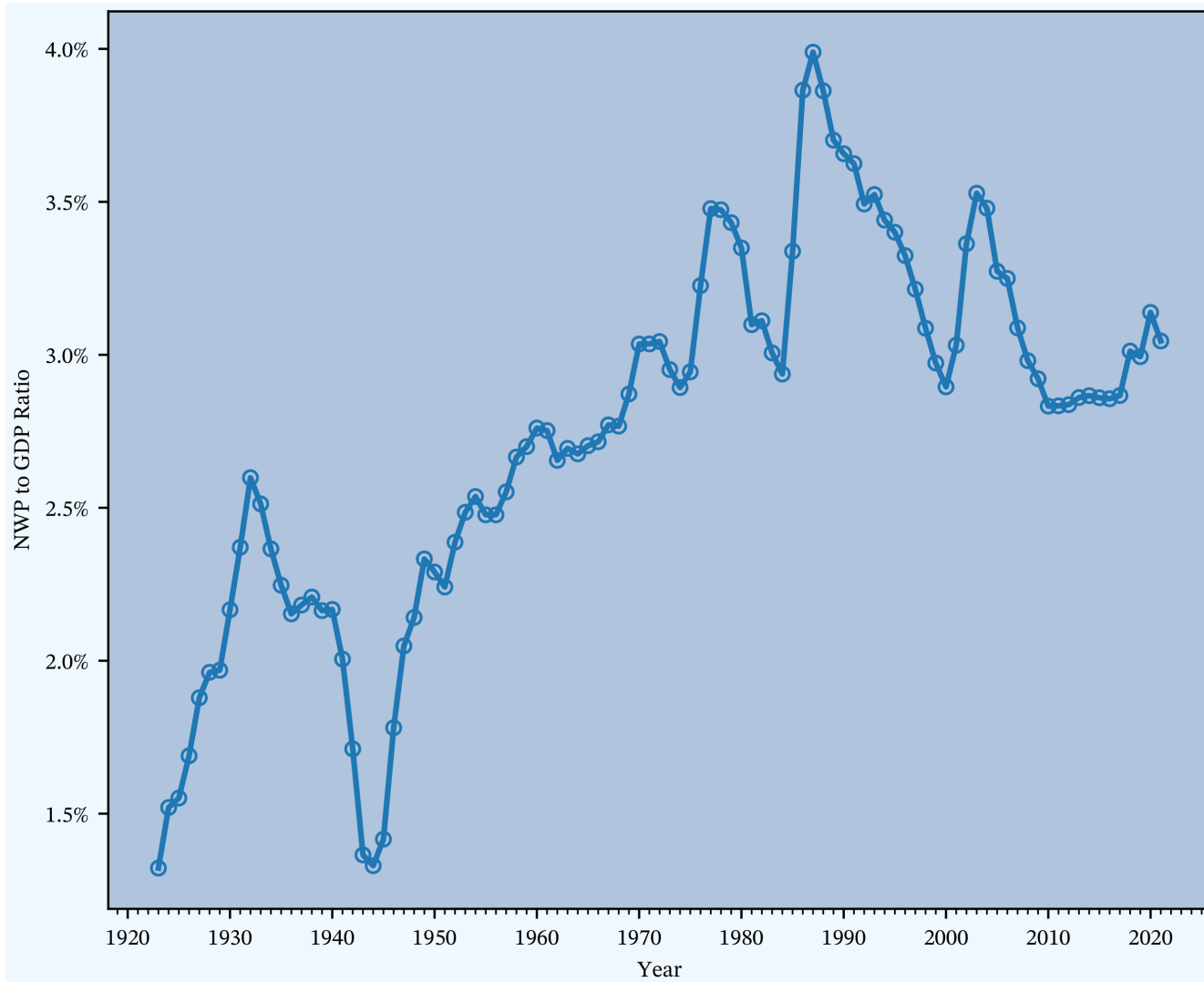
- a. Bad catastrophe losses
- b. Cumulative reserve inadequacy
- c. Raging inflation
- d. Bad catastrophe losses and cumulative reserve inadequacy
- e. Cumulative reserve inadequacy and raging inflation

Question 3: Background

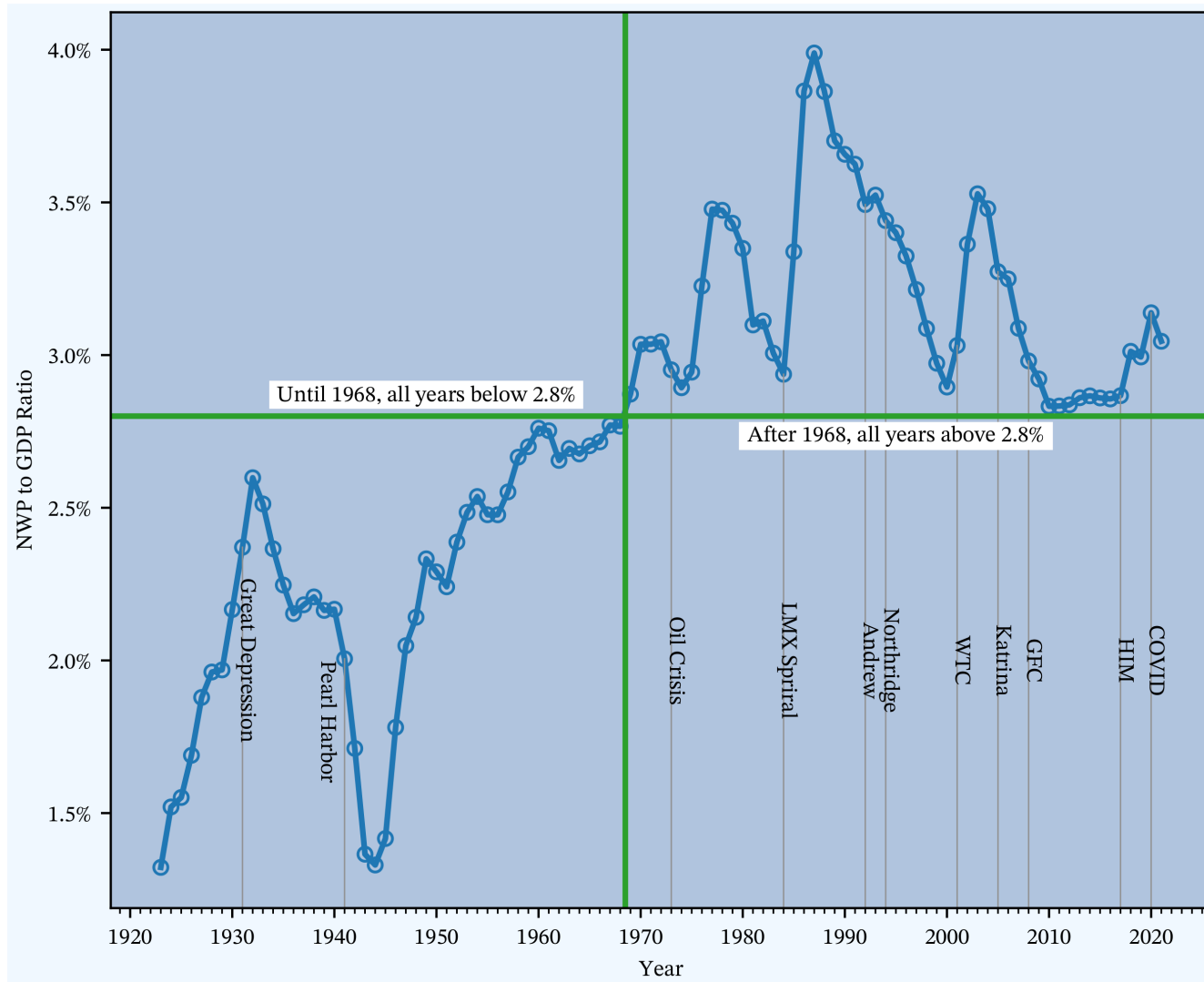
The last market-wide hard market occurred after

- a. 2001 post-WTC
- b. 2005 post-Katrina
- c. 2008 post-GFC
- d. 2012 post-Sandy
- e. 2017 post-Harvey, Irma, & Maria

Premium to GDP Ratio

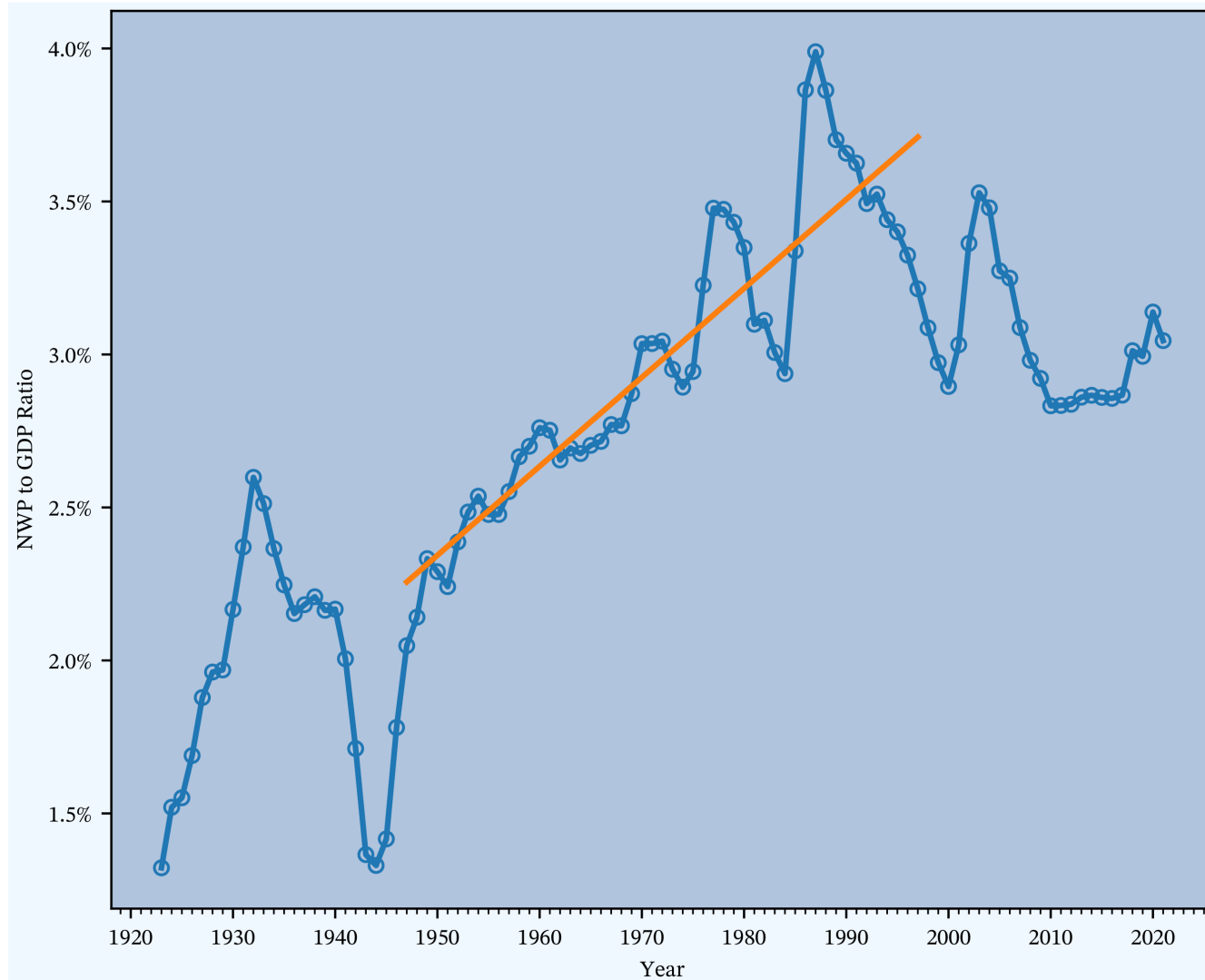


Premium to GDP Ratio 1968 Watershed

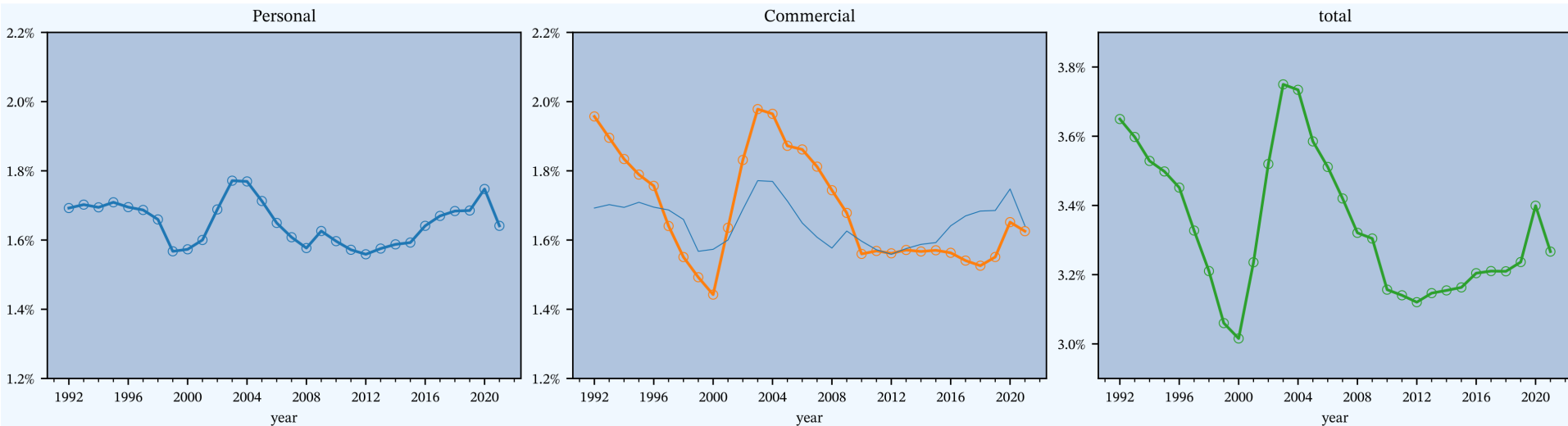


Premium to GDP Ratio

Cyclical Growth Between 1947 and 1997

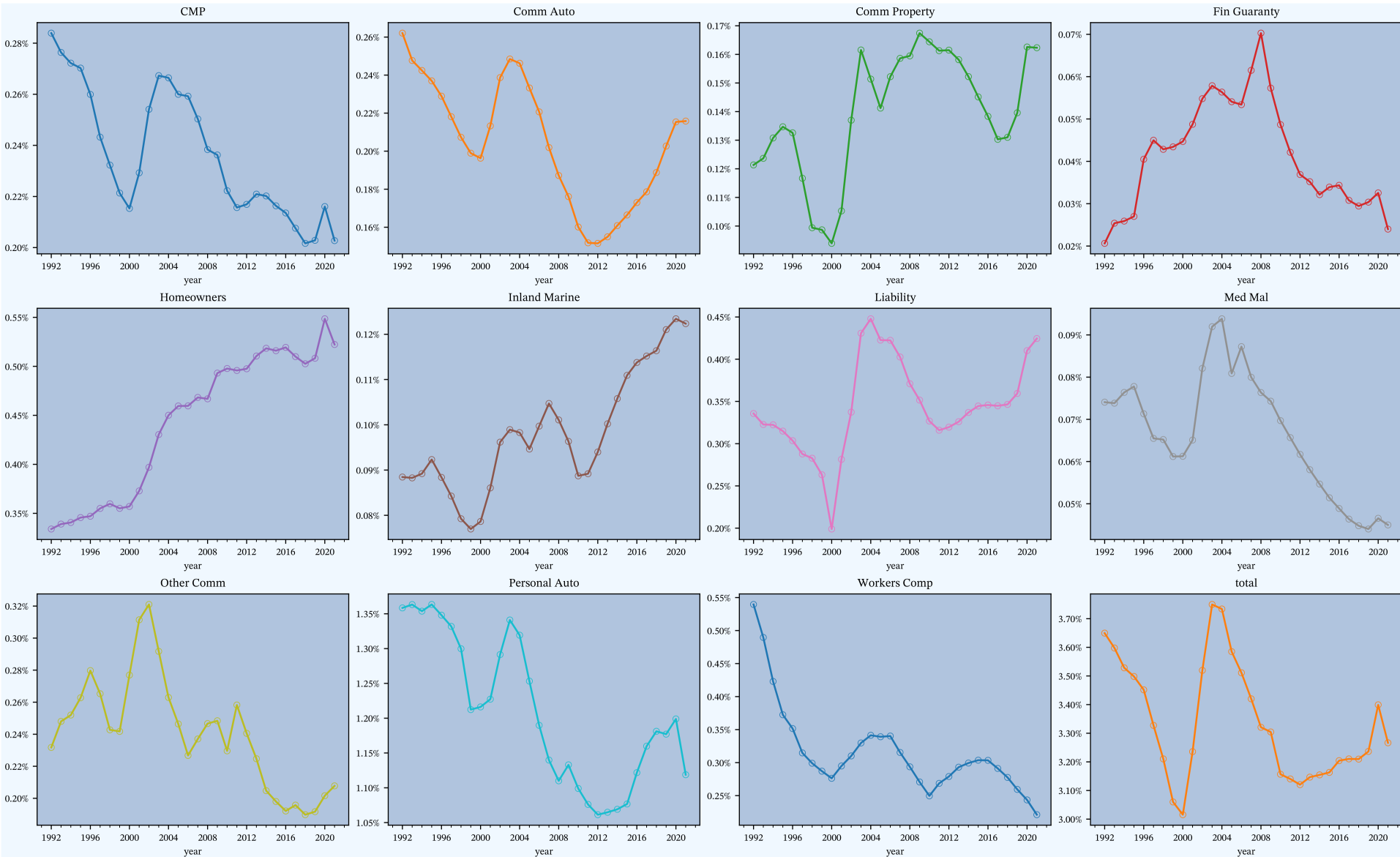


The Underwriting Cycle Is Driven by Commercial Lines



Premium to GDP for personal lines vs. commercial shows the cycle is more driven by commercial

Calm Surface Masks Inner Turmoil



Question 4: Growth

Which line of business has seen the **fastest** cumulative premium growth since 1992?

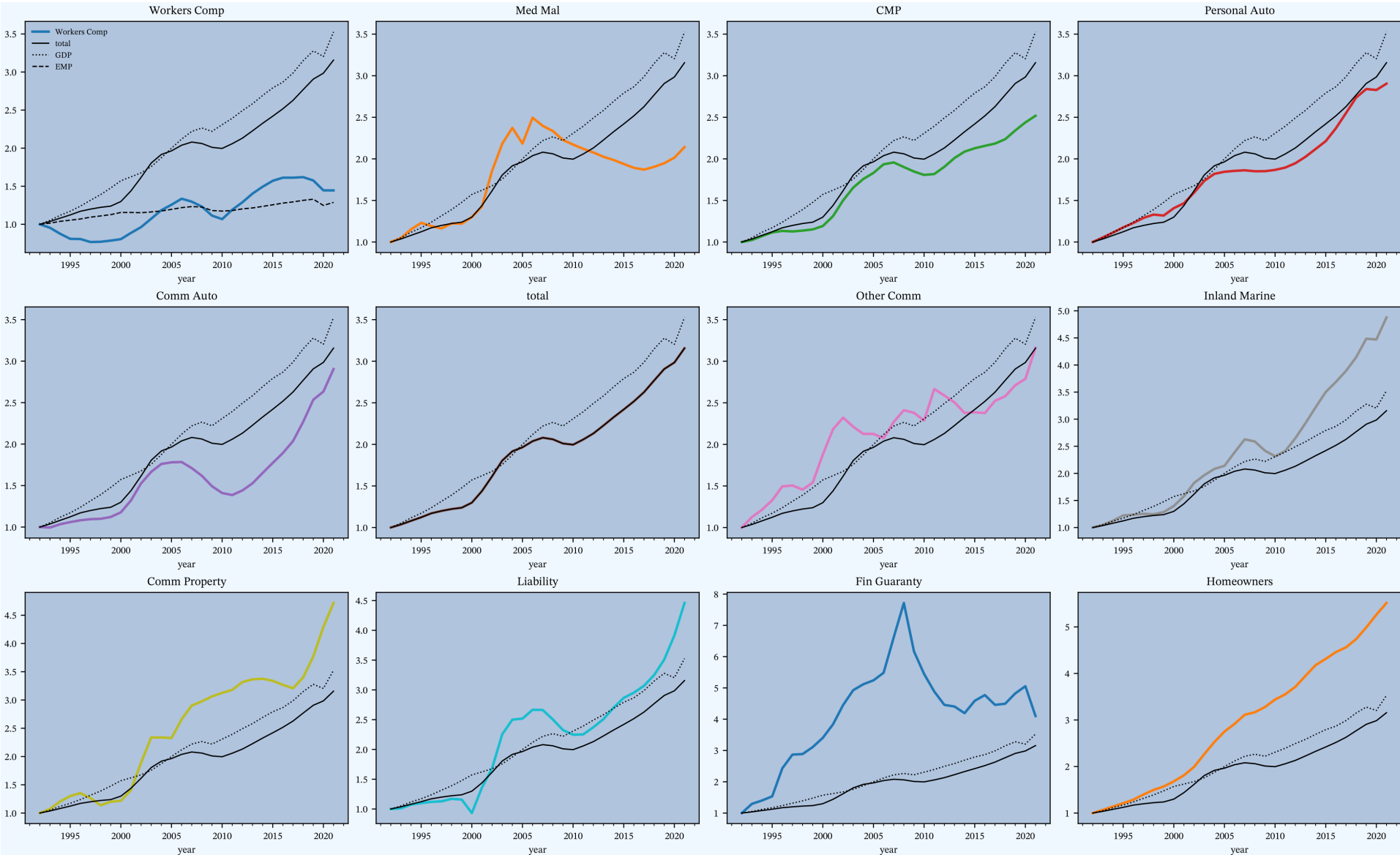
- a. Personal Auto
- b. Commercial Auto
- c. Workers Compensation
- d. Homeowners
- e. Medical Malpractice

Question 5: Growth

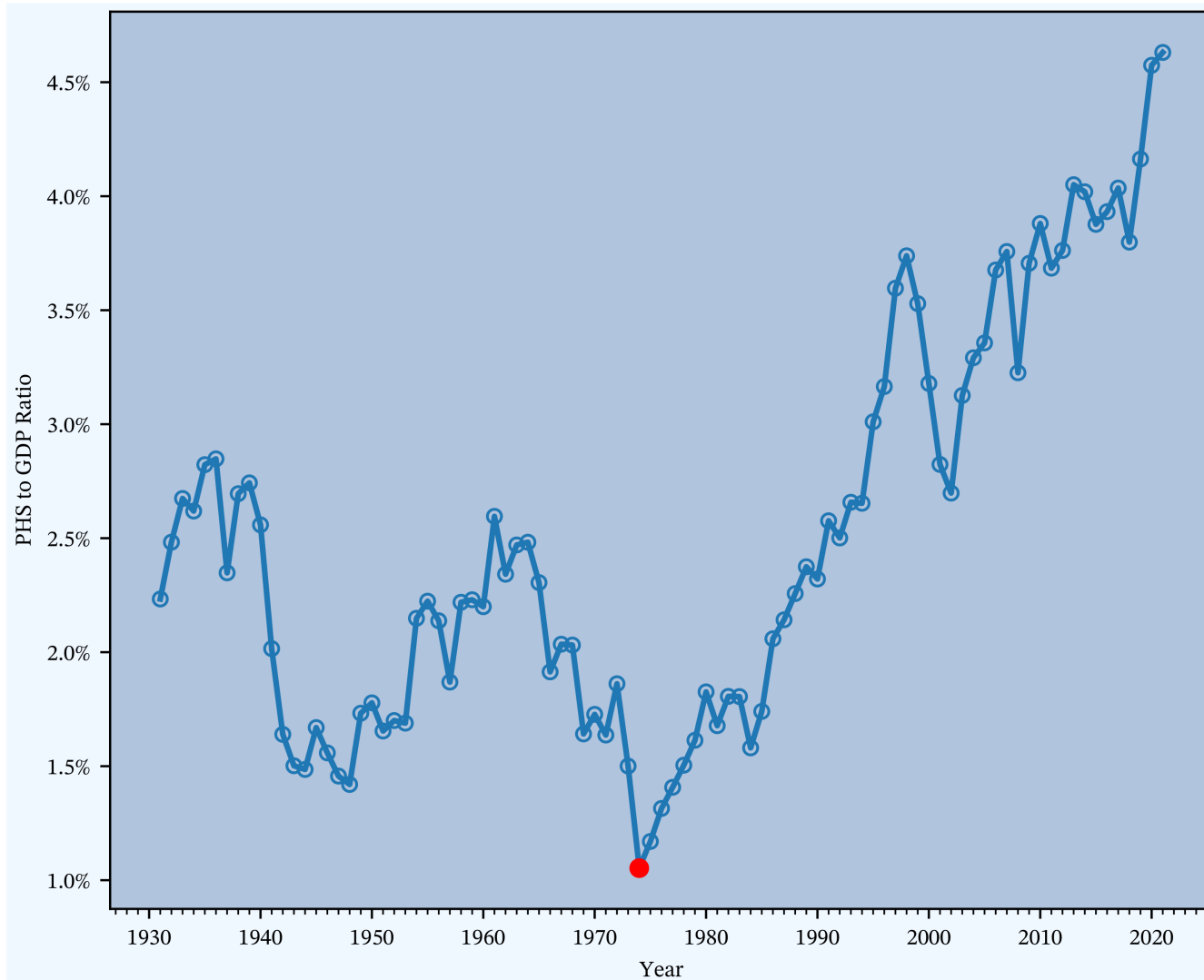
Which line of business has seen the **slowest** cumulative premium growth since 1992?

- a. Personal Auto
- b. CMP
- c. Workers Compensation
- d. Inland Marine
- e. Medical Malpractice

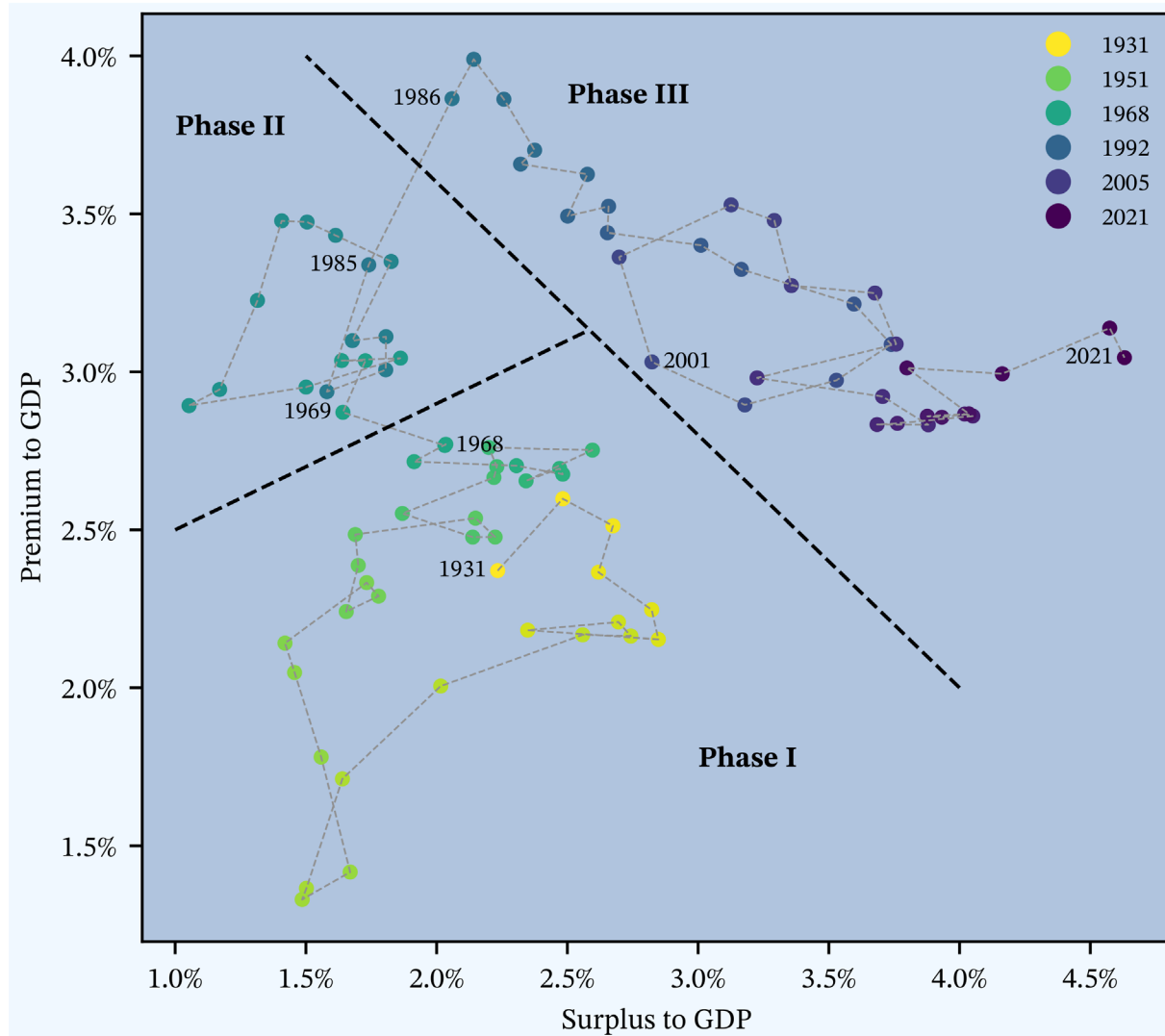
Premium and GDP Growth Since 1992 (1992=1.0)



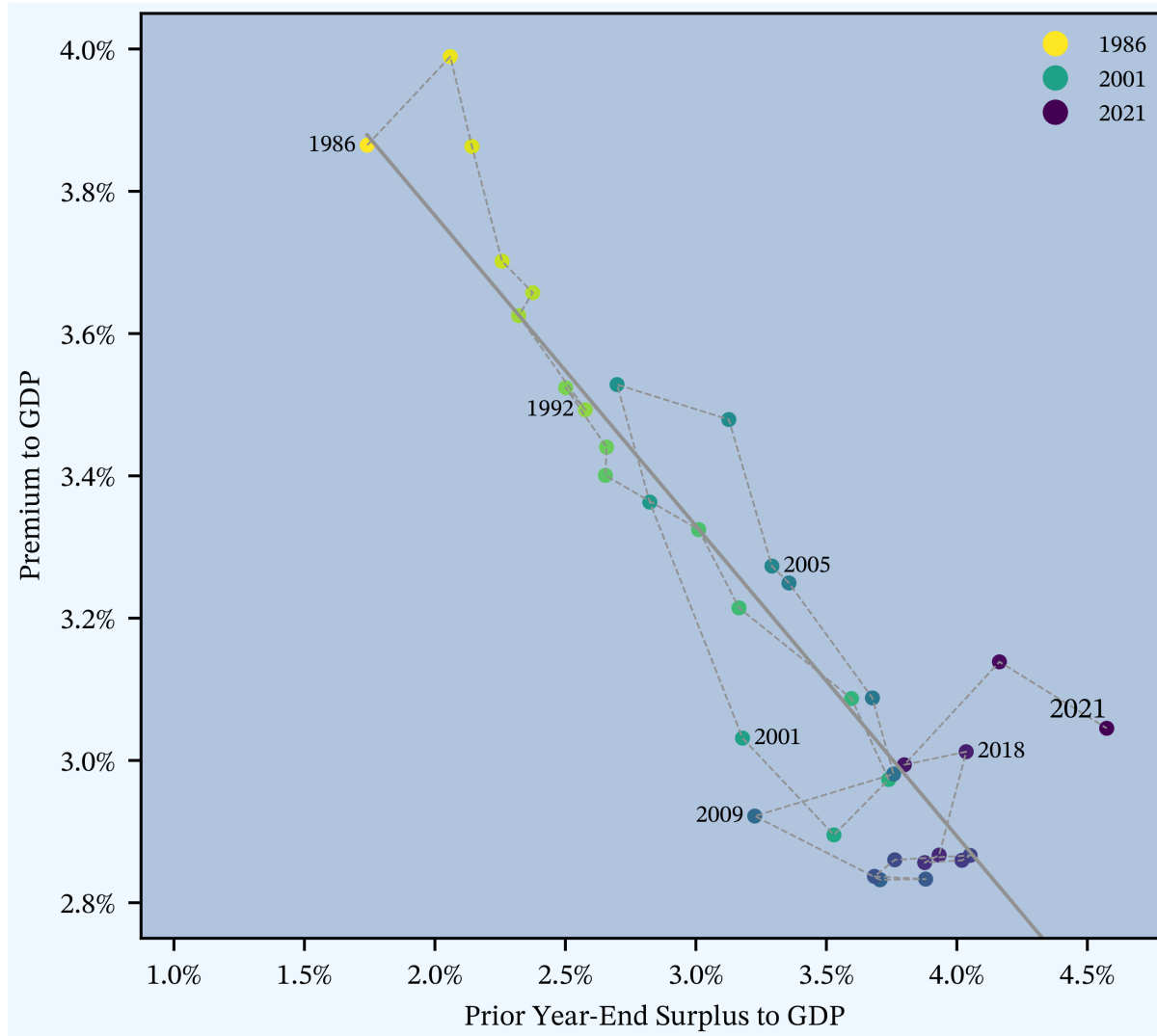
Surplus to GDP Ratio, 1931-2020e



Three Phases of Market Dynamics Since 1931



Market Dynamics Since 1986 Explained by Prior Year Surplus Levels



Question 6: Risk and Volatility

Which line of business has seen the **highest** standard deviation of loss ratio since 1992

- a. Commercial Auto
- b. CMP
- c. Workers Compensation
- d. Financial Guaranty
- e. Homeowners

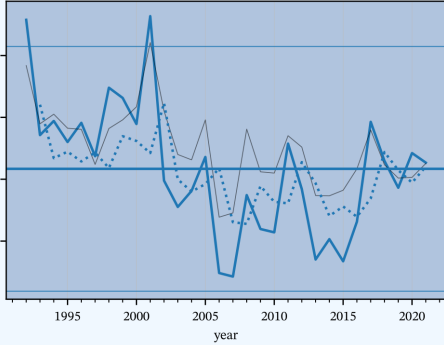
Question 7: Risk and Volatility

Which line of business has seen the **lowest** standard deviation of loss ratio since 1992

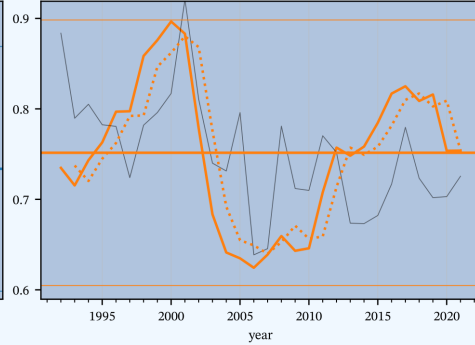
- a. Commercial Auto
- b. Personal Auto
- c. Workers Compensation
- d. General Liability
- e. Homeowners

Direct Loss Ratio Time Series by Major Line

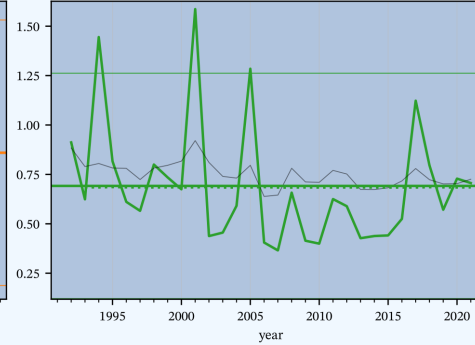
CMP; SD=0.107 (0.0634), cor=0.893
ar fit, r2=0.263, rse0=0.0862



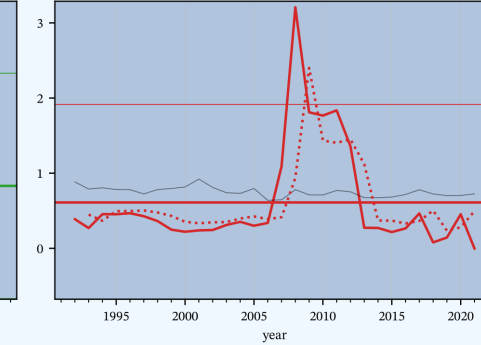
Comm Auto; SD=0.0794 (0.0502), cor=0.405
ar fit, r2=0.78, rse0=0.0385



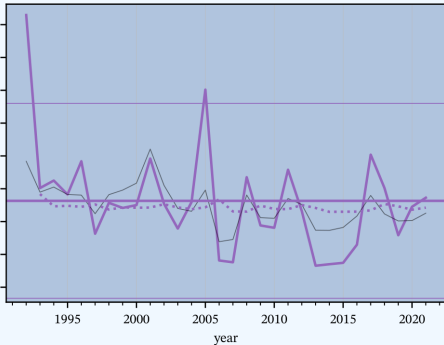
Comm Property; SD=0.309 (0.151), cor=0.709
ar fit, r2=6.07e-06, rse0=0.317



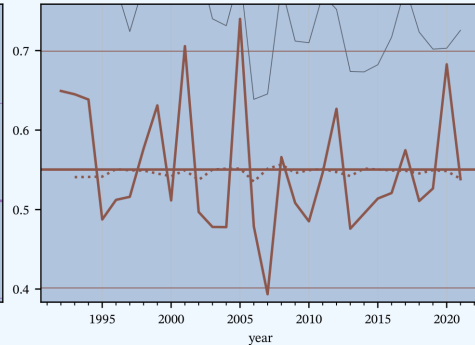
Fin Guaranty; SD=0.706 (0.56), cor=-0.0453
ar fit, r2=0.468, rse0=0.533



Homeowners; SD=0.161 (0.104), cor=0.766
ar fit, r2=0.00902, rse0=0.124



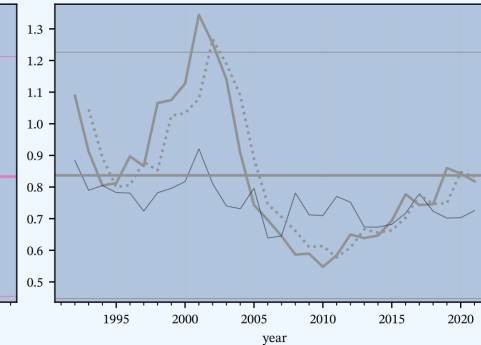
Inland Marine; SD=0.0806 (0.0424), cor=0.633
ar fit, r2=0.0041, rse0=0.0811



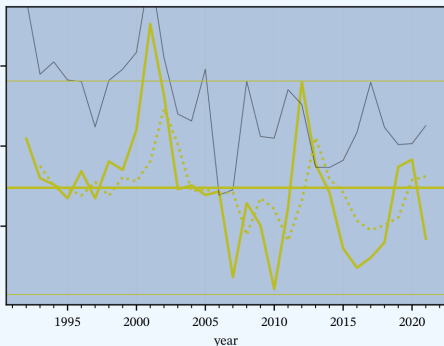
Liability; SD=0.159 (0.126), cor=0.704
ar fit, r2=0.665, rse0=0.0938



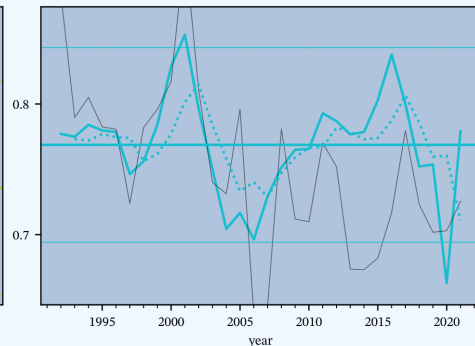
Med Mal; SD=0.211 (0.156), cor=0.661
ar fit, r2=0.789, rse0=0.0976



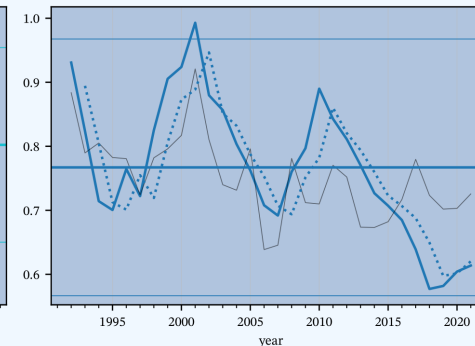
Other Comm; SD=0.0721 (0.0414), cor=0.599
ar fit, r2=0.248, rse0=0.0639



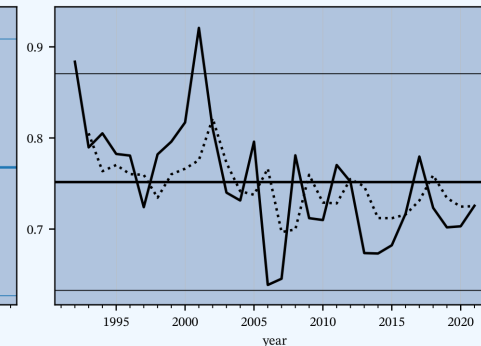
Personal Auto; SD=0.0403 (0.026), cor=0.481
ar fit, r2=0.299, rse0=0.0349



Workers Comp; SD=0.108 (0.0714), cor=0.611
ar fit, r2=0.712, rse0=0.0578



total; SD=0.0643 (0.0425), cor=1
ar fit, r2=0.23, rse0=0.0539

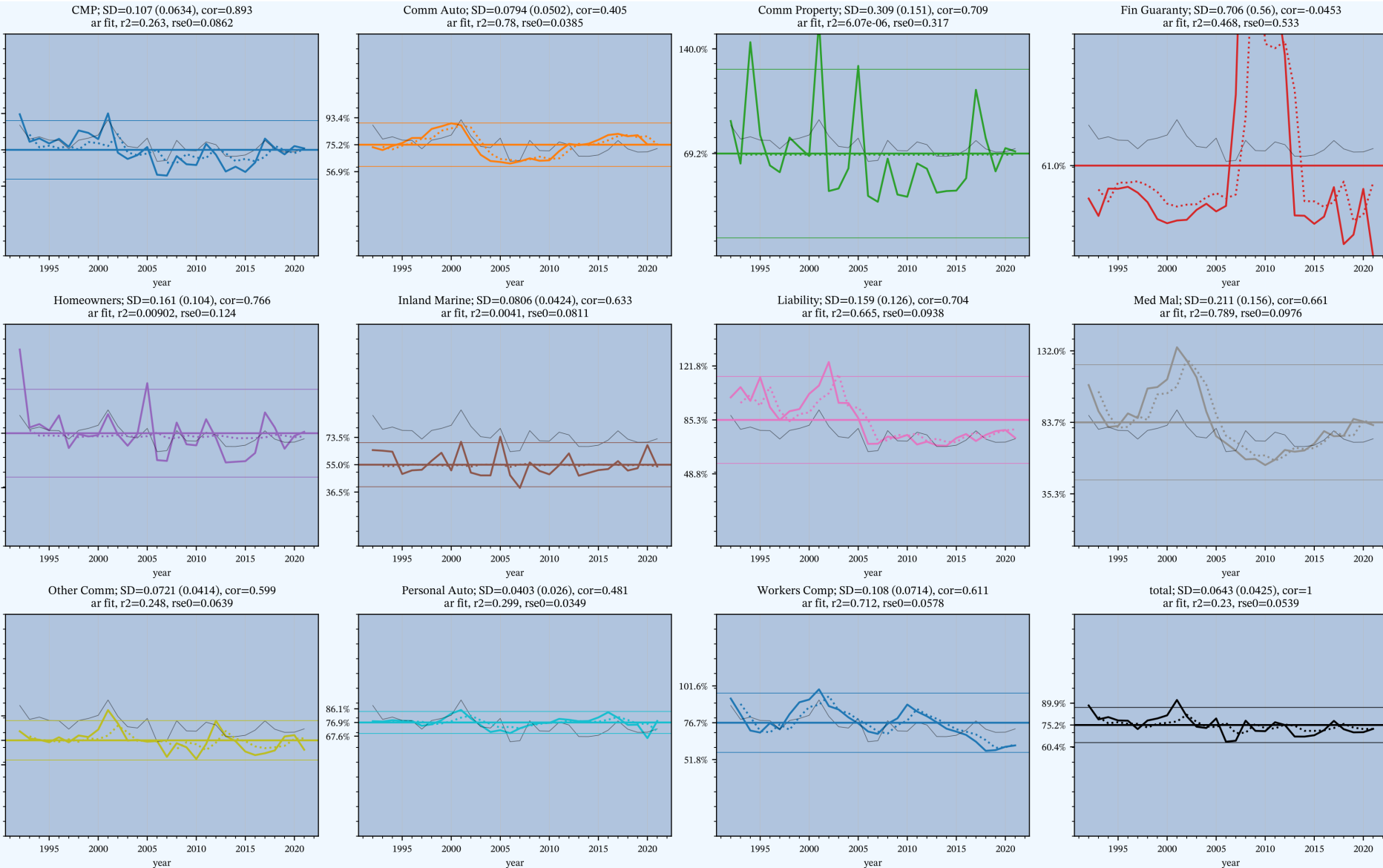


Loss Ratio Time Series by Major Line

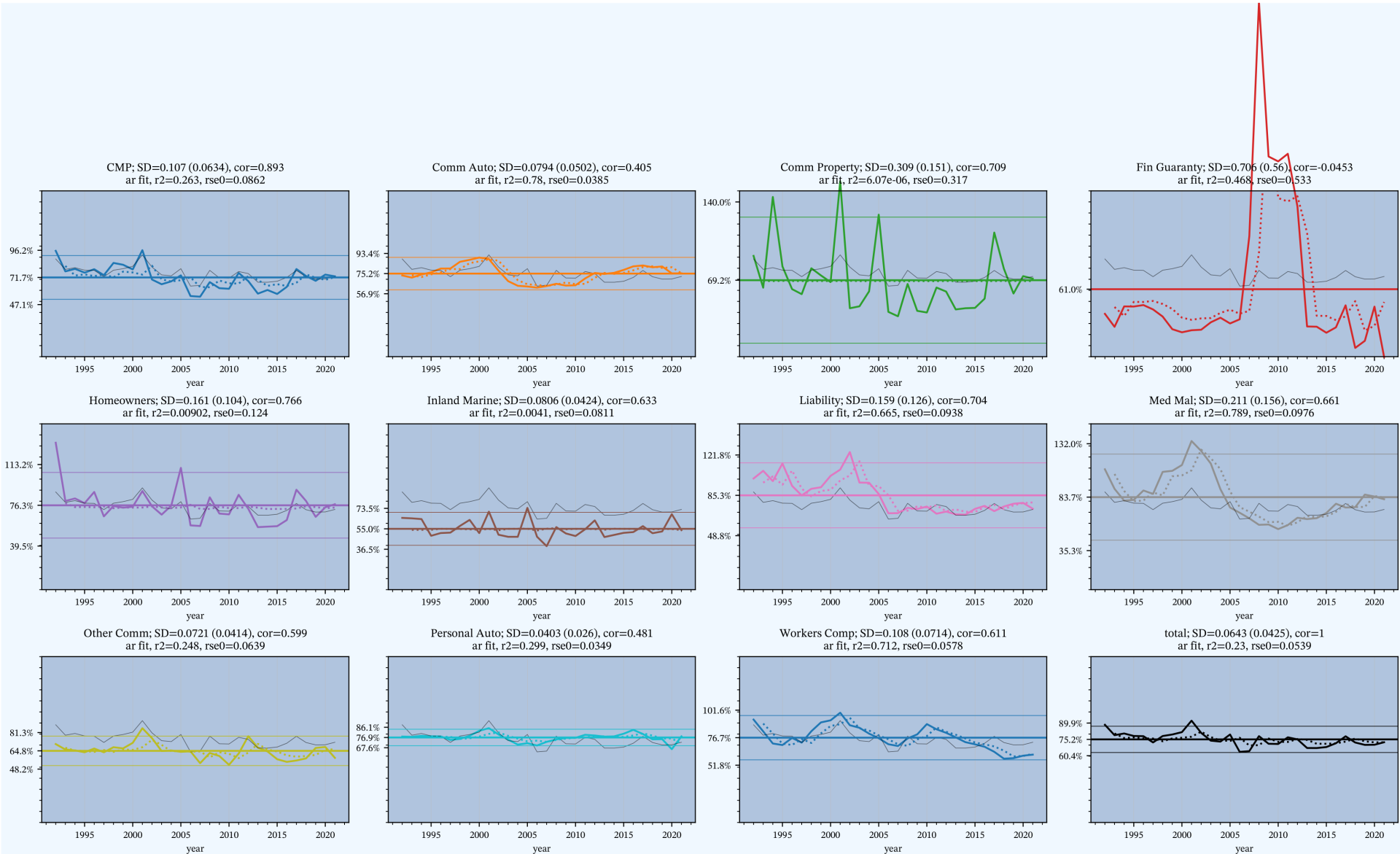
- Title decoder: CMP; SD=0.107 (0.0634), cor=0.893 ar fit, r2=0.263, rse0=0.0862
 - Line; standard deviation
 - Down-side semi-deviation is shown in parenthesis (explain)
 - Correlation of the line with total on the first line
 - (second line) shows the R^2 and residual standard error of an autoregressive loss ratio model
- Interpretation
 - When the rse is much lower than SD it suggests the market cycle is predictable
 - Tends to occur in casualty lines (e.g., commercial auto, medical malpractice, private passenger auto, and workers compensation)
 - The cycle for property lines tends to be idiosyncratic, for obvious reasons.
- Line Legend
 - Thin gray line in each plot shows the total loss ratio, for context
 - The horizontal lines show the mean (thicker) and mean $\pm \Phi^{-1}(30/31) = \pm 1.85$ standard deviations
 - If the loss ratios were normally distributed, we expect all observations from 30 years (1992-2021) to fall within these tram lines
 - They provide a surprisingly good estimate of the range of loss ratio, except for Financial Lines (which uses a different tick spacing, note).

Direct Loss Ratio Time Series by Major Line

Loss Ratio Scale 0 to 150 Percent



Some Lines Are More Volatile Than Others...



Question 8: Capstone

Premium is riskier than loss for which of the following combinations of lines?

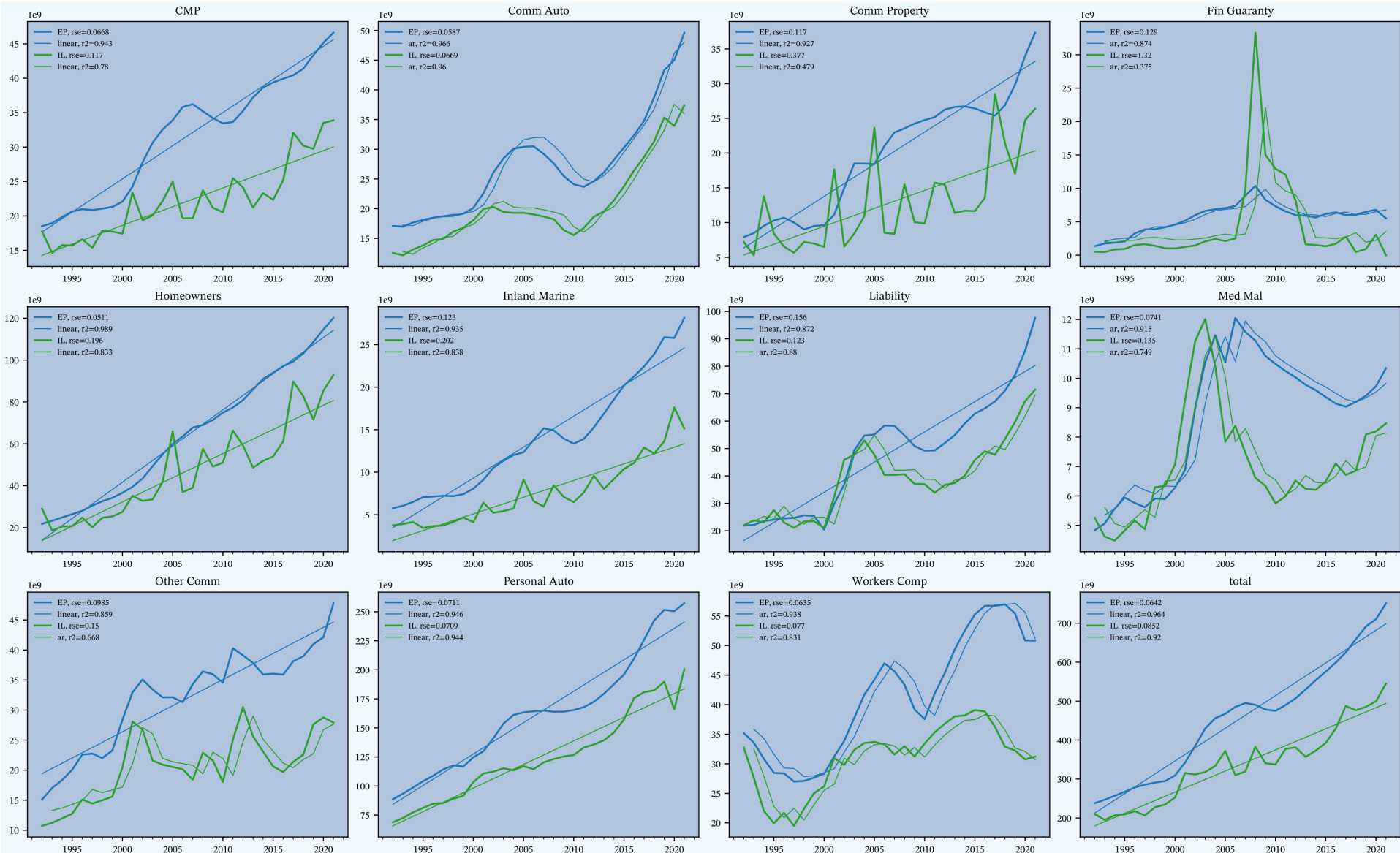
Answers

- a. Personal Auto and Commercial Auto
- b. Personal Auto and Liability
- c. Commercial Auto and Liability
- d. Commercial Auto and Workers Compensation
- e. Commercial Auto, Liability, and Workers Compensation

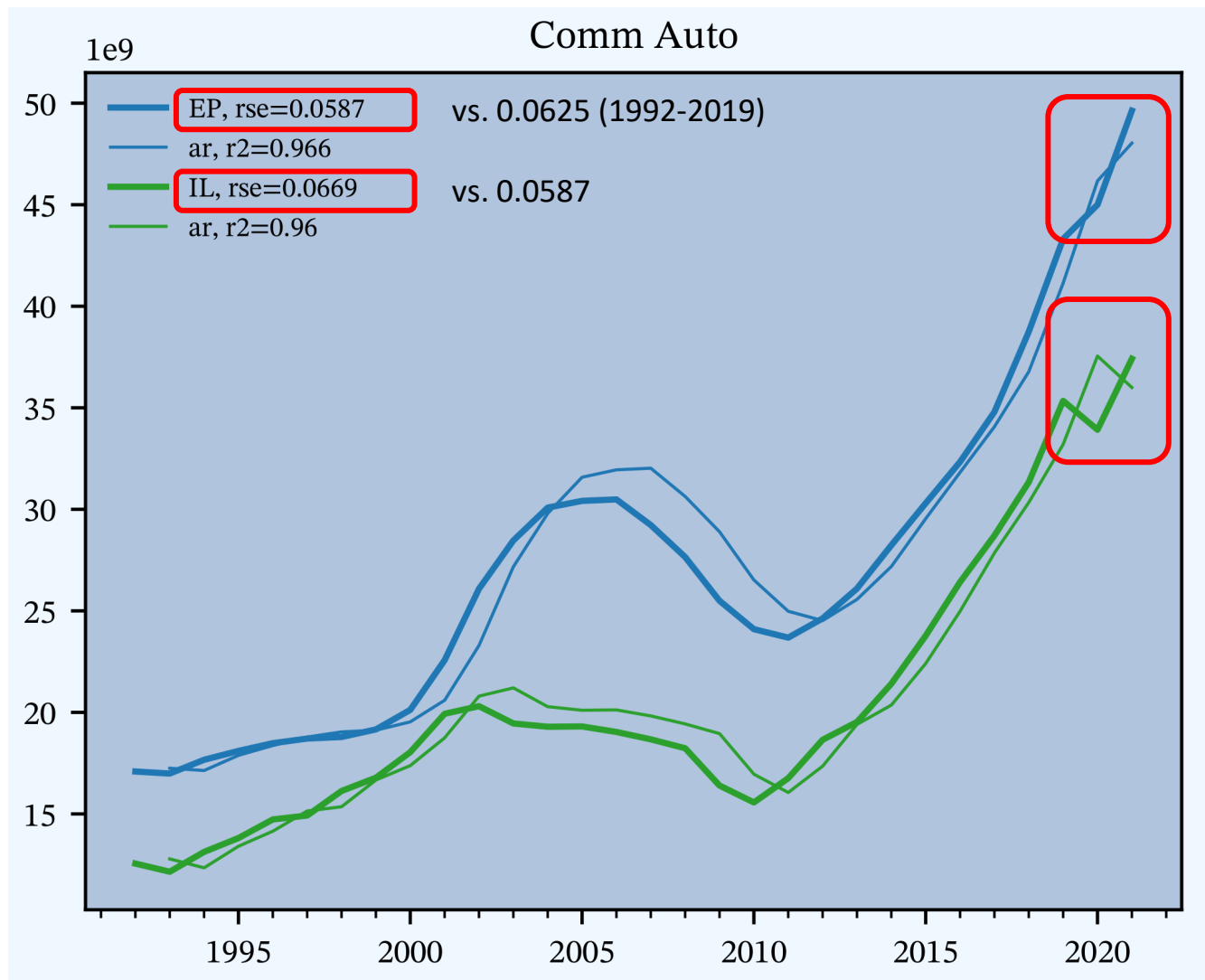
COVID...



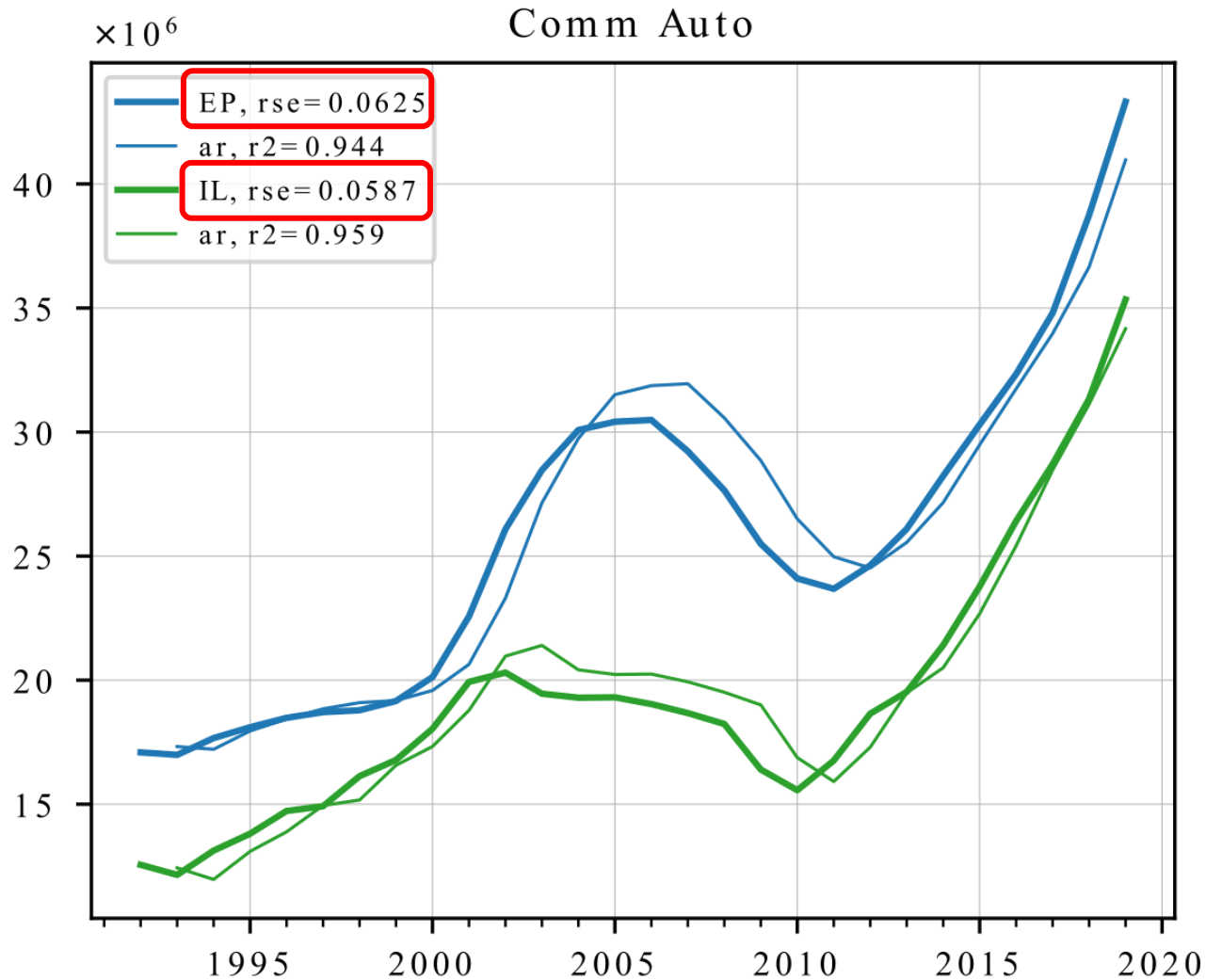
Direct Premium and Loss Dynamics: 1992-2021



Direct Premium and Loss Dynamics: 1992-2021



Direct Premium and Loss Dynamics: 1992-2019



Implications for Risk Management Decision Making

1. Use residual volatility: must take out what is known
2. Property lines dominated by event-driven loss volatility
3. Casualty lines combine loss volatility and underwriting cycle uncertainty: AY emergence vs. CY moving-average loss
4. Underwriting cycle is event-driven and is unpredictable

Implications for Risk Management Decision Making

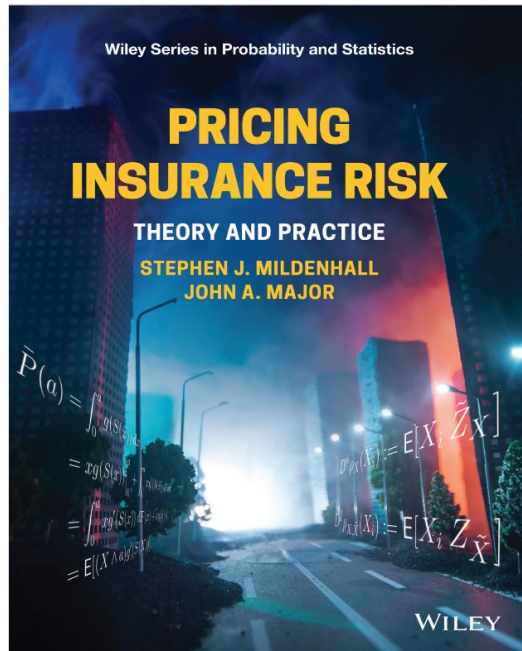
5. Pitfalls of loss ratio-based risk modeling with fixed premium

- Broadly reasonable for property
- Understates risk for casualty
- Makes it harder to model pricing-driven correlations

6. Quota share protection covers premium risk and is more valuable than a loss ratio model indicates

- “[C]apability of the model is consistent with the intended purpose” (ASOP 50)

More Resources



- <https://www.pricinginsurancerisk.com>
- <https://www.convexrisk.com/pirc>



- [Stephen Mildenhall & David Wright: The Macro Environment in Insurance - YouTube](#)
- [Stephen Mildenhall & David Wright: The Macro History of Insurance Part 2 - YouTube](#)
 - <https://podcast.notunreasonable.com/>