The Underwriting Cycle: Measurement & Analysis

May 20, 2008 – John G. Aquino FCAS MAAA

BENFIELD

Overview

- Cycle Definition & Explanations
- Historical Data Sets
- Data Analysis
- Conclusions

Cycle Definition & Explanations

- **Recurring Periods Of Industry Underwriting Losses & Profits**
- **Explanations Studied**
  - Underwriting Margin Excluding Cats
  - Variations In Investment Returns
  - Capacity
  - Catastrophe Losses
  - Cost Of Reinsurance
- **Explanations Not Studied**
  - Competition Beyond Capacity
  - Behavioral Models

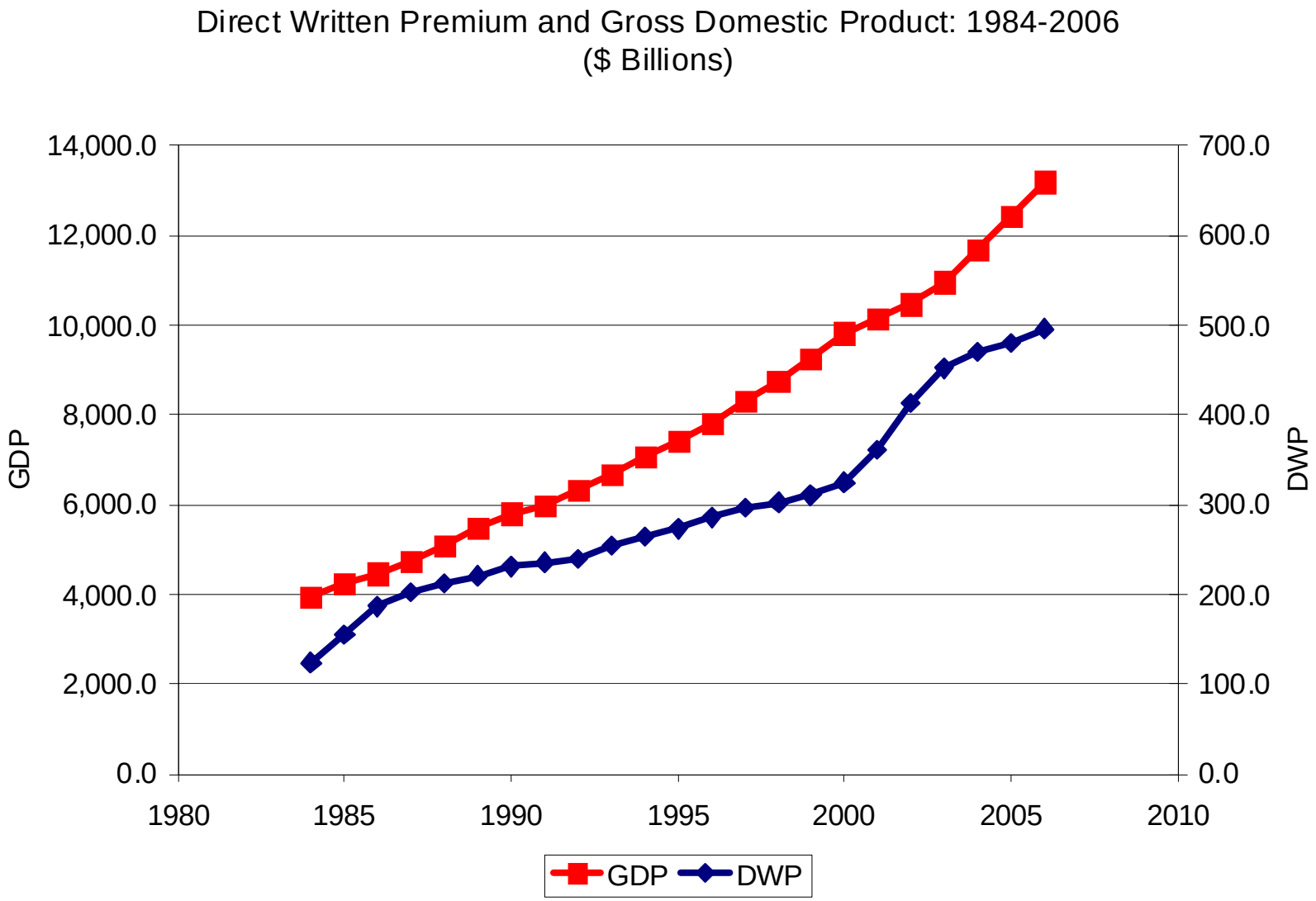
Historical Data Sets

- **Set 1: P&C 1984-2006**
  - Direct Written Premium
  - GDP
  - Calendar Year and Accident Year Underwriting Profit
  - Operating Profit
  - Total Investment Return
  - Accident Year Ceded Loss Ratio
  - Catastrophe Losses
- **Set 2: Stock P&C 1924-2001**
  - Net Earned Premium
  - GDP
  - Calendar Year Underwriting Profit
  - Investment Income
  - Total Investment Return
  - Unrealized Gains
- **Sources: Aggregates & Averages, Highline, BEA**

Data Analysis

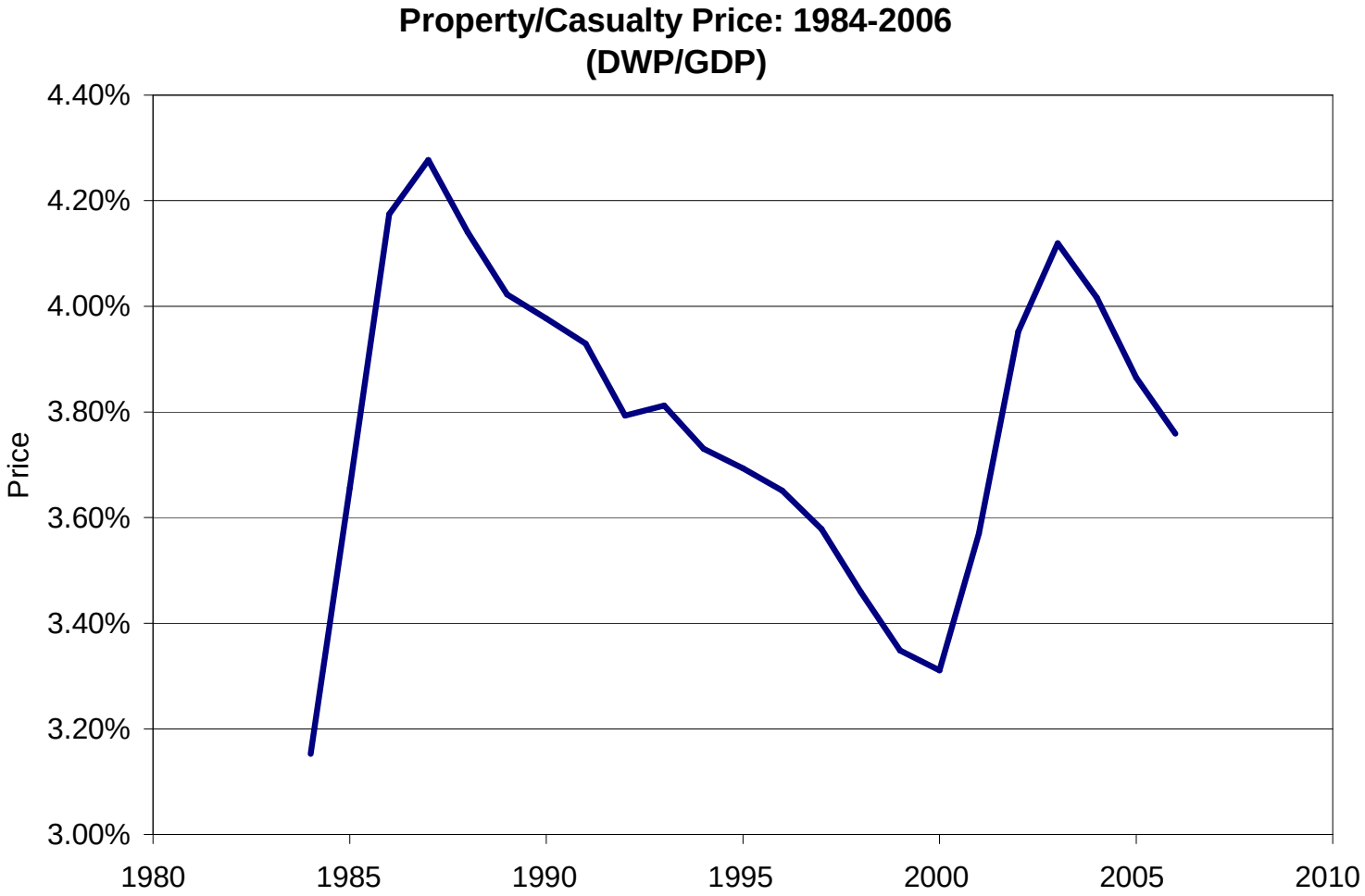
- Cycle History
- Joint Time Series
- Regression Analysis
- Conclusions

Recent Cycle History: Raw Price Data



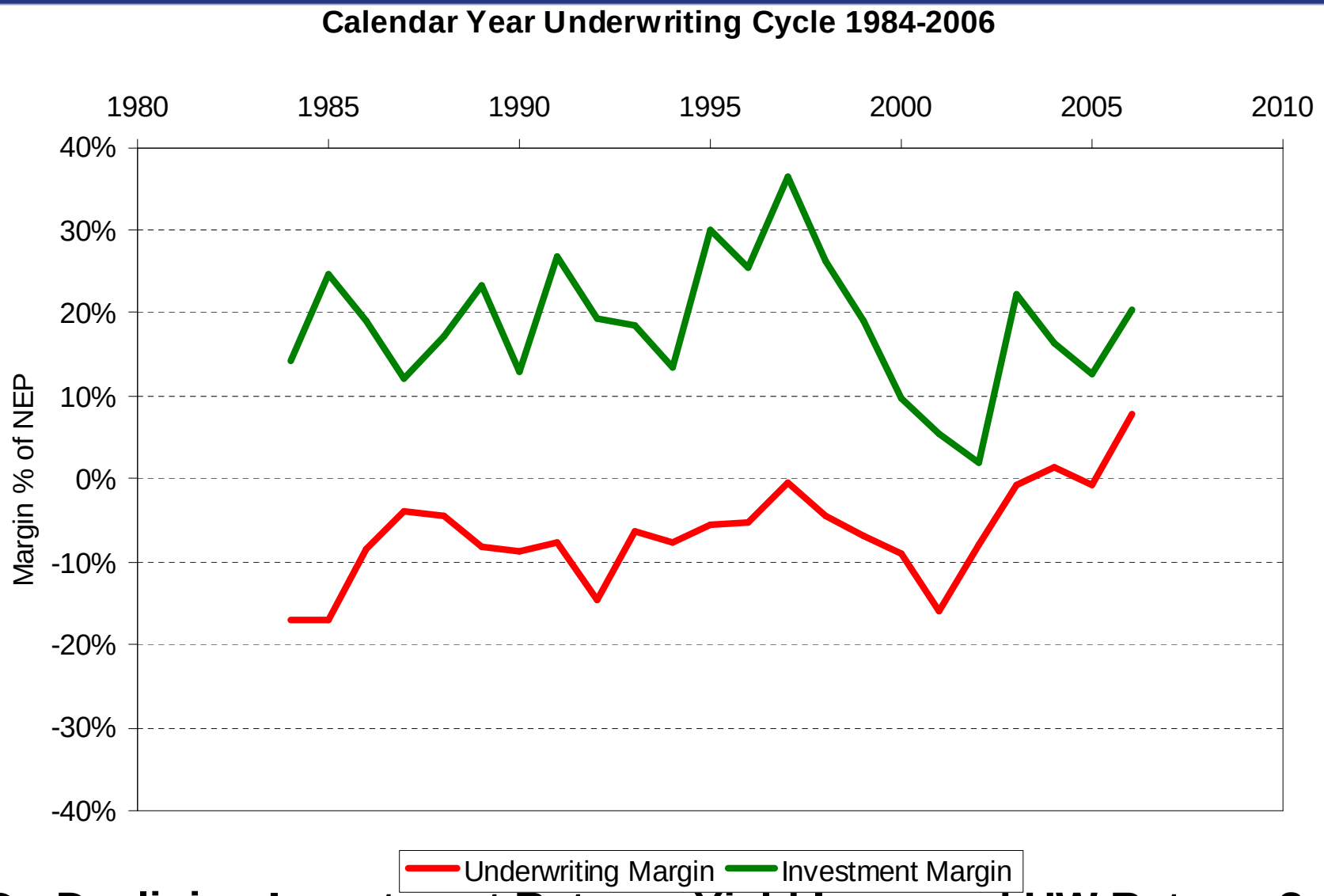
- **GDP Is "Exposure;" DWP/GDP Is "Price"**

Recent Cycle History: Price Variability



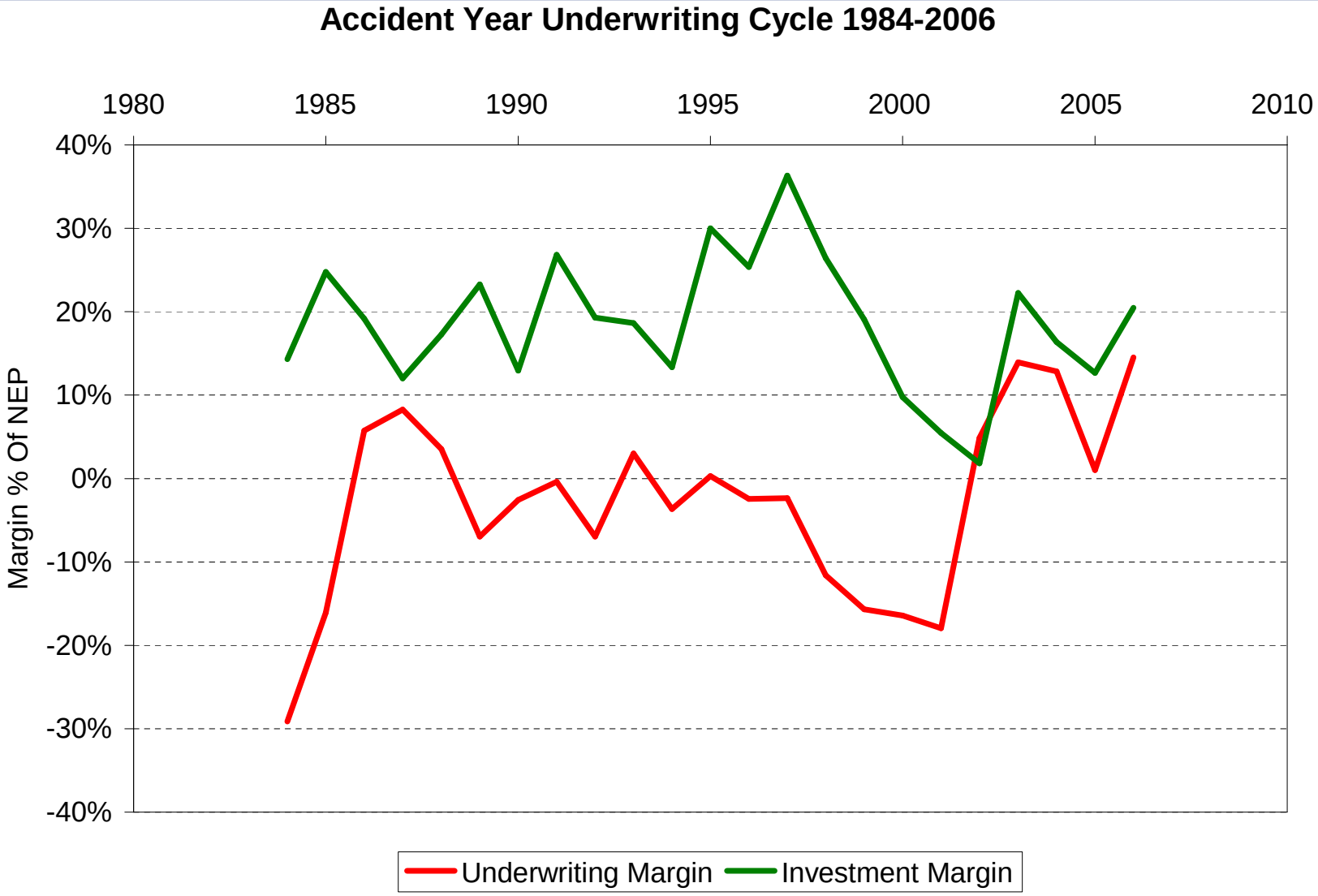
- **Price Variability Is Acute**

Recent Cycle History: Calendar Year Variability



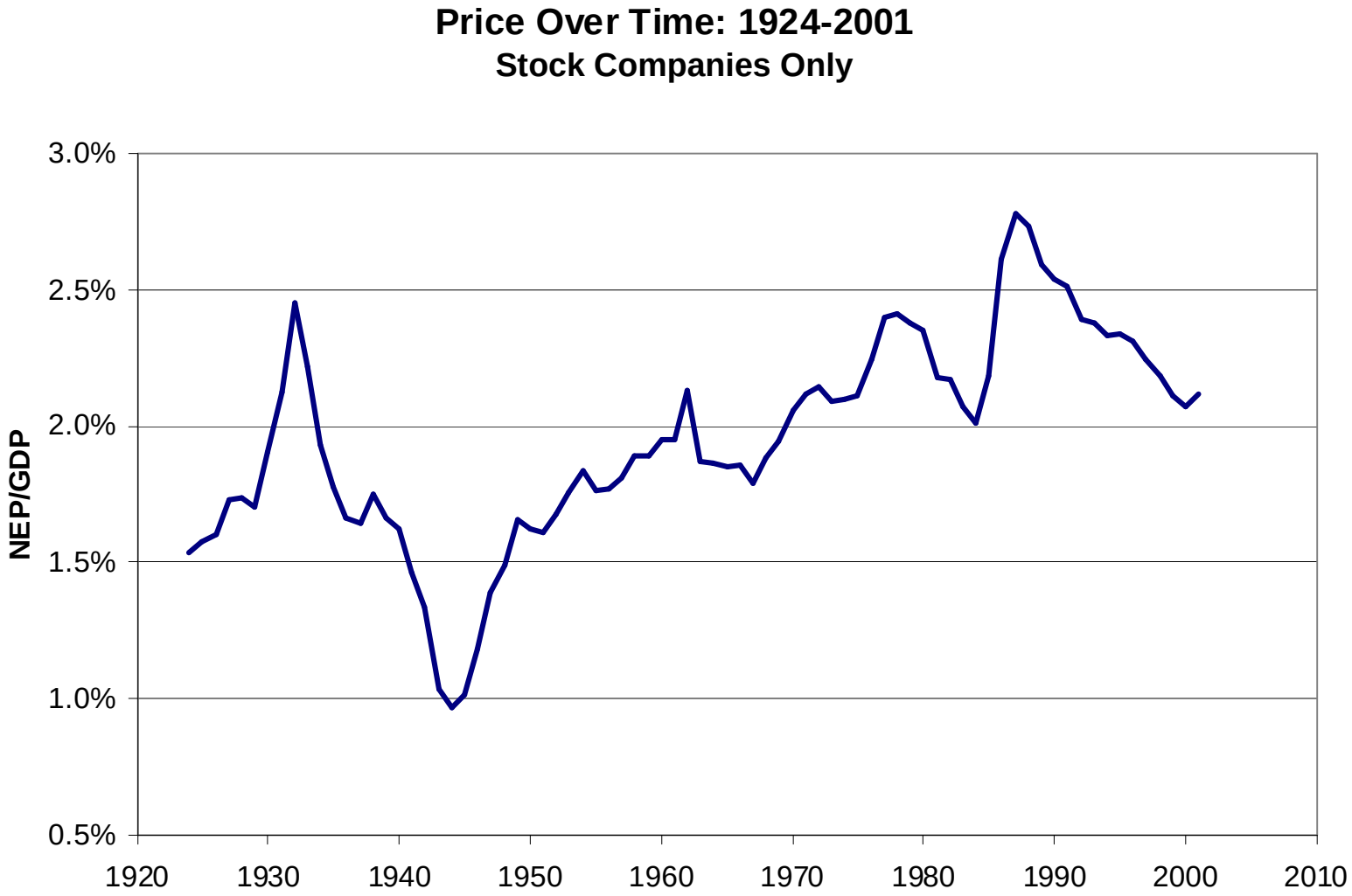
- **Do Declining Investment Returns Yield Improved UW Returns?**

Recent Cycle History: Accident Year Variability



- **Accident Year Variability Exceeds Calendar Year Variability**

Long Term Cycle History: Price Variability

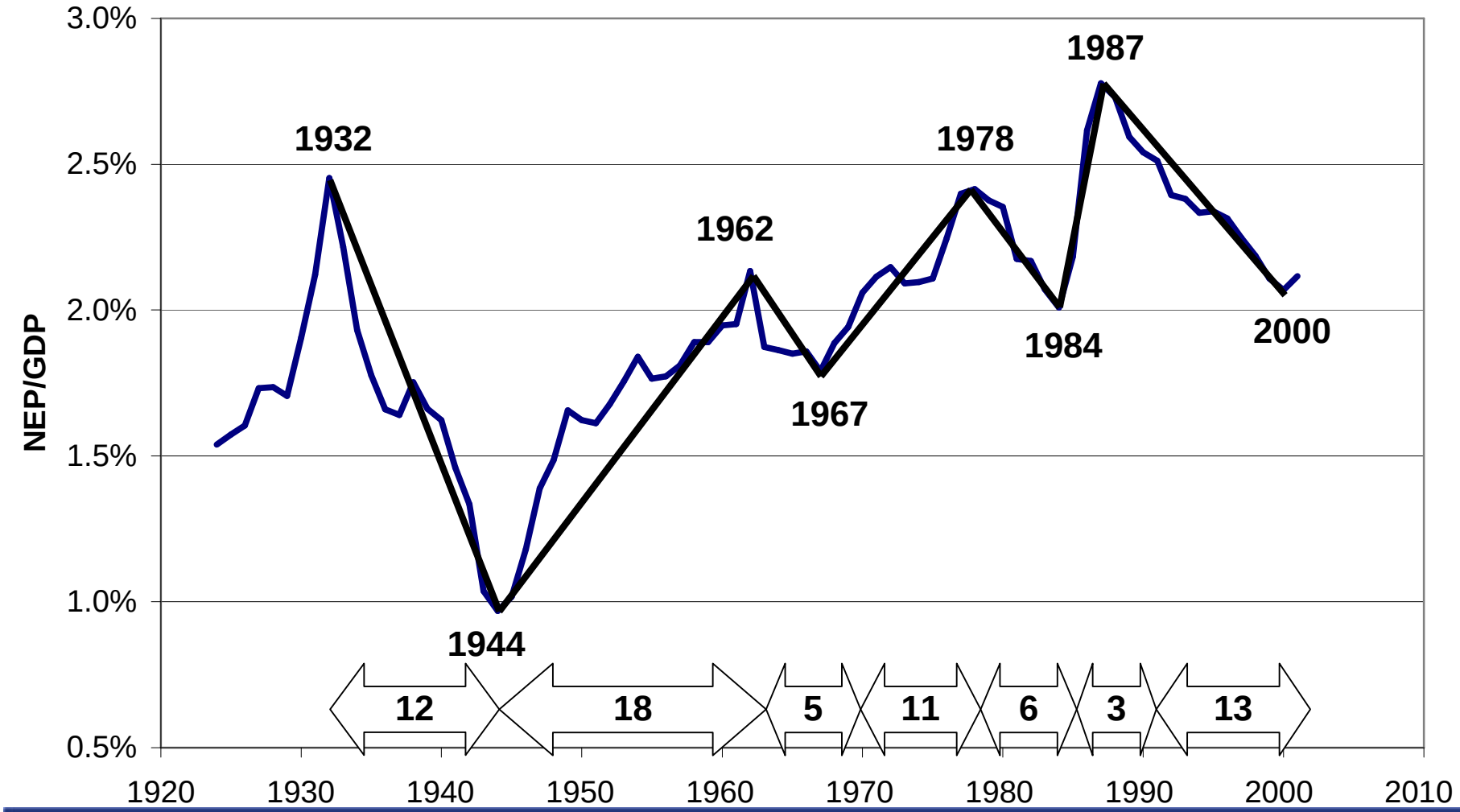


- **Price Variability: Has It Really Changed?**

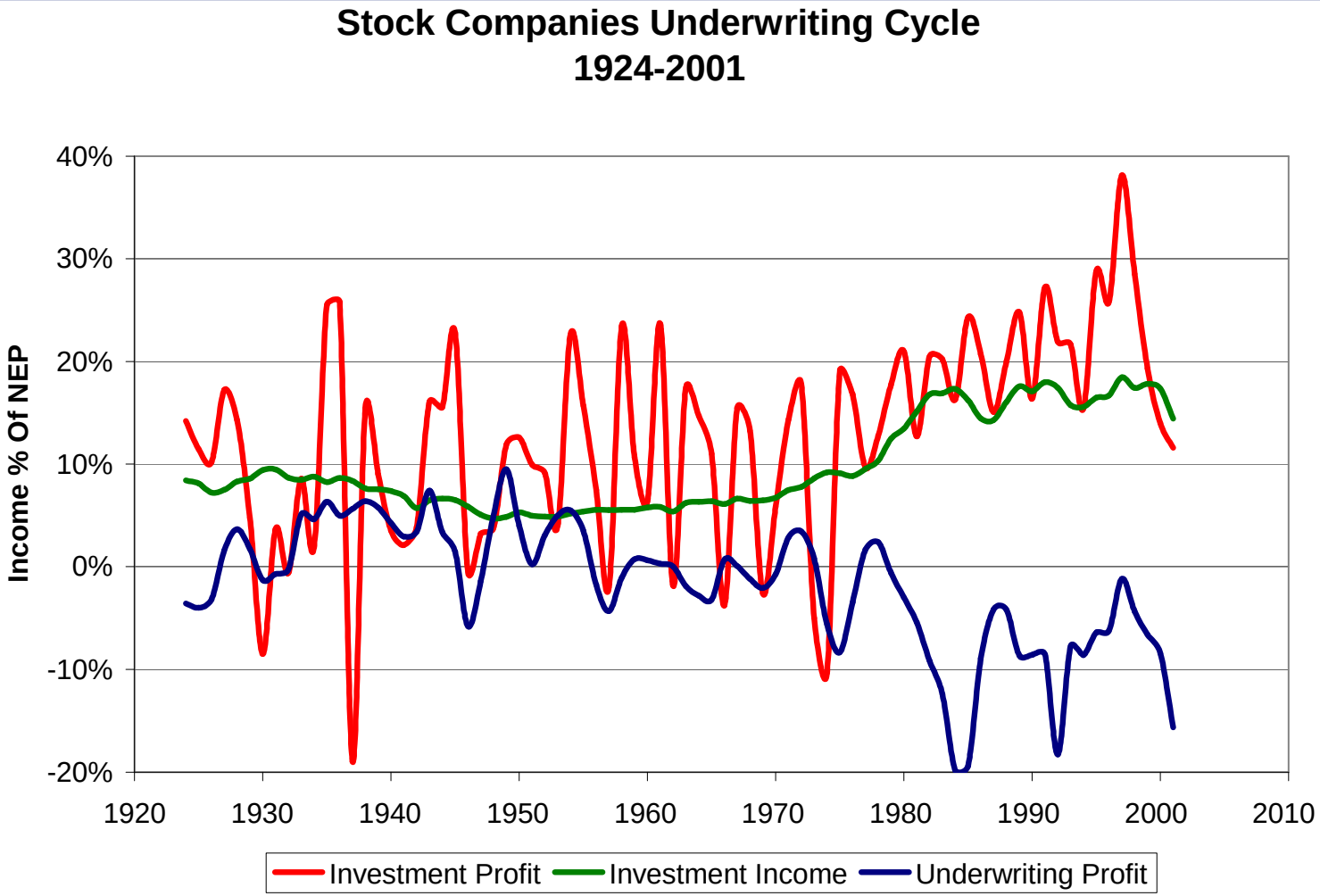
Long Term Cycle History: Cycle Duration

Price Cycles: 1924-2001

Stock Companies Only

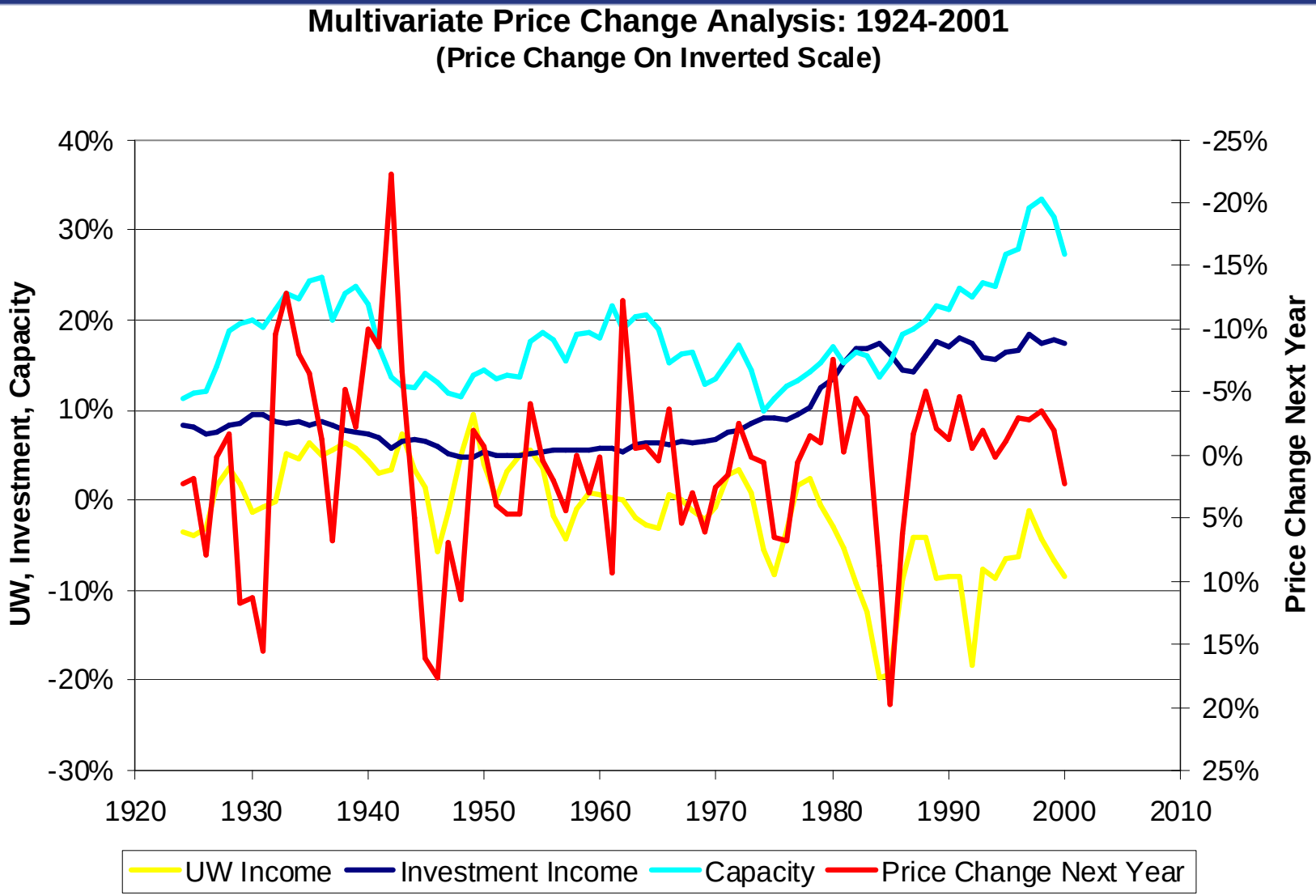


Long Term Cycle History: Calendar Year Variability



- **Investment Income Expansion Since 1970's**
- **Unrealized Gains Of The 1980's and 1990's Increased Capacity**

Joint Time Series: Long Term Data



- **Do Investment Income And Capacity Matter?**

Regression Analysis: Long Term Data

$$\frac{\Delta P}{P} = \alpha + \beta_1 \frac{10 \times \text{Surplus}}{\text{GDP}} + \beta_2 \frac{\text{CY Underwriting Income}}{\text{Net Earned Premium}} + \beta_3 \frac{\text{Investment Income}}{\text{Net Earned Premium}}$$

Regression Statistics	
Multiple R	0.485
R Square	0.235
Adjusted R Square	0.204
Standard Error	0.063
Observations	77.000

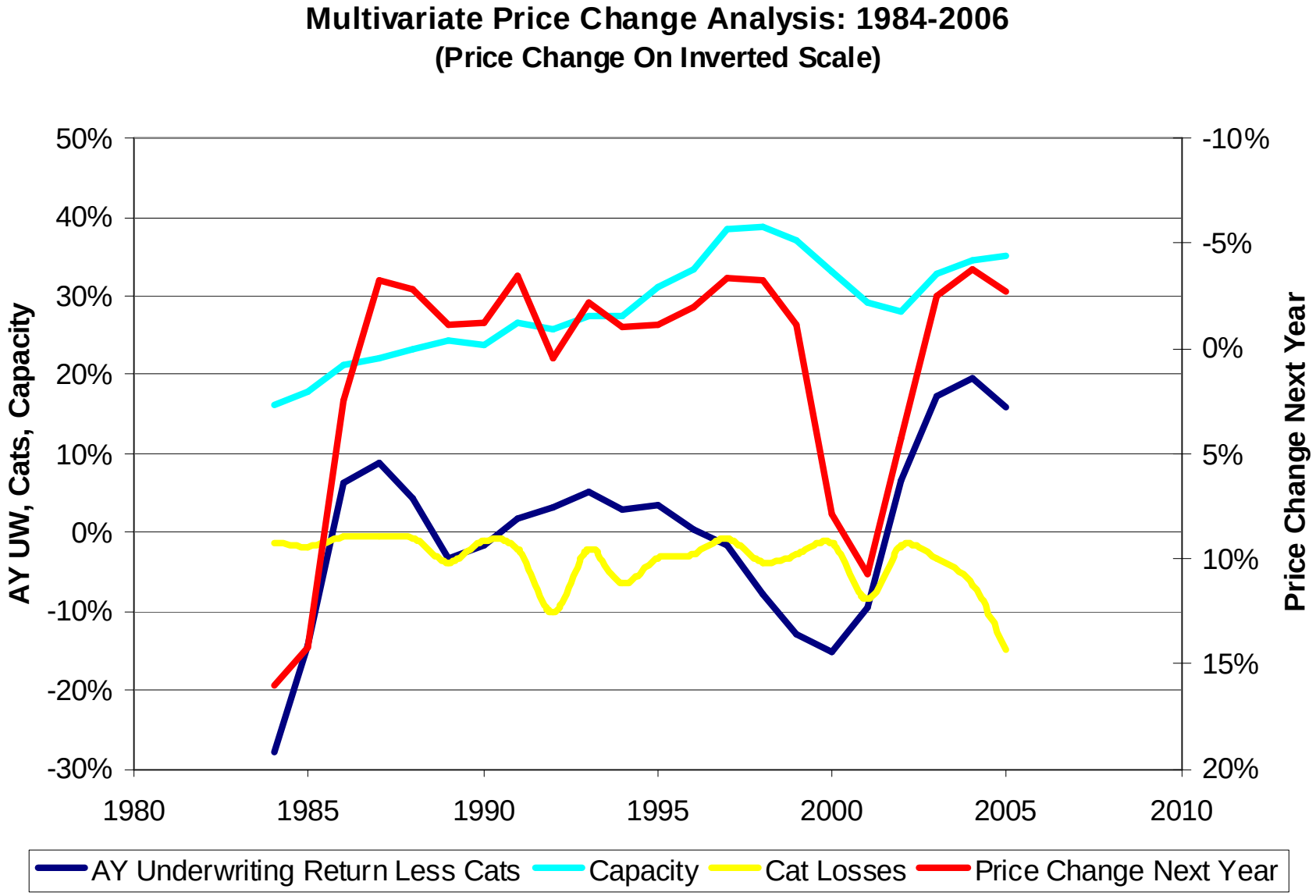
The signs of all coefficients are "correct." Capacity is not "significant."

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3.000	0.088	0.029	7.489	0.000
Residual	73.000	0.285	0.004		
Total	76.000	0.373			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.097	0.027	3.626	0.001	0.044	0.150
Capacity	-0.193	0.185	-1.044	0.300	-0.563	0.176
UW	-0.686	0.195	-3.526	0.001	-1.074	-0.299
II	-0.679	0.303	-2.239	0.028	-1.284	-0.075

Joint Time Series: Recent Data



Regression Analysis: Recent Data

$$\frac{\Delta P}{P} = \alpha + \beta_1 \frac{\text{AY UW Income} + \text{Cats}}{\text{Net Earned Premium}} + \beta_2 \frac{-\text{Cats}}{\text{Net Earned Premium}} + \beta_3 \frac{10 \times \text{Surplus}}{\text{GDP}}$$

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.82
R Square	0.67
Adjusted R Square	0.62
Standard Error	0.04
Observations	22.00

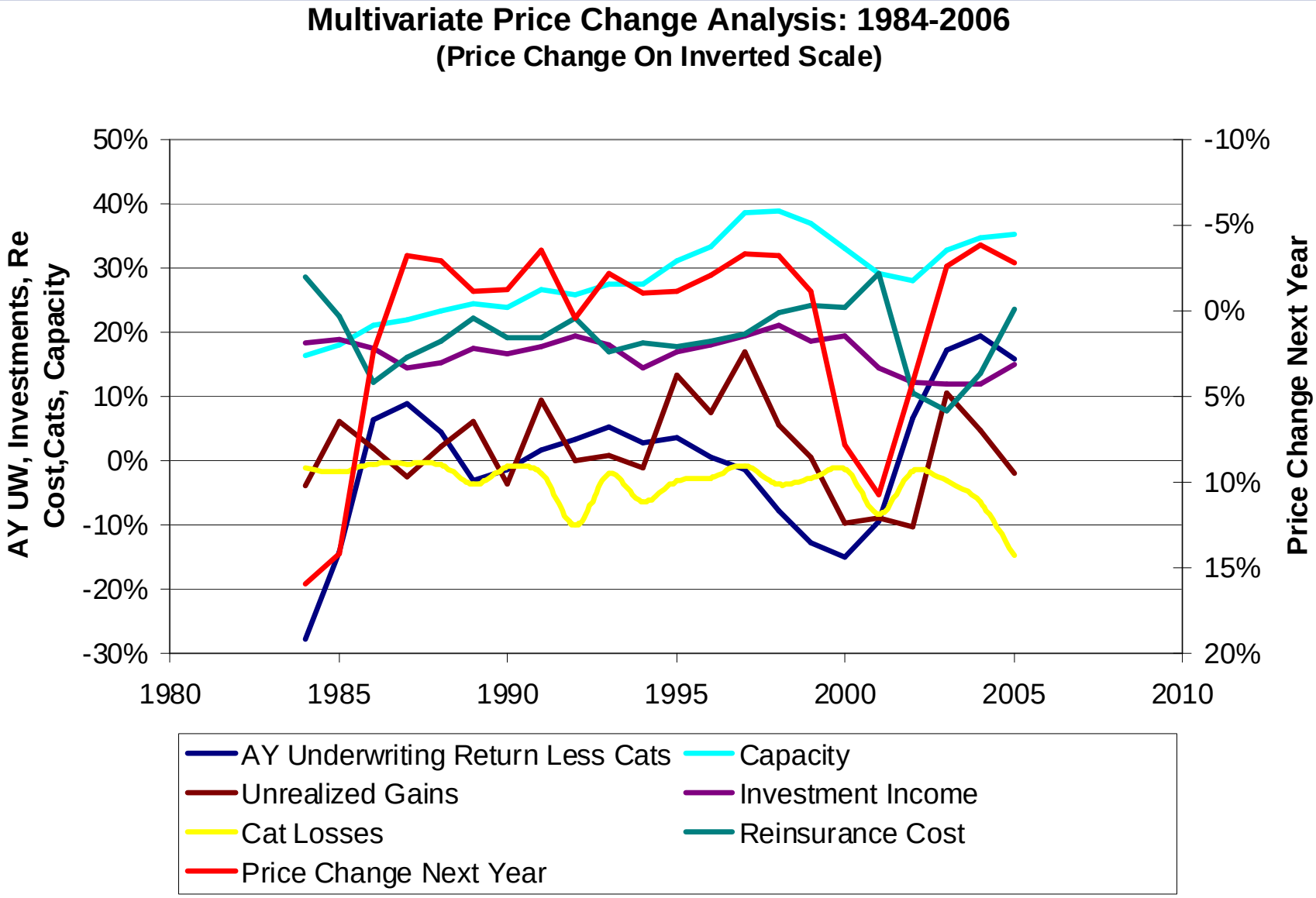
The signs of all coefficients are "correct." Cats are not "significant."

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3.00	0.05	0.02	12.23	0.00
Residual	18.00	0.02	0.00		
Total	21.00	0.07			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.10	0.04	2.76	0.01	0.02	0.18
UW%	-0.35	0.08	-4.70	0.00	-0.51	-0.20
Cats	-0.39	0.24	-1.63	0.12	-0.90	0.11
Capacity	-0.38	0.13	-2.86	0.01	-0.65	-0.10

More Joint Time Series: Recent Data



More Regression Analysis: Recent Data

$$\frac{\Delta P}{P} = \alpha + \beta_1 \frac{\text{AY UW Income} + \text{Cats}}{\text{Net Earned Premium}} + \beta_2 \frac{\text{Investment Income}}{\text{Net Earned Premium}} + \beta_3 \frac{\text{Unrealized Gains}}{\text{Net Earned Premium}}$$
$$+ \beta_4 \frac{-\text{Cats}}{\text{Net Earned Premium}} + \beta_5 \frac{\text{Cost Of Reinsurance}}{\text{Net Earned Premium}} + \beta_6 \frac{\text{Surplus}}{\text{GDP}}$$

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6.00	0.06	0.01	11.14	0.00
Residual	15.00	0.01	0.00		
Total	21.00	0.07			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.15	0.08	1.93	0.07	-0.02	0.31
UW%	-0.77	0.16	-4.74	0.00	-1.12	-0.42
II%	-0.68	0.39	-1.74	0.10	-1.53	0.16
UR%	-0.03	0.11	-0.29	0.78	-0.28	0.21
Cats	-0.93	0.35	-2.67	0.02	-1.67	-0.19
Re	1.90	0.88	2.15	0.05	0.01	3.78
Capacity	-0.29	0.11	-2.54	0.02	-0.54	-0.05

The signs of all coefficients are "correct." Investment returns are not "significant."

Conclusions

- **Time Series Analysis Is Consistent With Intuition**
- **Price Rises When**
  - Accident Year Underwriting Margin Excluding Cats Falls
  - Cats Rise
  - Investment Income Falls
  - Unrealized Gains Fall
  - Capacity Falls

Conclusions

- **1984-1987 Was “Harder” Than 2001-2003**
- **8 Market Cycles From 1924 To 2000**
  - 12, 18, 5, 11, 6, 3 and 13 years
  - Mean Duration = 10 Years
  - Standard Deviation = 5 Years
- **Causes Of The “Long” 13 Year Soft Market Of 1990’s**
  - Above Average Investment Income
  - Exceptional Unrealized Capital Gains
  - Below Average Catastrophes
  - Cheap Reinsurance