The Munich Chain Ladder: Overview and Example

Presented by: Susan J. Forray, FCAS, MAAA
Principal and Consulting Actuary
(262) 796-3328
susan.forray@milliman.com

Presented for: Midwestern Actuarial Forum
Chicago, IL

March 28, 2011

Milliman

Overview

§ Background

§ Graphical Example

§ Methodology Details

§ Advantages and Disadvantages

§ Questions

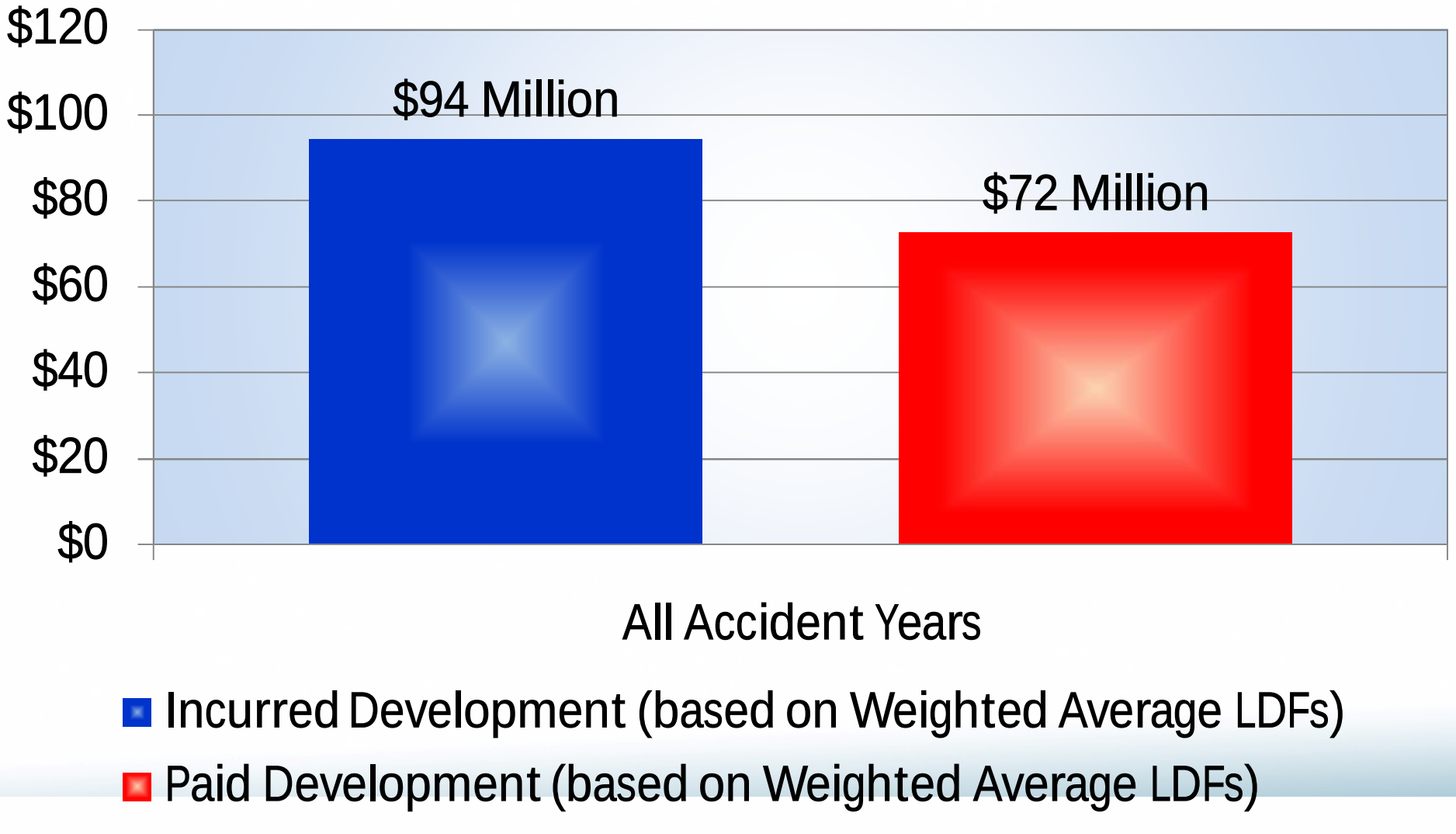
Background

- Developed by Drs. Gerhard Quarg and Thomas Mack
- Originally published in a German journal in 2004
- Since reprinted in *Variance* (Fall 2008)
- Seeks to resolve the differences that arise between the standard paid and incurred chain ladder indications
  - MCL provides separate indications for paid and incurred, but they are much closer to one another
- Standard chain ladder methods ignore the correlation between paid losses and incurred losses

Munich Chain Ladder Example

- Drawn from actual insurance company data
  - Certain information altered to maintain confidentiality
- Commercial auto liability
- Slowdown in claim closings (3-6 months)
  - May be due to decreasing frequency of small claims
- Possible case reserve strengthening

Indicated Unpaid Loss ($ Millions)



Milliman

Paid-to-Incurred Ratios at 6 Months of Development

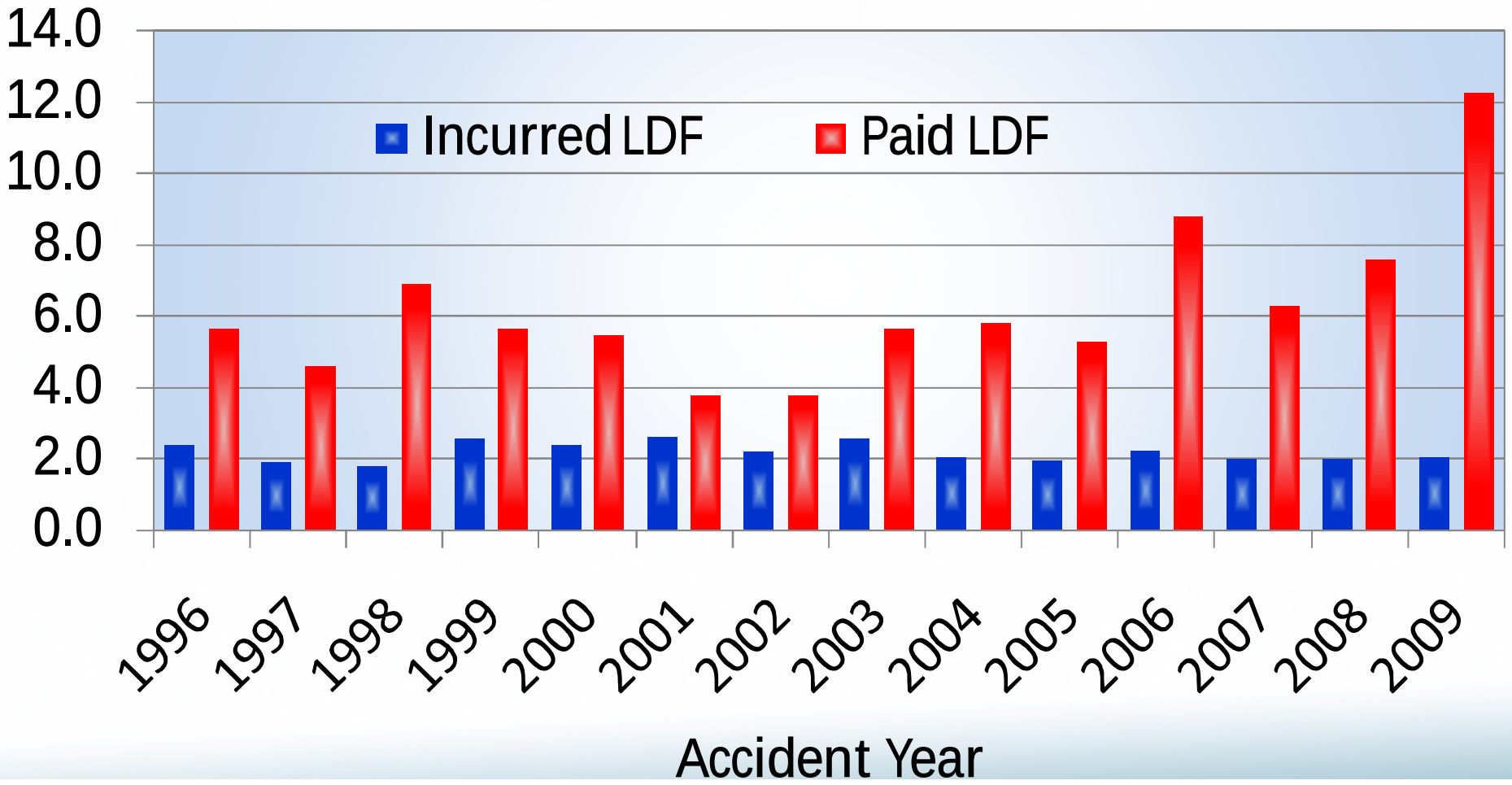
Milliman

Possible Explanations

- Decrease in frequency
  - Recent claims on average more severe
  - May be causing slowdown in payment pattern
- Slowdown in payment pattern
  - Primarily driven by fewer small claims
  - Other claims may be closing more slowly too
- Case reserve strengthening
  - Not to be confused with change in average case reserve due to changing characteristics of open claims

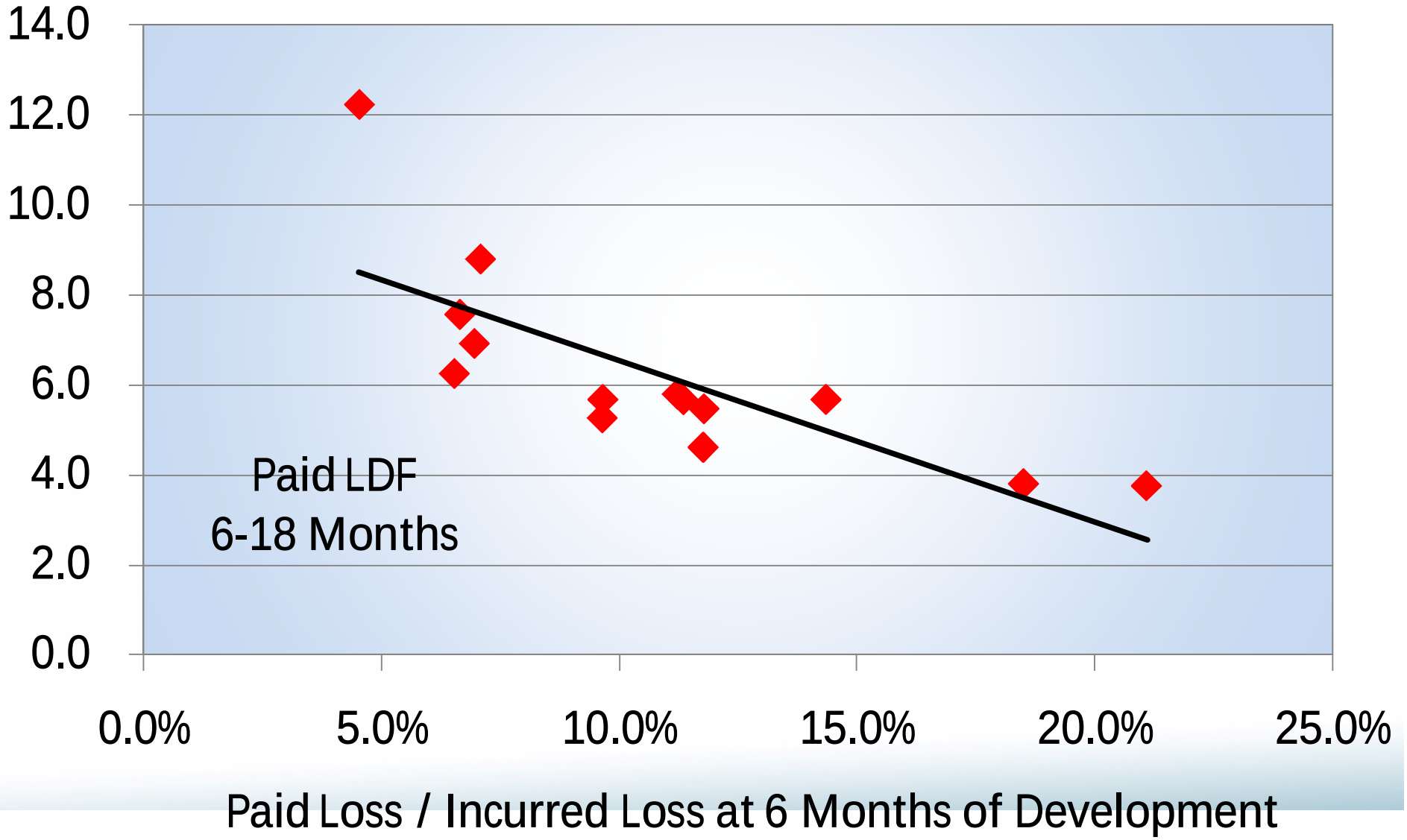
Incremental Loss Development Factors

6-18 Months of Development



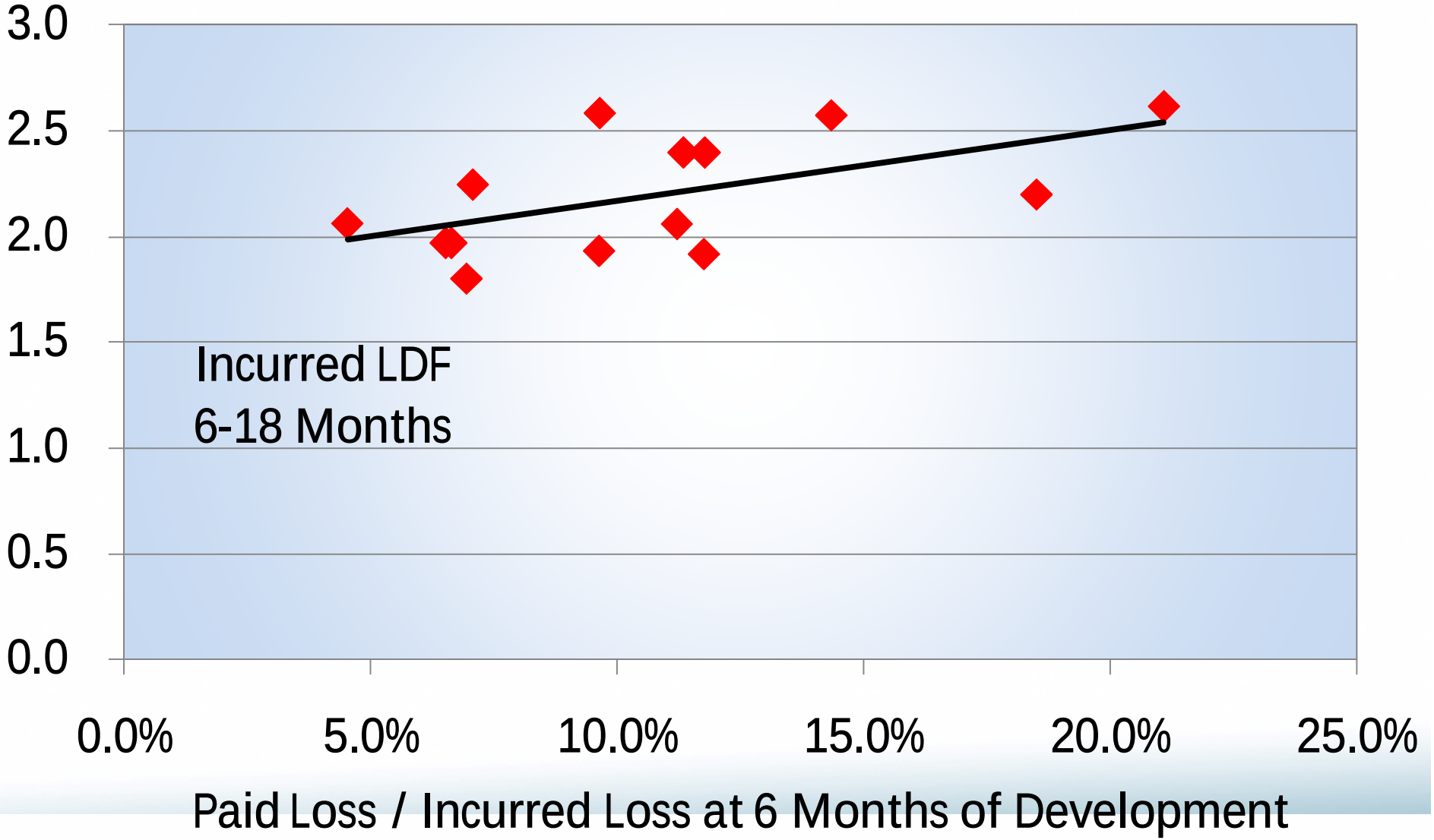
Milliman

Paid LDFs vs. Paid-to-Incurred Ratio



Milliman

Incurred LDFs vs. Paid-to-Incurred Ratio



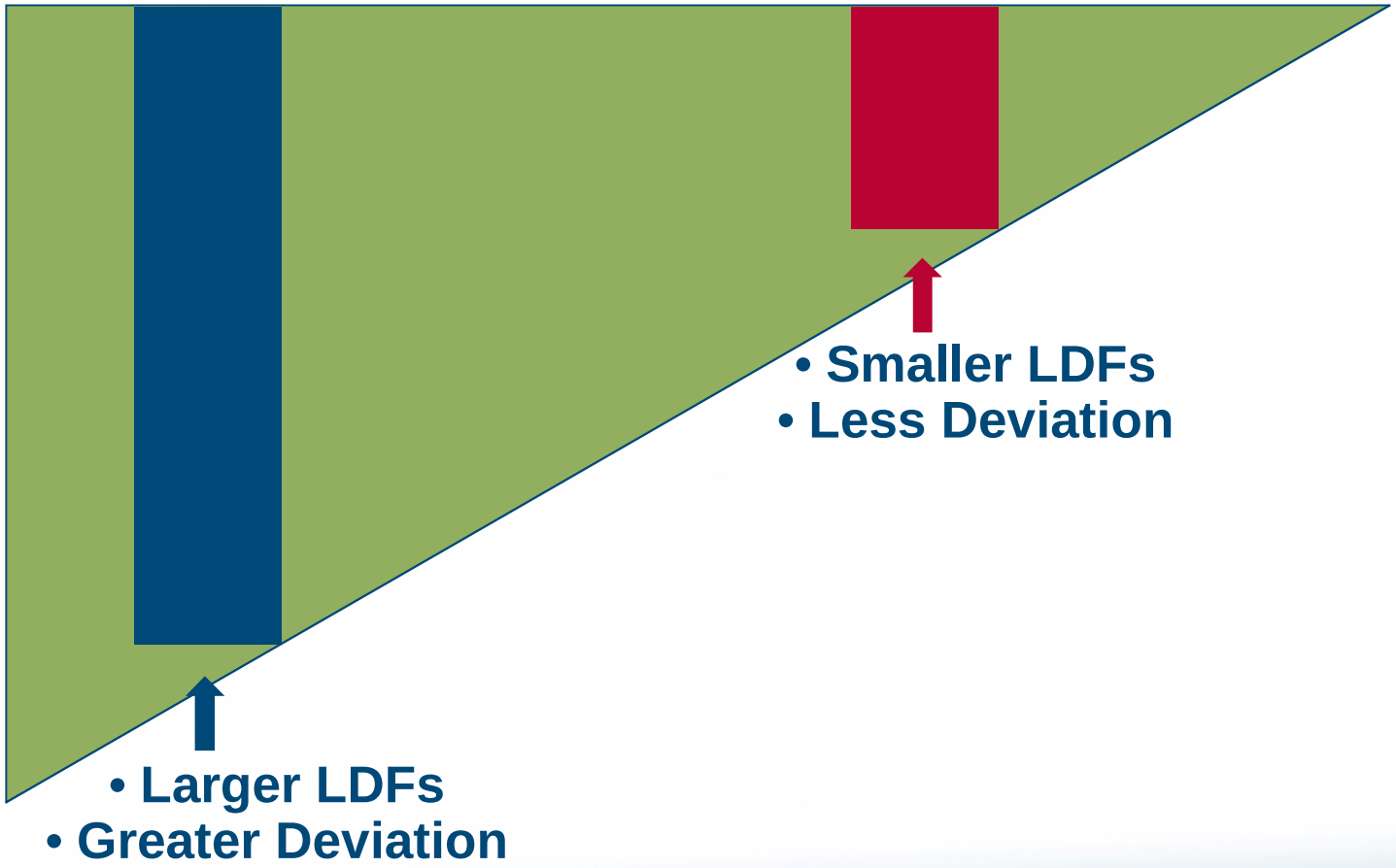
Milliman

Munich Chain Ladder Method

- Reflects the relationship between paid-to-incurred ratios and subsequent development
  - Standard chain ladder methods magnify an unusual paid-to-incurred ratio in a given accident year (leverage effect)
  - Paid-to-incurred ratio should converge to 1.00 in each accident year if the chain ladder methods are to be consistent
- In doing so, considers all development periods as a whole

Milliman

LDF Differences by Development Period

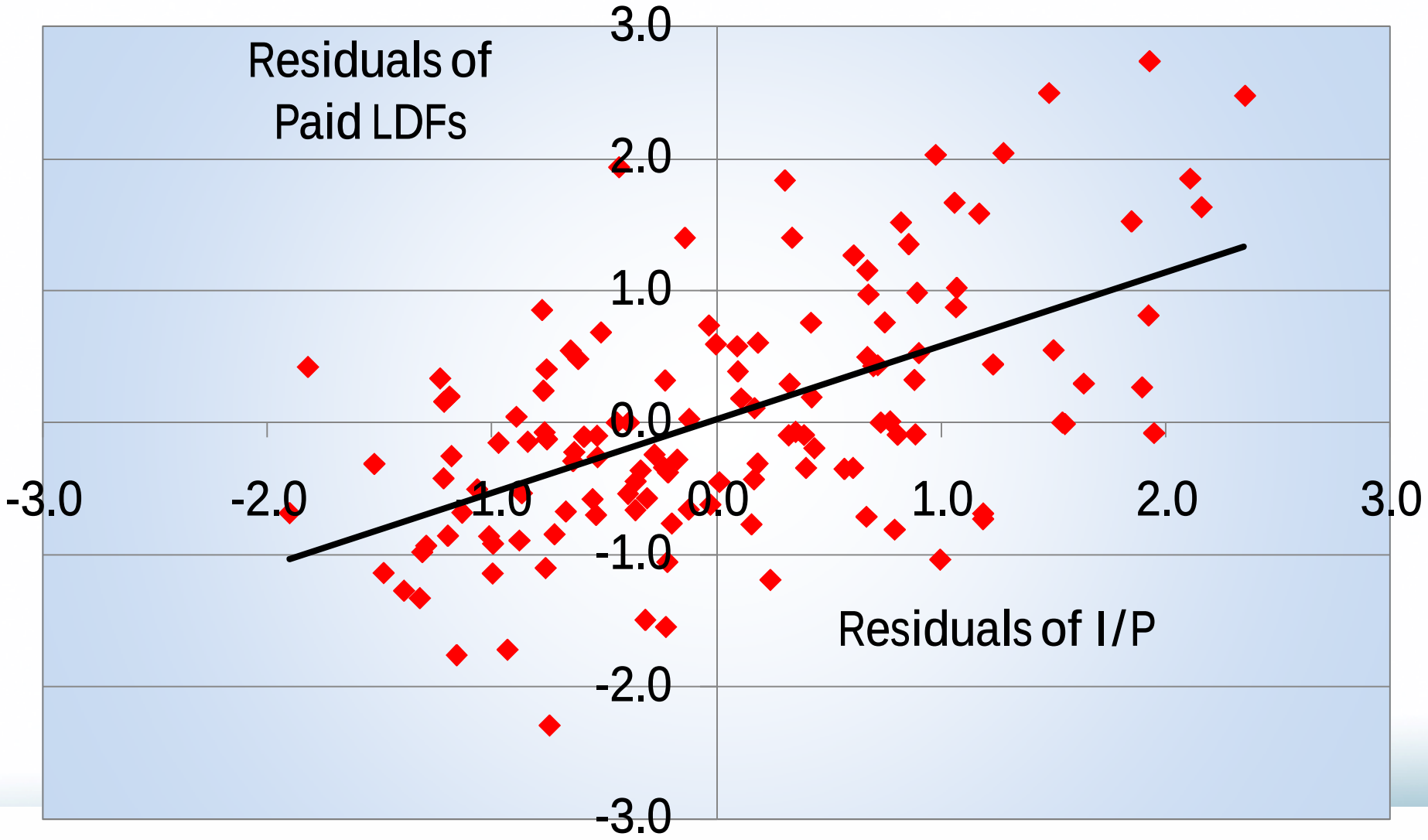


Milliman

Adjustment for LDF Differences

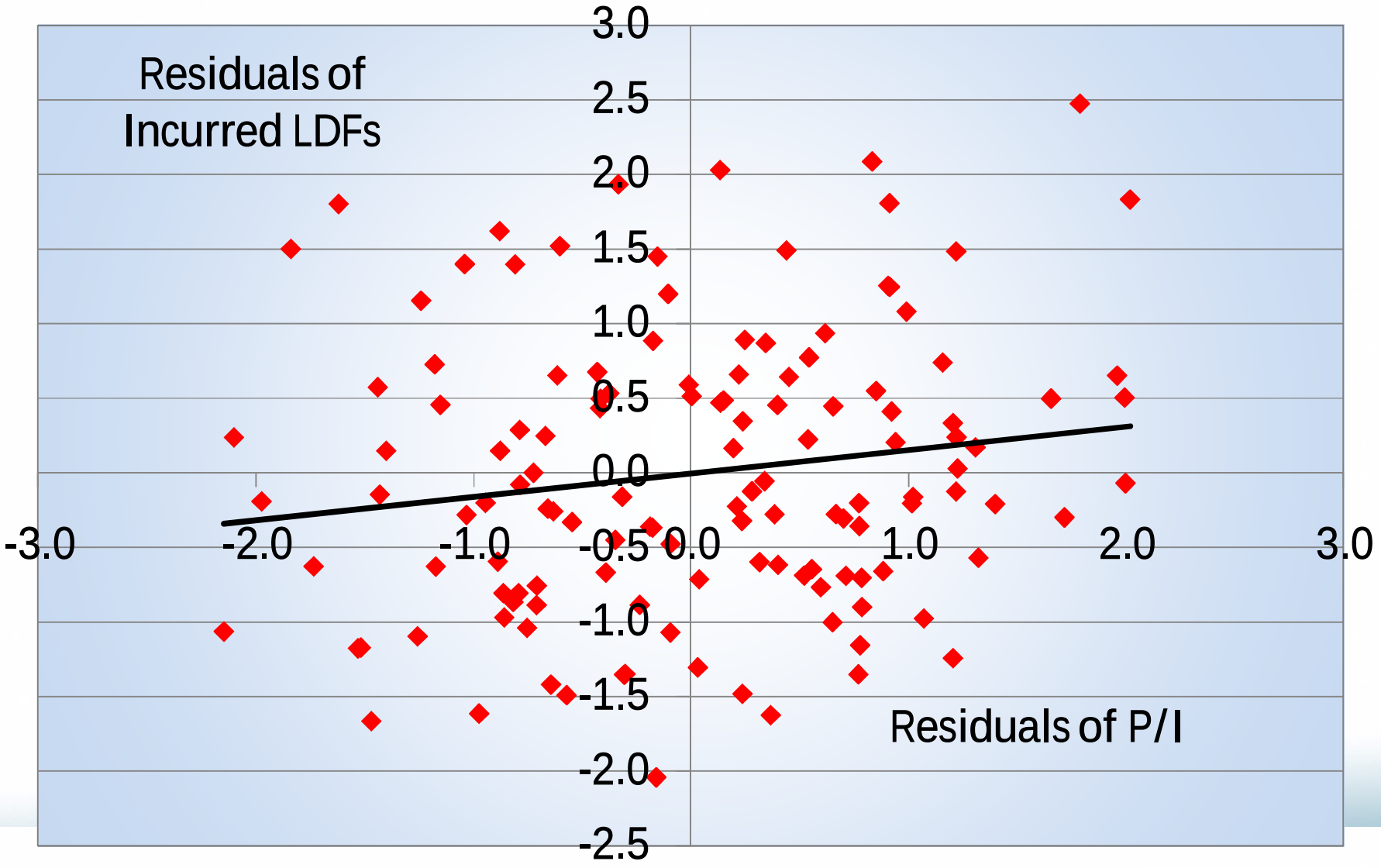
- Residual = $\dfrac{\text{LDF} - \text{Wtd Avg LDF}}{\text{Std Deviation of LDFs}}$
- Assumption: other LDF differences due only to volatility
  - i.e., residuals are independent and identically distributed
- Allows use of all LDFs at once
- Method also considers residuals of paid-to-incurred and incurred-to-paid ratios

Paid Residual Plot



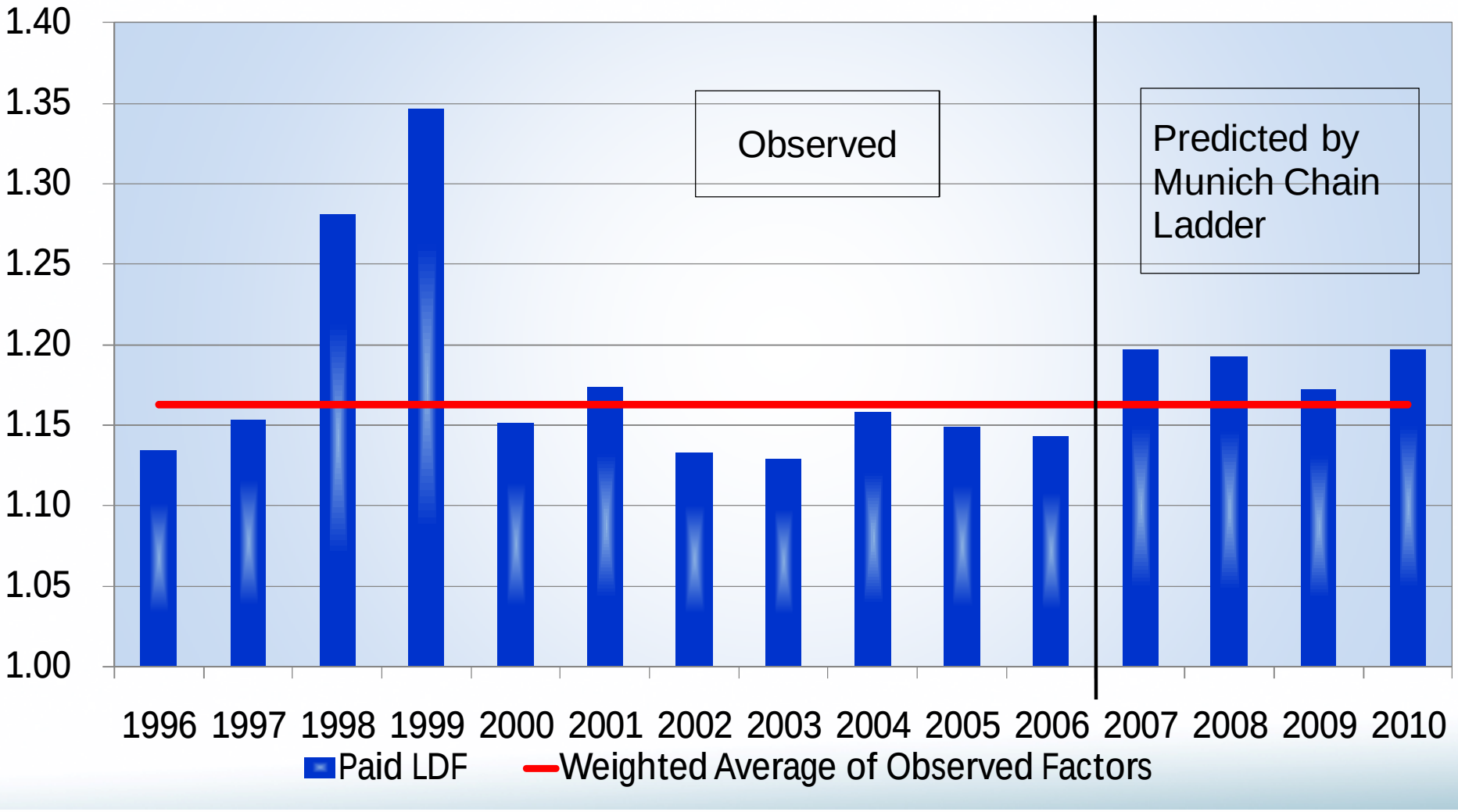
Milliman

Incurred Residual Plot



Milliman

Paid LDFs: 48-60 Months of Development



Milliman

Munich Chain Ladder – The Steps

Incurred Method

- Step 1: LDFs and Ratios
  - Incurred development factors and paid-to-incurred ratios
- Step 2: Weighted Averages and Standard Deviations
  - By development period, for each item in Step 1
- Step 3: Residuals
  - Now, data from different development periods has been standardized and can be grouped together
- Step 4: Conduct Linear Regression
  - Regress residuals of incurred LDFs against residuals of P/I ratios

Munich Chain Ladder – The Steps

Incurred Method (continued)

§ Step 5: Calculate Indicated LDFs

- Recursive process, based on regression parameters solved for in Step 4
- LDFs will vary across accident years, in accordance with their paid-to-incurred ratios

§ Step 6: Derive Ultimate Losses

- Cumulate the indicated LDFs and multiply by the losses incurred-to-date

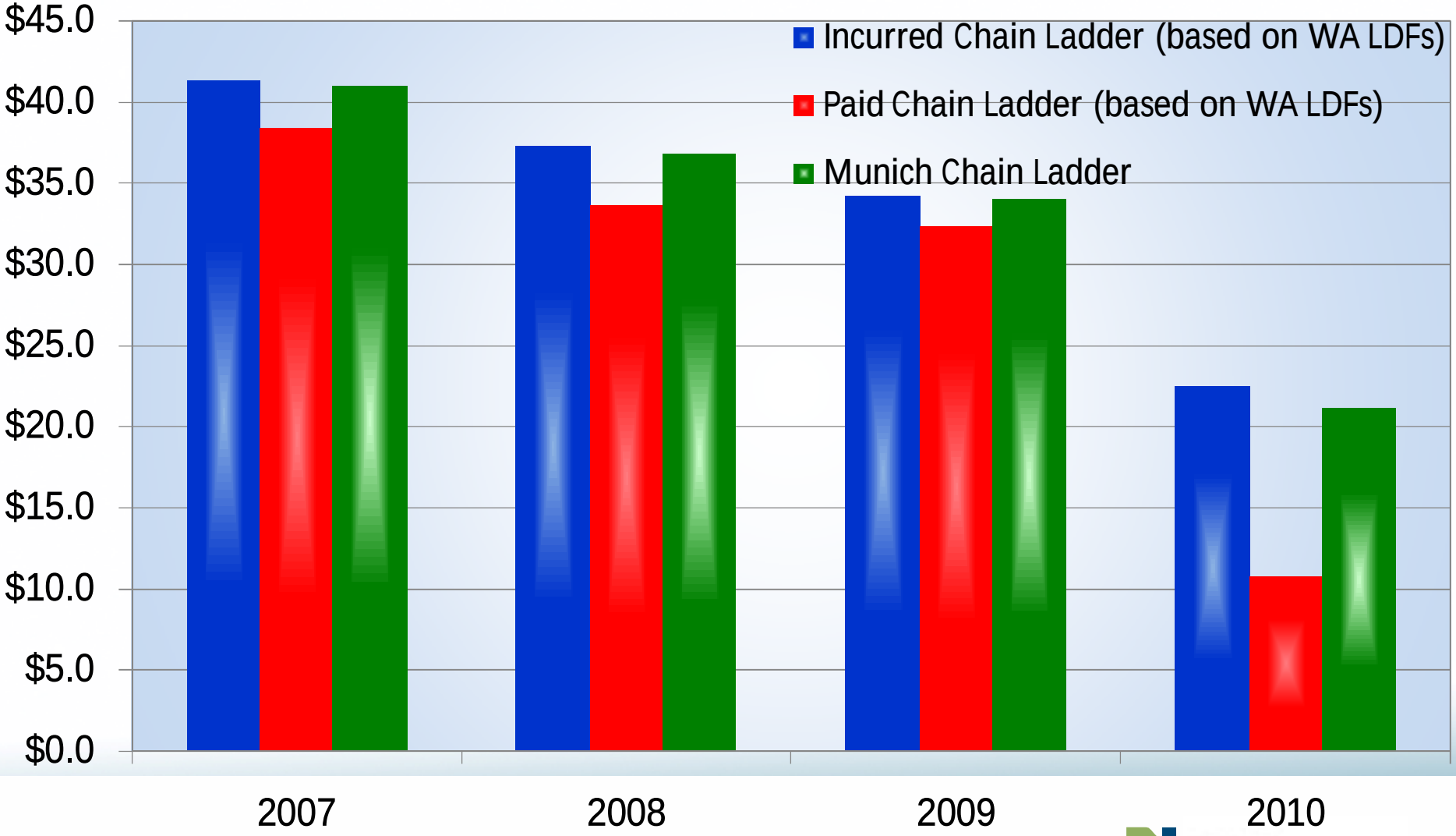
Munich Chain Ladder – The Steps

Paid Method

- Step 1: LDFs and Ratios
  - *Paid* development factors and *incurred-to-paid* ratios
- Steps 2 - 6:
  - Same as Incurred Method, but using the data listed above

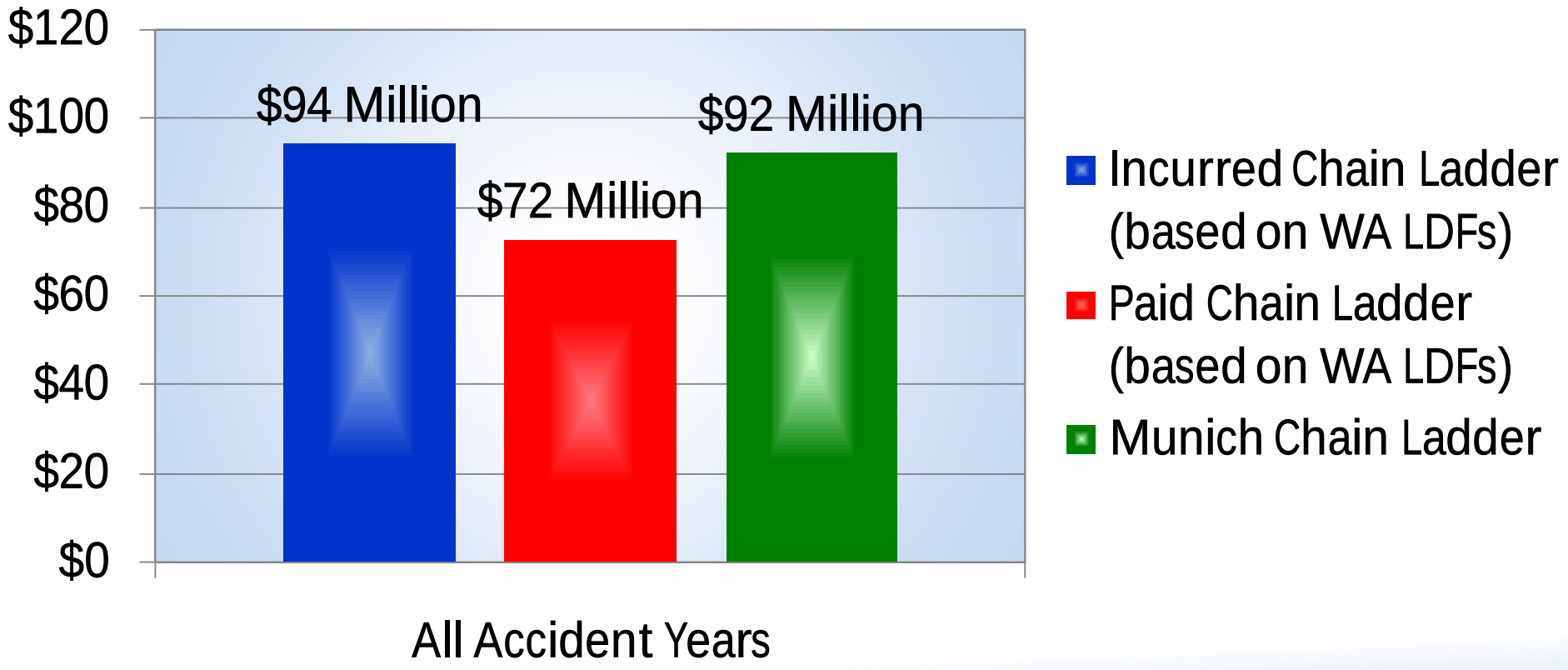
Milliman

Indicated Ultimate Loss by Accident Year
(in $Millions)



Milliman

Indicated Unpaid Loss ($ Millions)



Milliman

Advantages

- May resolve differences between paid and incurred development methods
- Uses paid and incurred information simultaneously
- More stable than other adjusted chain ladder methods (e.g., Berquist-Sherman, Brosius)
- Has a sound theoretical basis, yet is intuitive and understandable

Disadvantages

- More complex to implement than other reserving methods
- May not respond well to small data sets
- Parameters may need smoothing and extrapolation, especially when run-off extends beyond the most recent development period

Other Points

- Can also use for claim counts
  - e.g., closed with indemnity and incurred
- Two indications may still be derived
  - i.e., “paid” and “incurred” Munich Chain Ladder
- May not perform well when paid-to-incurred ratios extend outside of historical range
- Paid-to-incurred ratio can vary for different reasons
  - Can affect method reliability

References

§ Quarg, G., and T. Mack, “Munich Chain Ladder,” *Variance* Vol. 2, 2008, pp. 266-299

Milliman

Questions?

Susan Forray, FCAS, MAAA
Principal and Consulting Actuary
Milliman
(262) 796-3328
susan.forray@milliman.com

Milliman