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A HISTORICAL PERSPECTIVE ON THE UNDERWRITING CYCLE AND A REINSURER PERSPECTIVE ON CYCLE MANAGEMENT

September 20-21, 2010

Dave Clark
Munich Reinsurance America, Inc

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Agenda

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Industry Reserving for Current Accident Year

Implications on Calendar Year Results

A Mathematical Model for the Cycle

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Reserving the Current Accident Year: All Lines Combined

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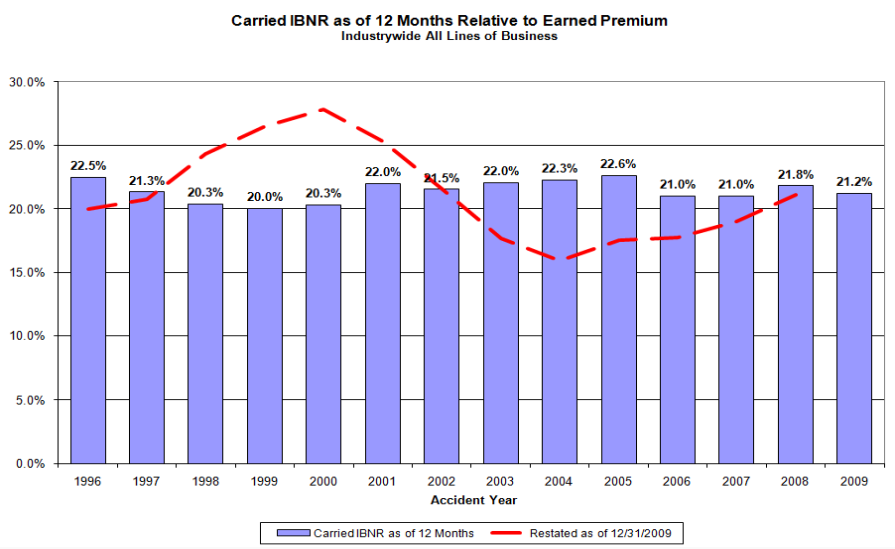

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Reserving the Current Accident Year: All Lines Combined

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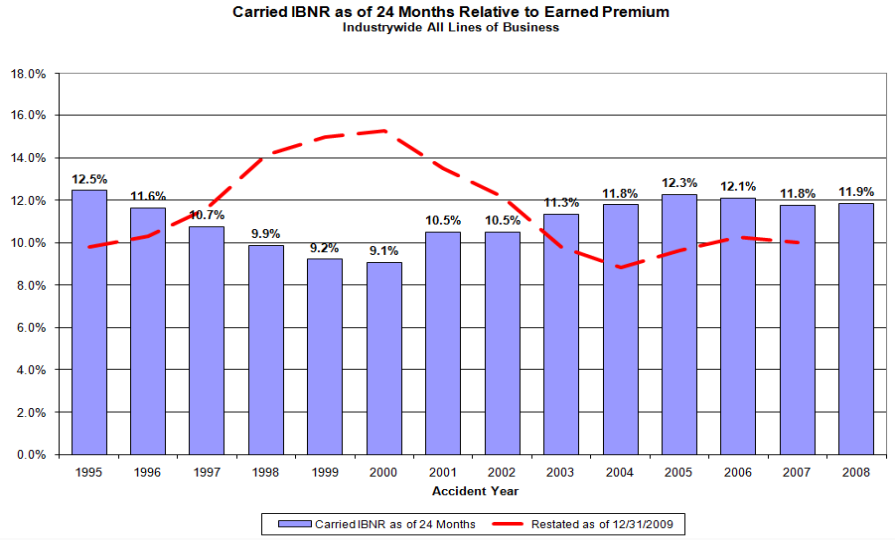

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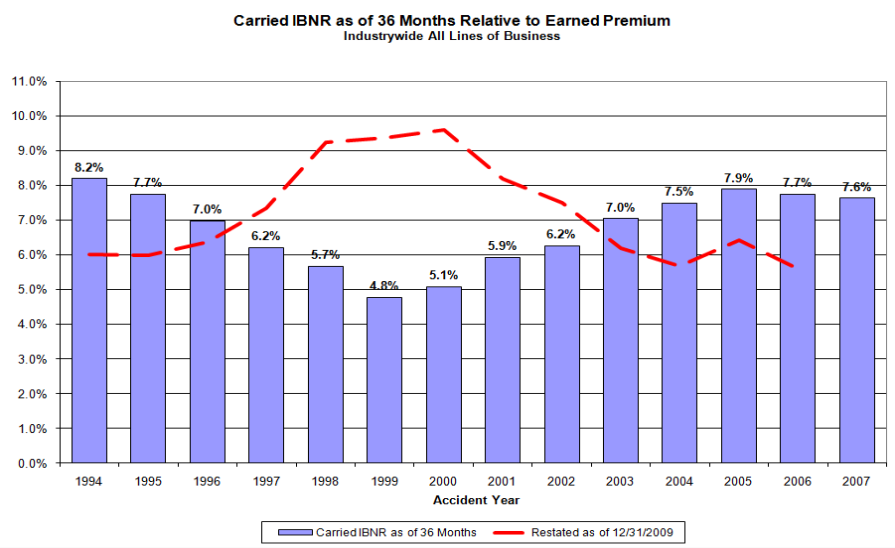

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Reserving the Current Accident Year: Commercial Multiple Peril (CMP)

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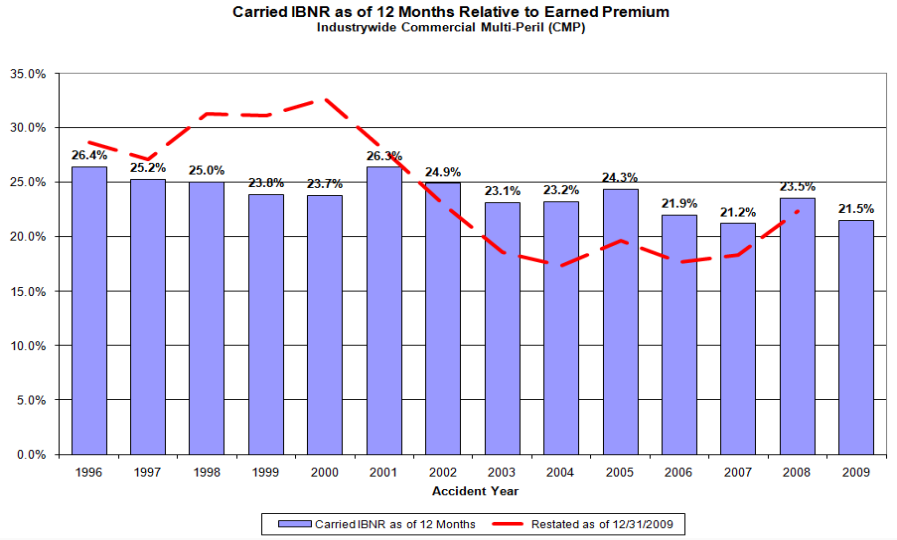

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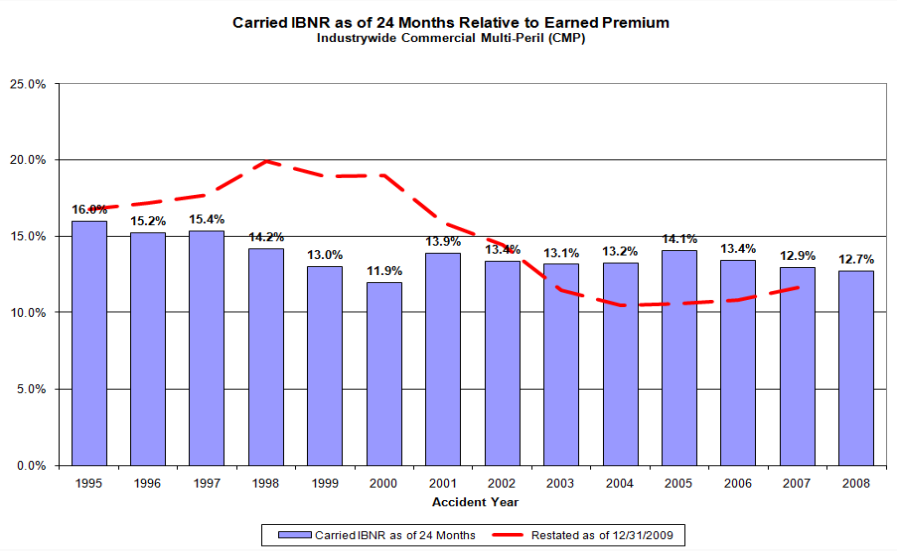

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Reserving the Current Accident Year: Commercial Multiple Peril (CMP)

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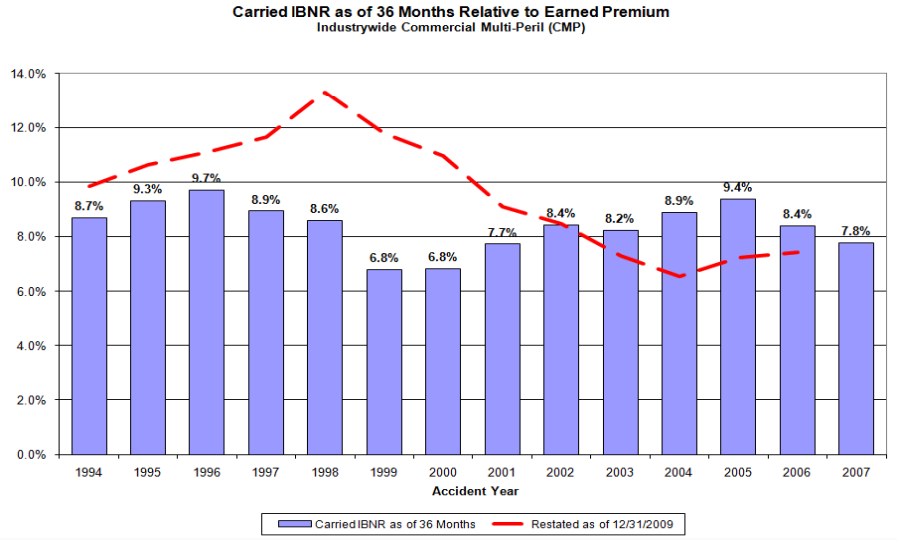

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Reserving the Current Accident Year: Workers Compensation

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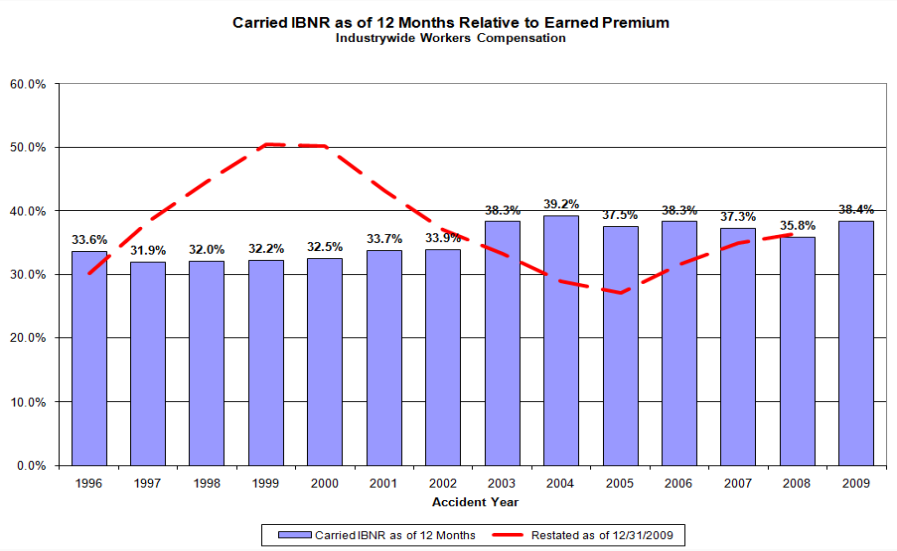

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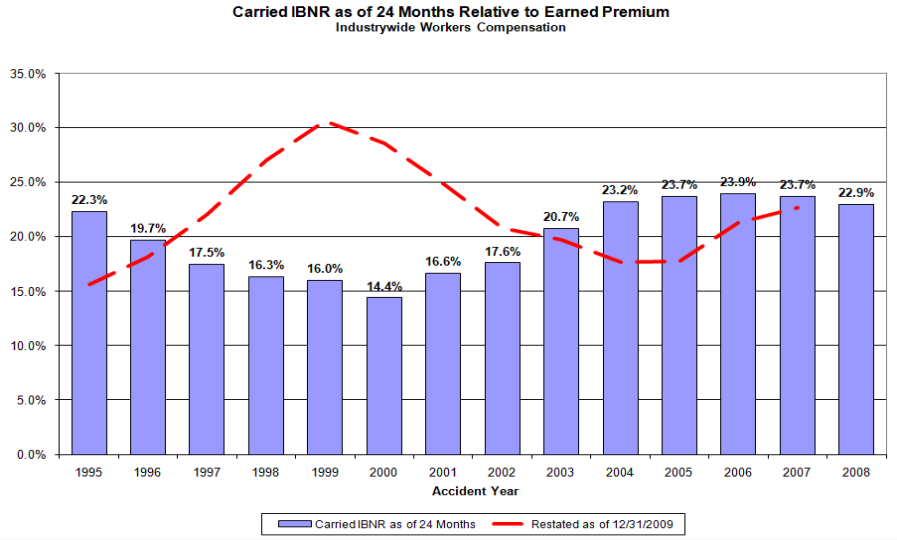

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Reserving the Current Accident Year: Workers Compensation

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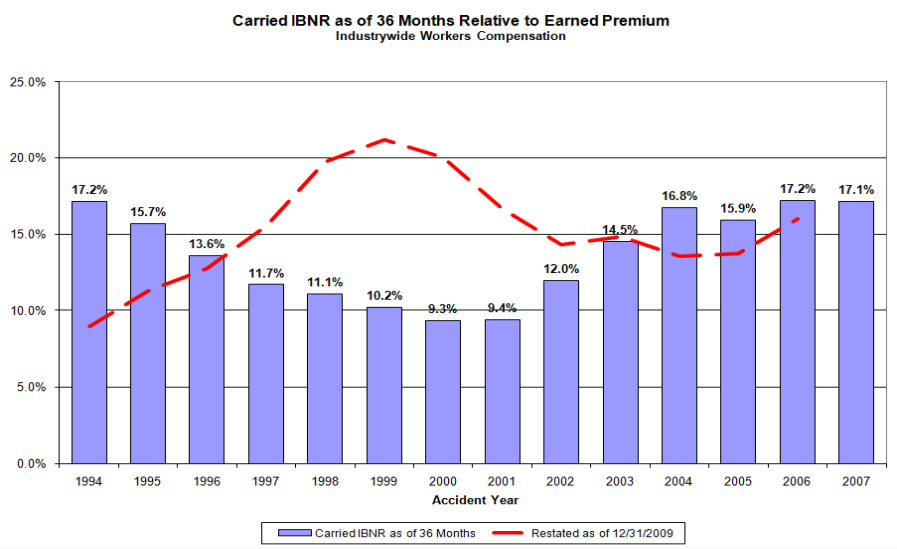

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Implications for Calendar Year Results

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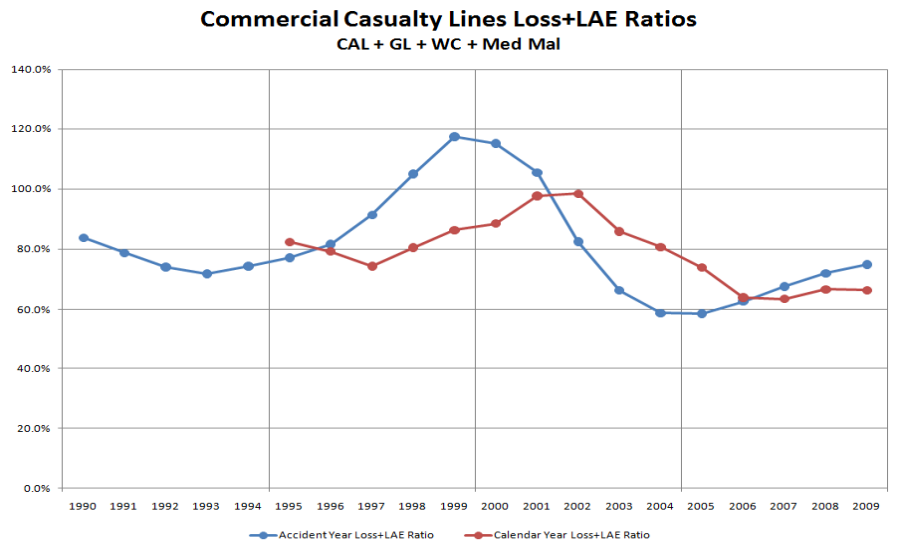

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A Mathematical Model of the U/W Cycle

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Assumptions

- Begin with deterministic steady-state for losses:
  - Each year's expected loss is (1+g) times the prior year
  - Value is unknown, but not a random variable
- Reserving is always done with a Bornhuetter-Ferguson method using the same permissible loss ratio, say, PLR=65%
- Pricing is done assuming reserving is done correctly
  - Pricing is an average of last three CY losses (adjusted for growth)

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A Mathematical Model of the U/W Cycle

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Basic Notation:

L_j = expected loss for accident year j

$CYIL_j$ = Booked calendar year j incurred loss

g = constant growth rate, such that $L_j = L_{j-1} \cdot (1+g) \quad \forall\, j$

PLR = Permissible Loss Ratio

$\{\beta_i\}_{i=1}^{\infty} = \beta_1, \beta_2, \cdots, \beta_n, \cdots$ = Incremental payment pattern by development period i

Such that $1 = \sum_{i=1}^{\infty} \beta_i$; and also desirable that $\beta_i > 0 \;\forall\, i$

Bornhuetter-Ferguson Estimate for Current Accident Year:

$$L_j \cdot \beta_1 + Premium_j \cdot PLR \cdot (1-\beta_1)$$

New working paper: "How to Create a Market Cycle"
http://www.casact.org/research/wp/

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A Mathematical Model of the U/W Cycle

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The premium for a given year is based on the average of the "n" most recent calendar year incurred losses (CYIL).

This definition immediately creates a relationship of calendar year (CY) results as a rolling average of accident year (AY) results.

$$Prem_j = \frac{1}{n} \cdot \sum_{k=1}^{n} \frac{CYIL_{j-k} \cdot (1+g)^k}{PLR}$$

$$ProfitAY_j = PLR \cdot Prem_j - L_j$$

$$ProfitCY_j = PLR \cdot Prem_j - CYIL_j = \sum_{i=1}^{\infty} ProfitAY_{j+1-i} \cdot \beta_i$$

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A Mathematical Model of the U/W Cycle

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The Calendar Year Incurred Loss (CYIL) can be written in a recursive form as a weighted average of prior calendar year losses.

Technically this is known as a ***linear difference equation*** (discrete analogy to a linear differential equation).

Simplified versions of the cycle can also be generated:

$$CYIL_j - L_j = \frac{1}{n} \cdot \sum_{k=1}^{n} \left\{ \left(CYIL_{j-k} - L_{j-k} \right) - \sum_{i=1}^{\infty} \left(CYIL_{j+1-i-k} - L_{j+1-i-k} \right) \cdot \beta_i \right\} \cdot (1+g)^k$$

If n=1 and $\beta_2 = 1$ and $\beta_k = 0$ for k<>2 (all loss paid in 2nd year):

$$CYIL_j - L_j = CYIL_{j-1} - CYIL_{j-2}$$

$$CYIL_j = a \cdot COS\left(2\pi \cdot \frac{j}{6} + b\right)$$ where a and b are arbitrary constants

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A Mathematical Model of the U/W Cycle

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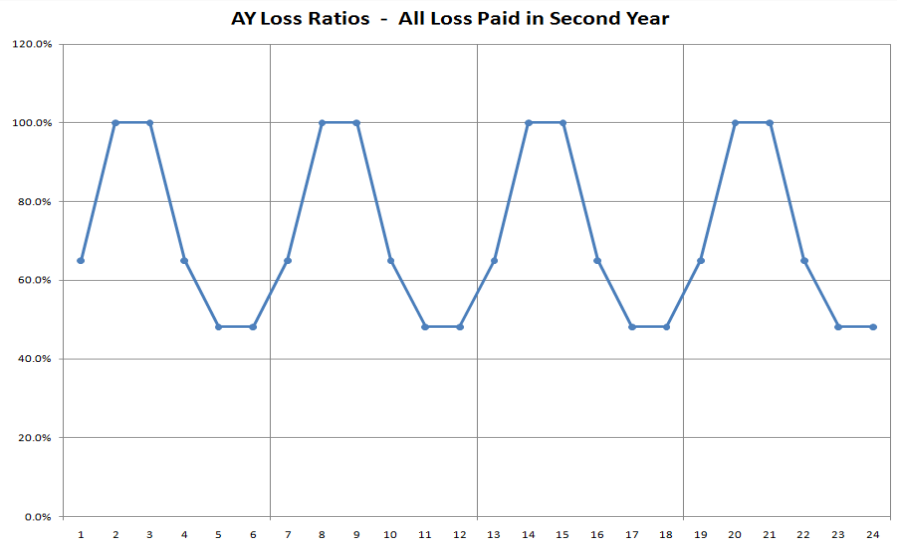

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A Mathematical Model of the U/W Cycle

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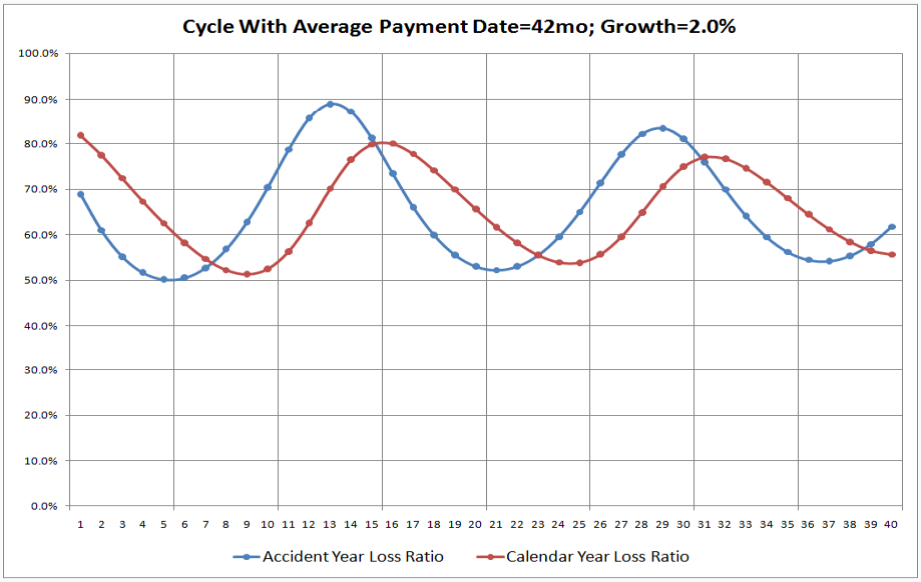

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A Mathematical Model of the U/W Cycle

Reserve Change Predicts AY Loss Ratio Change

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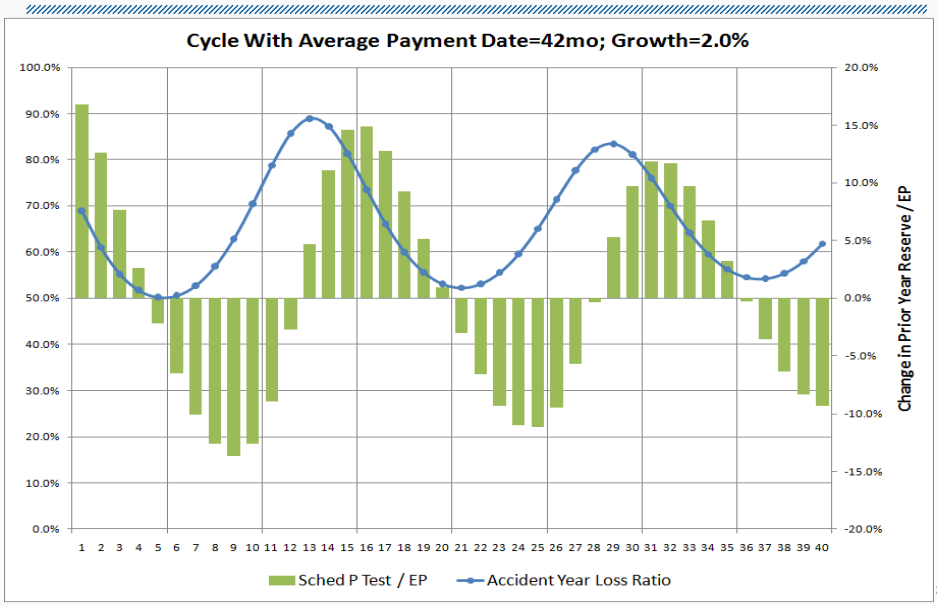

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A Mathematical Model of the U/W Cycle

Actual Relationship of Reserve Change and AY Loss Ratio

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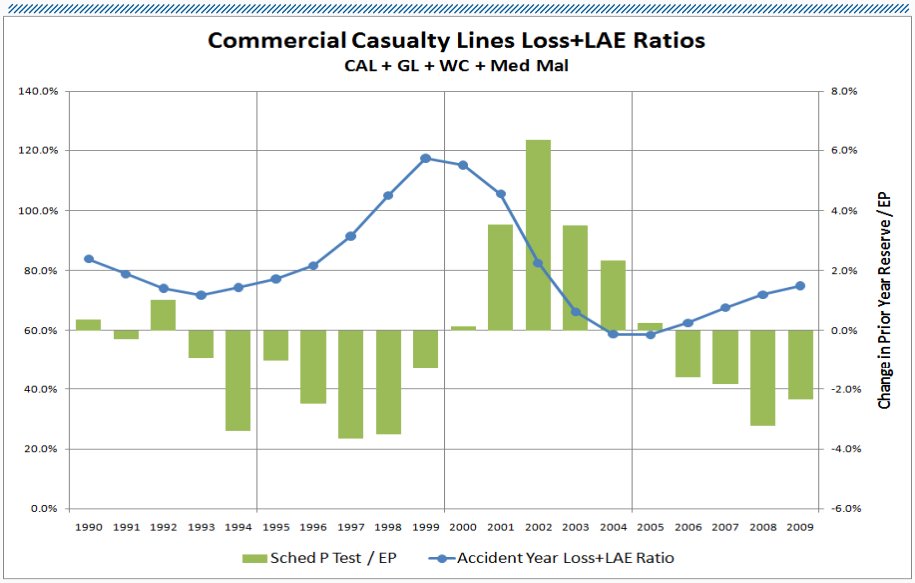

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Conclusions

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Underwriting Cycle involves both pricing and reserving

Use of Bornhuetter-Ferguson without changing PLR will perpetuate the cycle

Impact of the cycle means that reinsurance pricing actuary should:

- Select your own Loss Development Factors (LDFs) and ultimate losses by historical period
- Do not assume that recent Calendar Year results reflect current level of rate adequacy
- Compare company rate monitors versus other benchmarks

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