Where's the Beef?

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"Too many people were good at math but ignorant of history"

David Brooks

New York Times

1. Reserve risk theory
2. Testing of Bootstrap Model
3. Conclusions

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1. **Reserve risk theory**
2. Testing of Bootstrap Model
3. Conclusions

1. Reserve Risk Theory

Total Risk

=

Systemic Risk

&

Independent Risk

Systemic Risk

- Internal systemic risk
  - model risk
  - data error

- External systemic risk
  - economic and social risk
  - legislative & political risk

Independent Risk

- Normal past and future random variability

1. Reserve risk theory
2. **Testing of Bootstrap Model**
3. Conclusions

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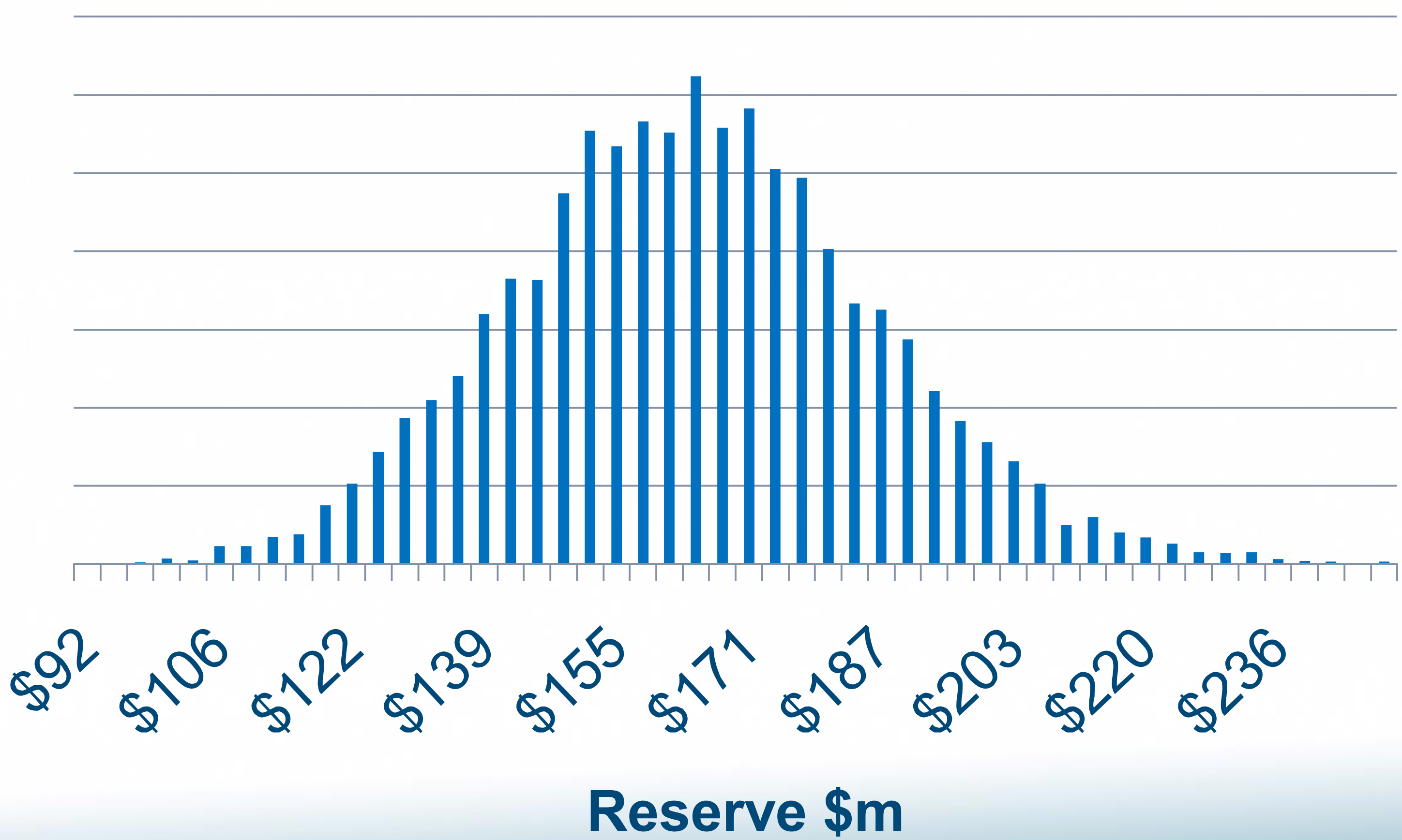
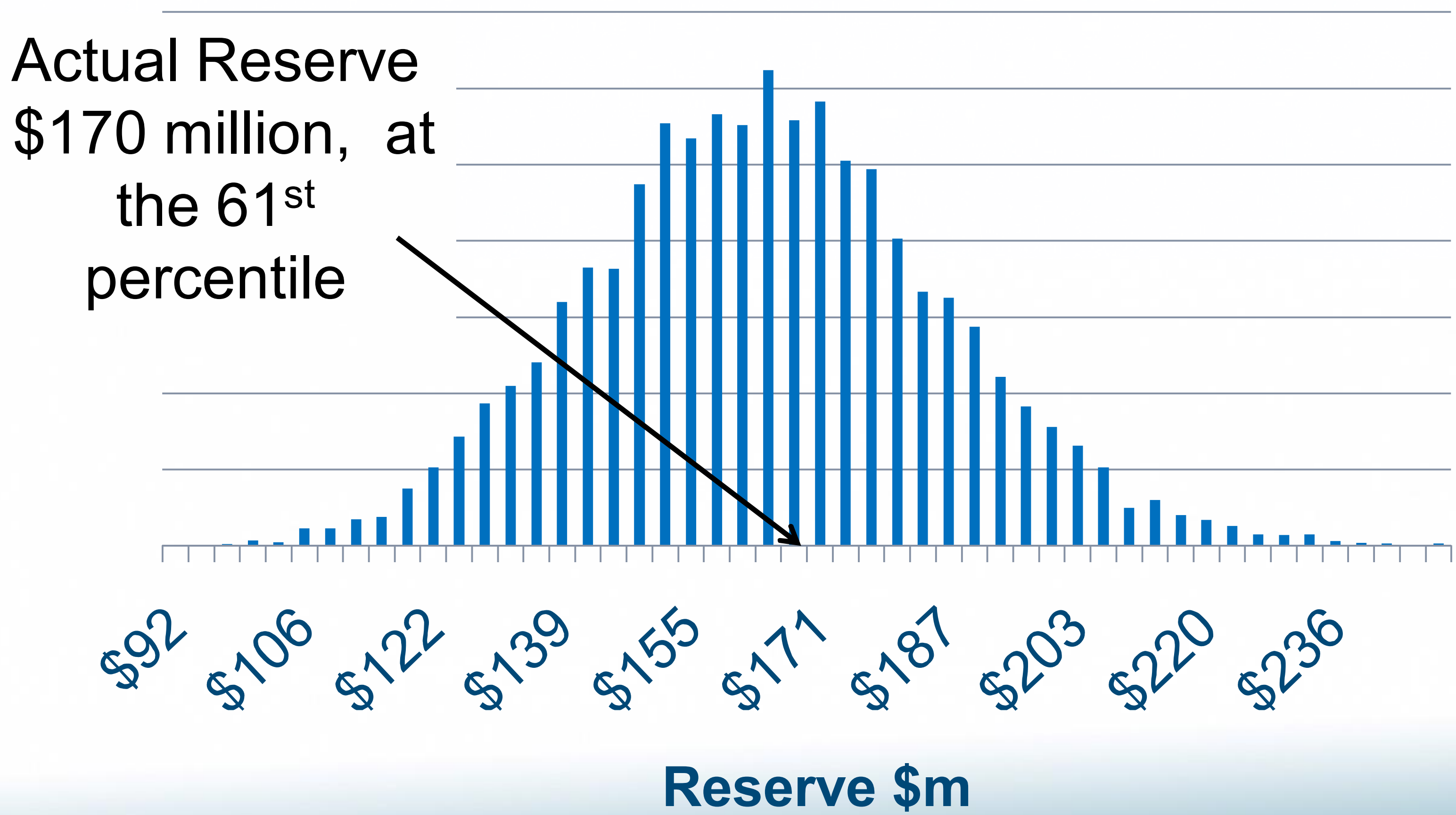
Company A

Distribution of Homeowners Unpaid as of 12/2000



Company A

Distribution of Homeowners Unpaid as of 12/2000



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51 Companies	Hindsight Unpaid Percentile
Company A	61%
Company B	99%
Company C	59%
….	….
….	….
Company AX	83%
Company AY	29%

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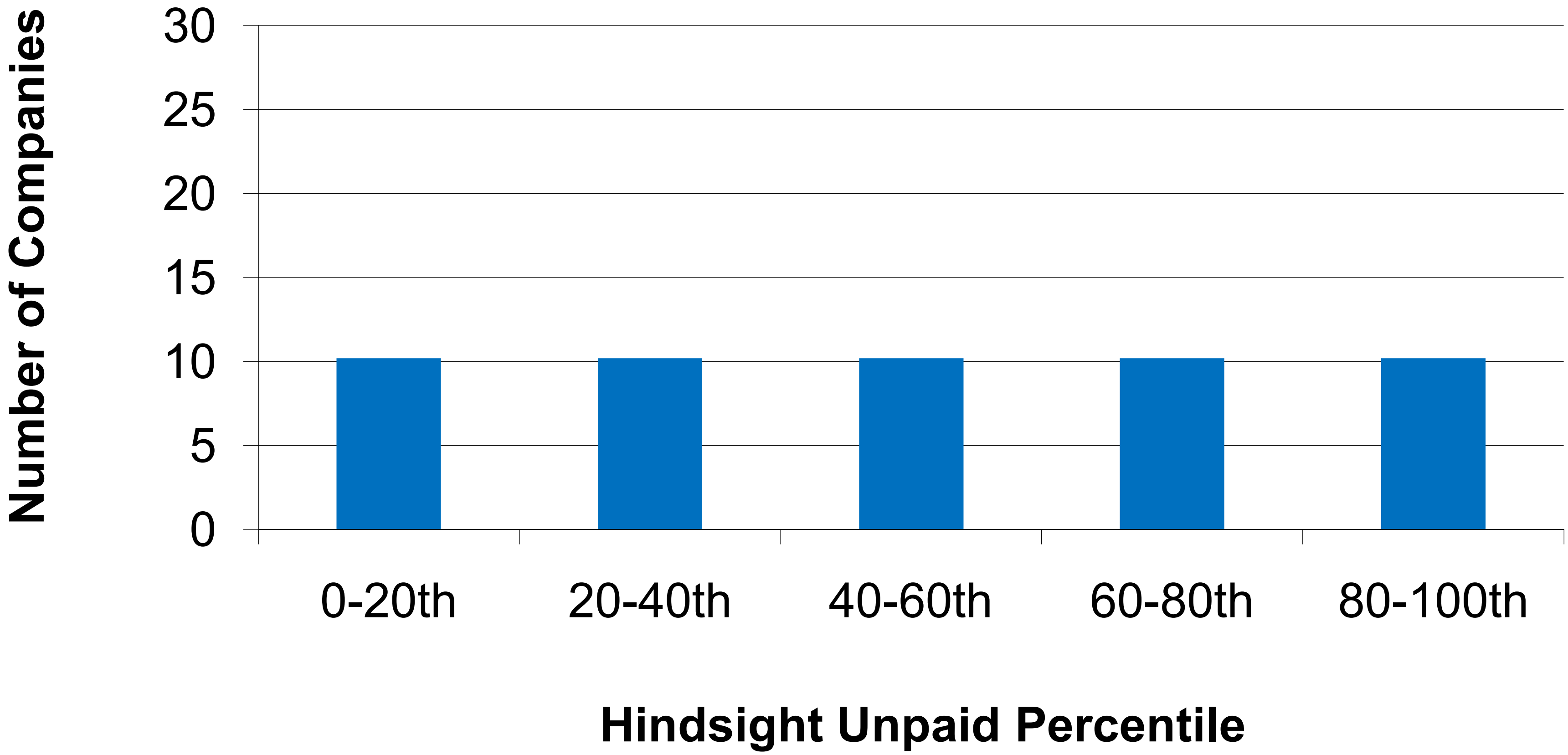
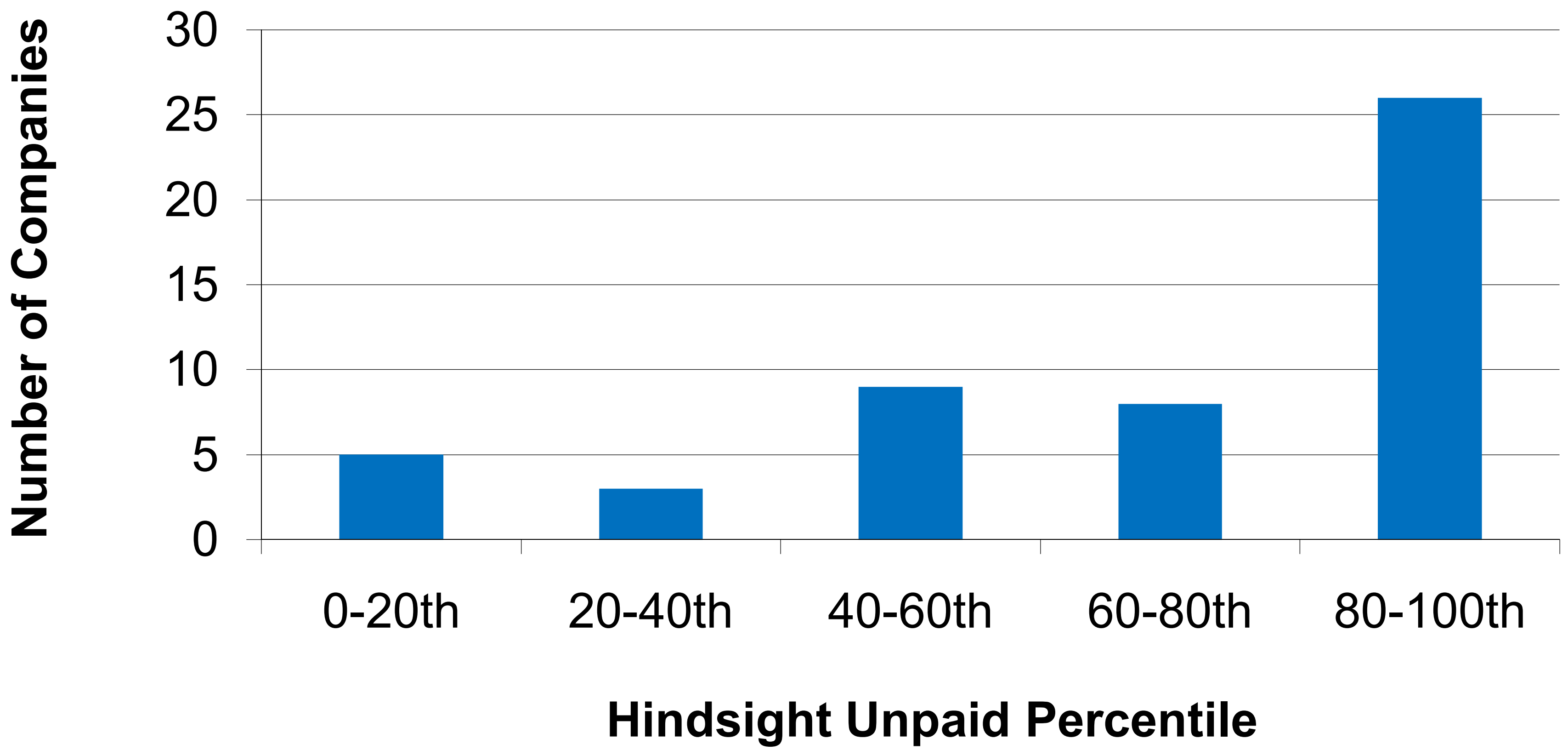
Ideal Histogram of the Hindsight Unpaid Percentile

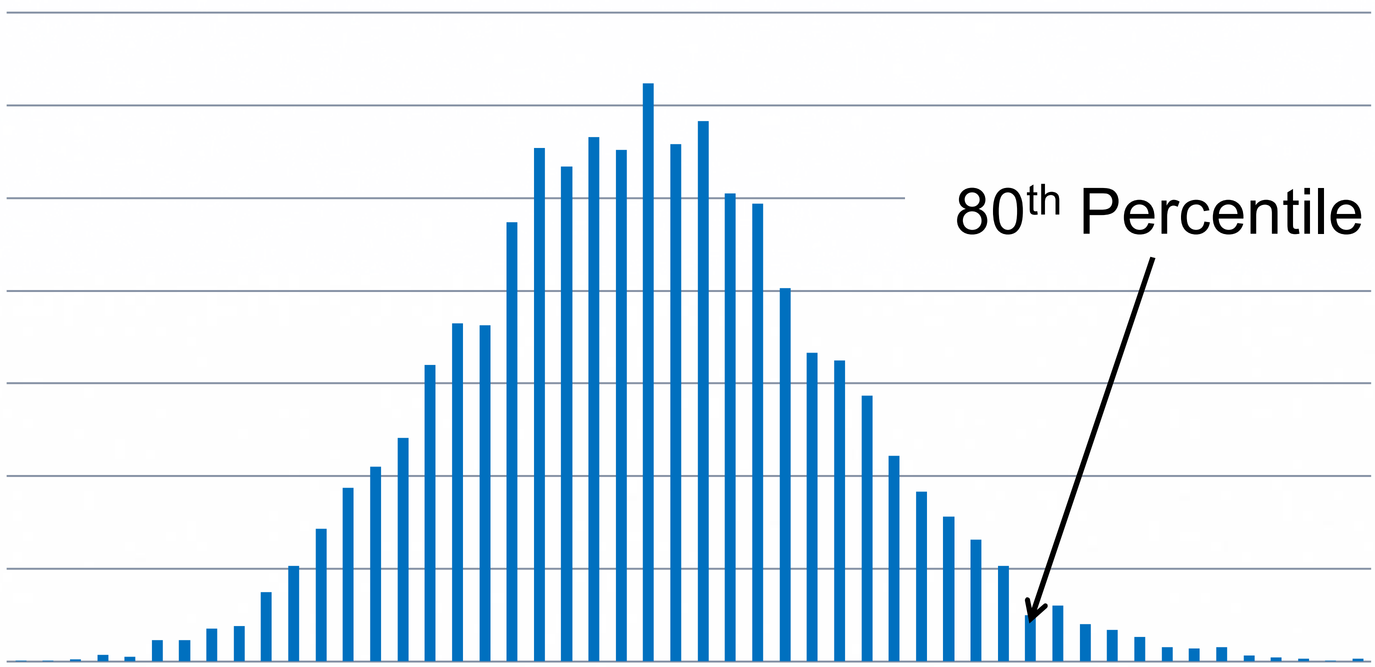


Homeowners as of 12/2000 Histogram of the Hindsight Unpaid Percentile



Some Company

Distribution of Homeowners Unpaid as of 12/2000



Reserve $m

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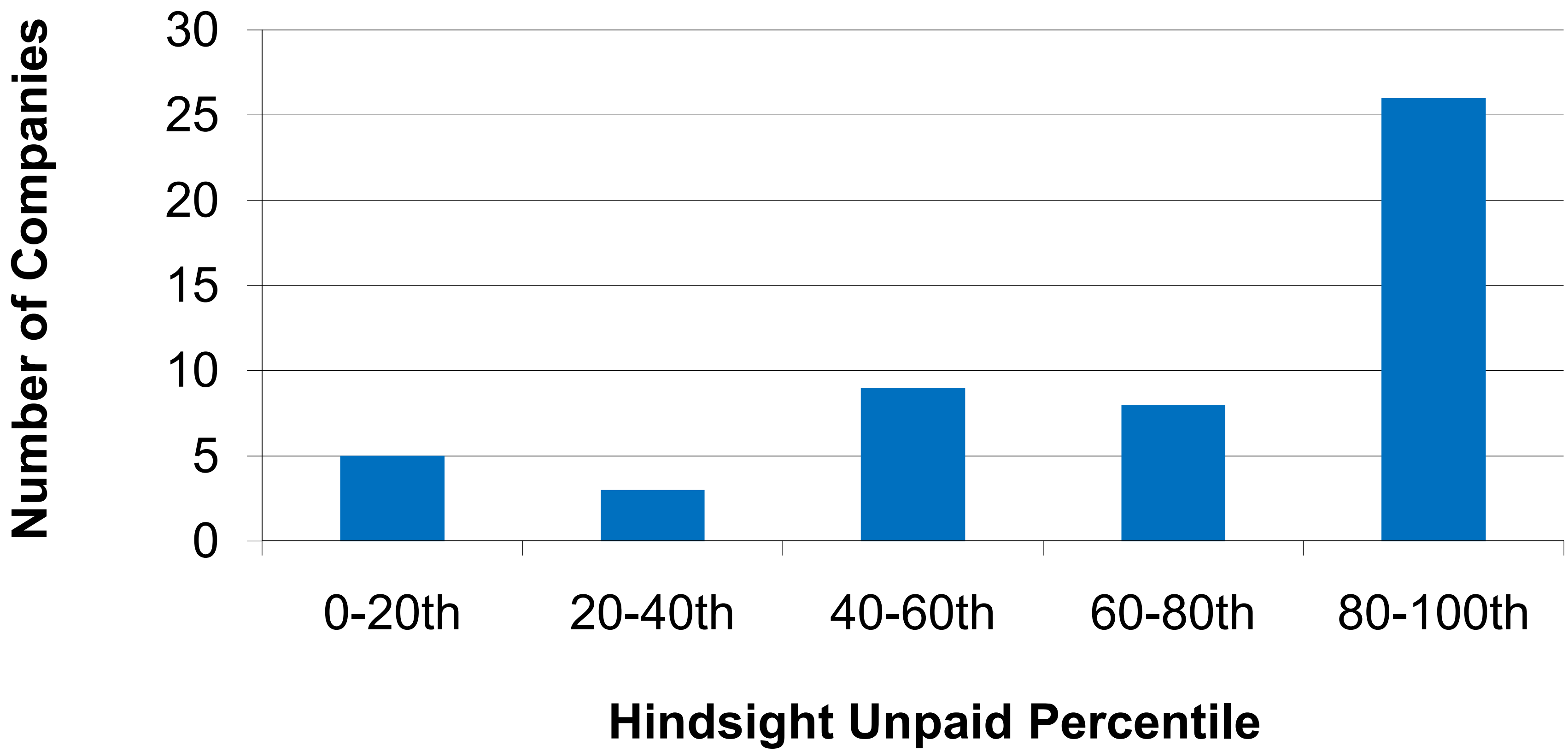
Homeowners as of 12/2000 Histogram of the Hindsight Unpaid Percentile



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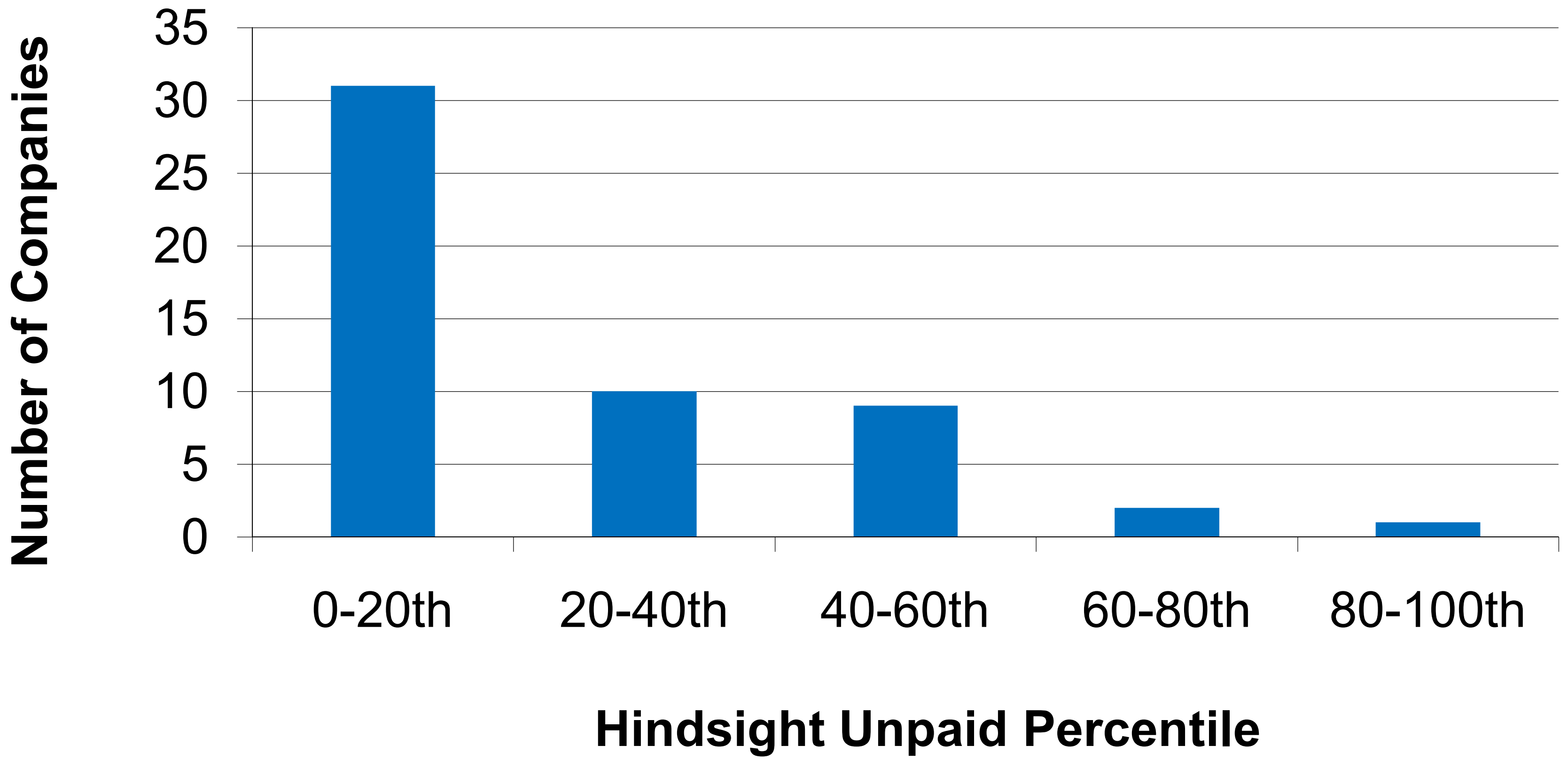
Homeowners as of 12/1996
Histogram of the Hindsight Unpaid Percentile



3rd Test: 8 Accident Years

- 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003
- 27 companies
- 27 x 8 = 216

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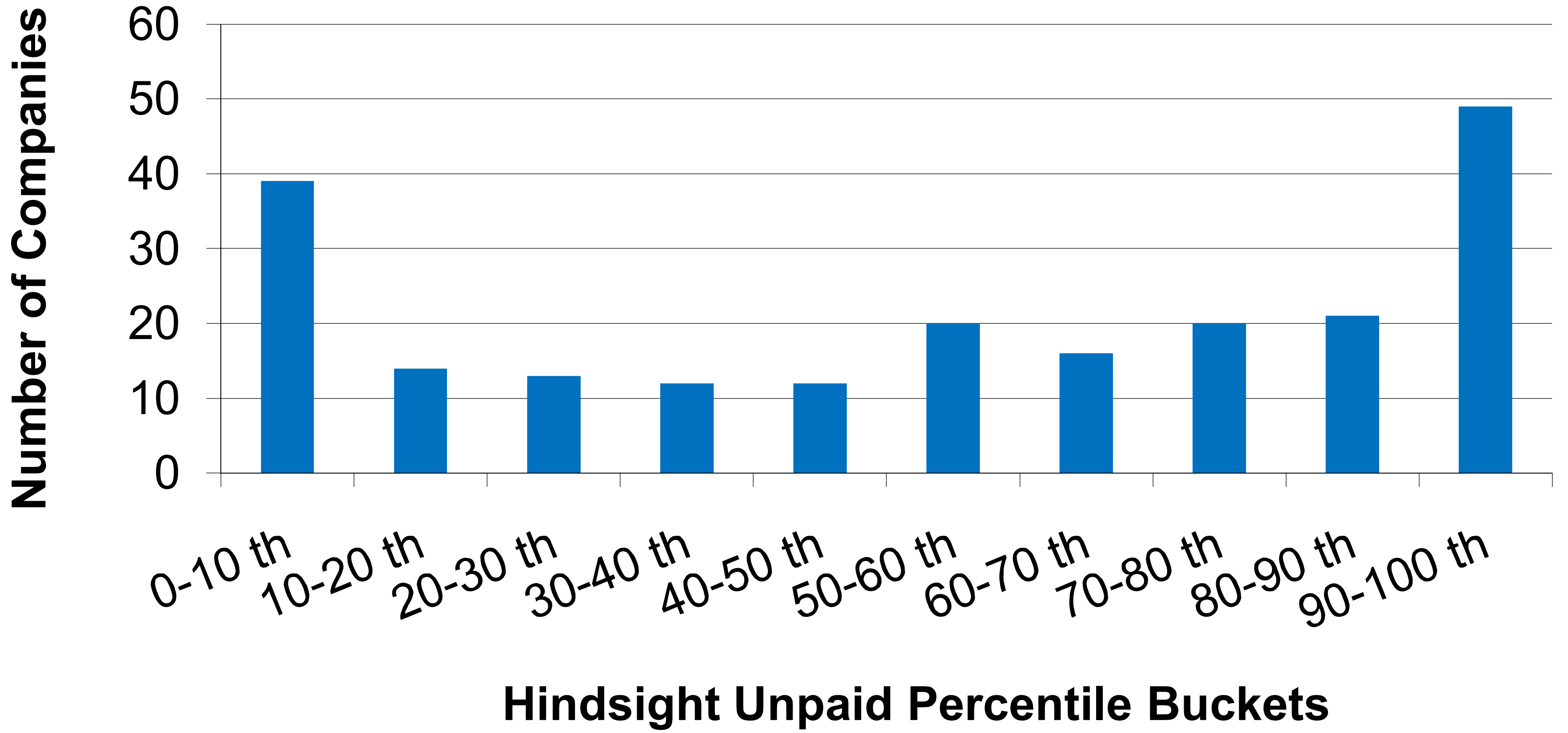
Homeowners
AY 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003
Histogram of the Hindsight Unpaid Percentile



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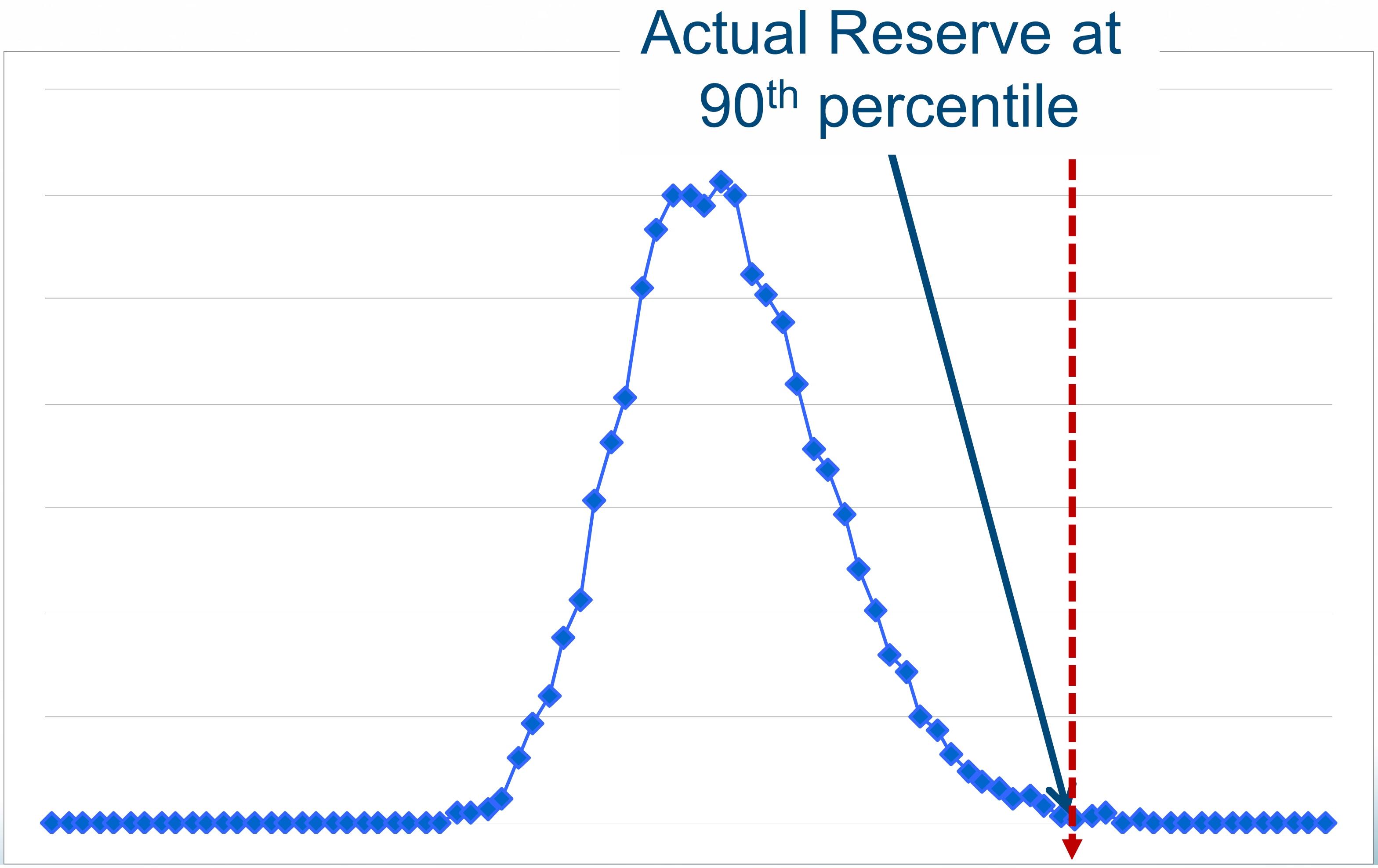
Original distribution



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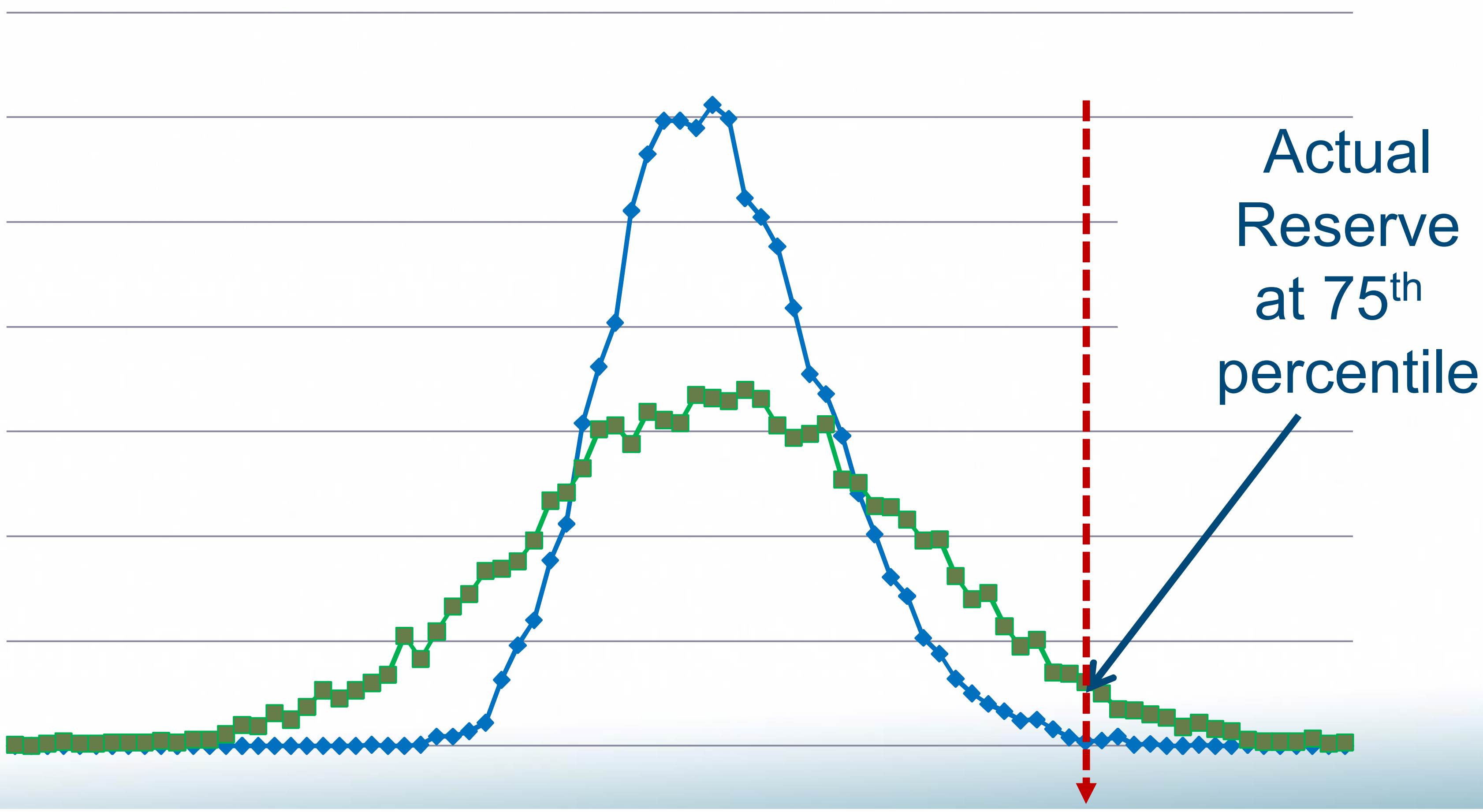
Original vs Wider Distribution



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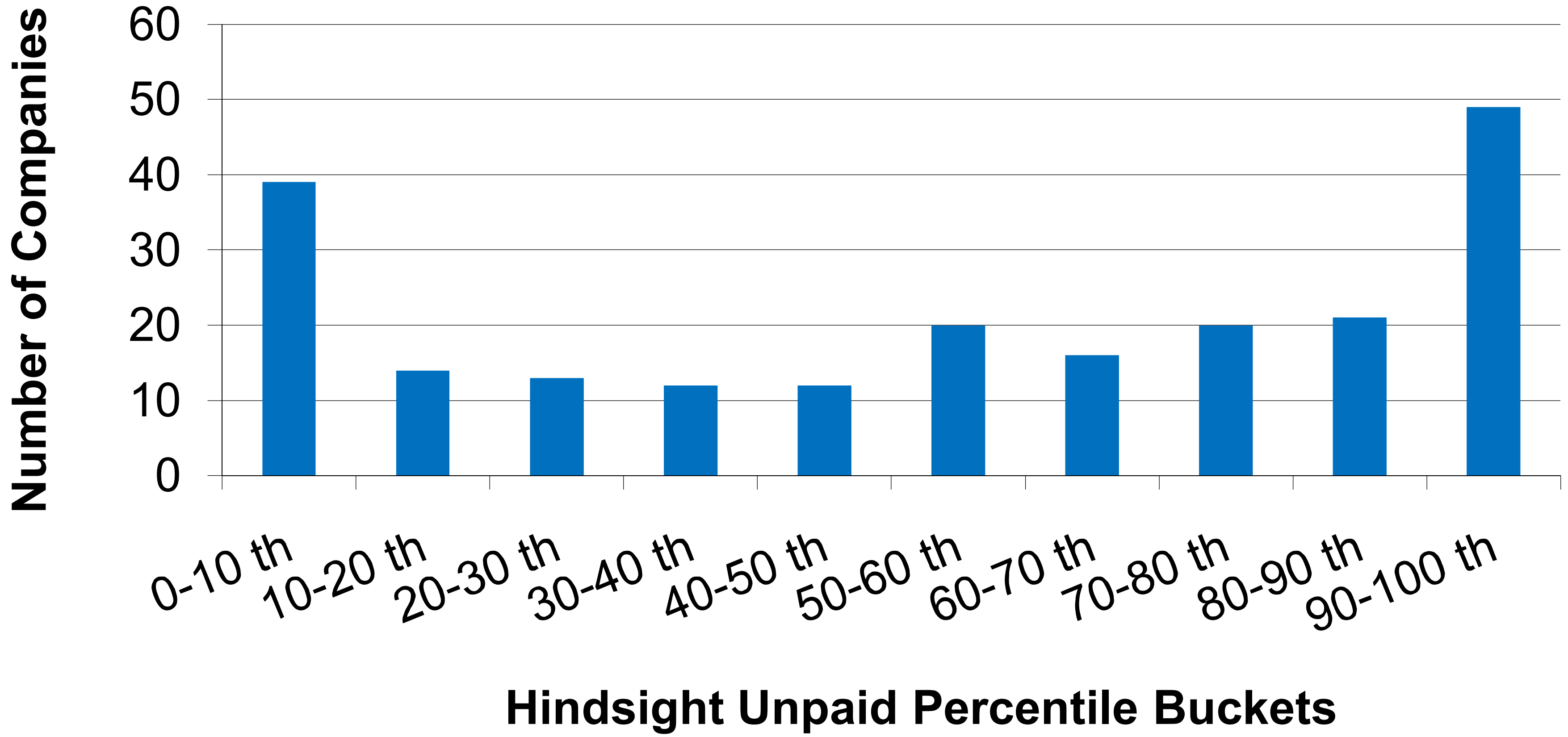
Homeowners
AY 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003
Histogram of the Hindsight Unpaid Percentile



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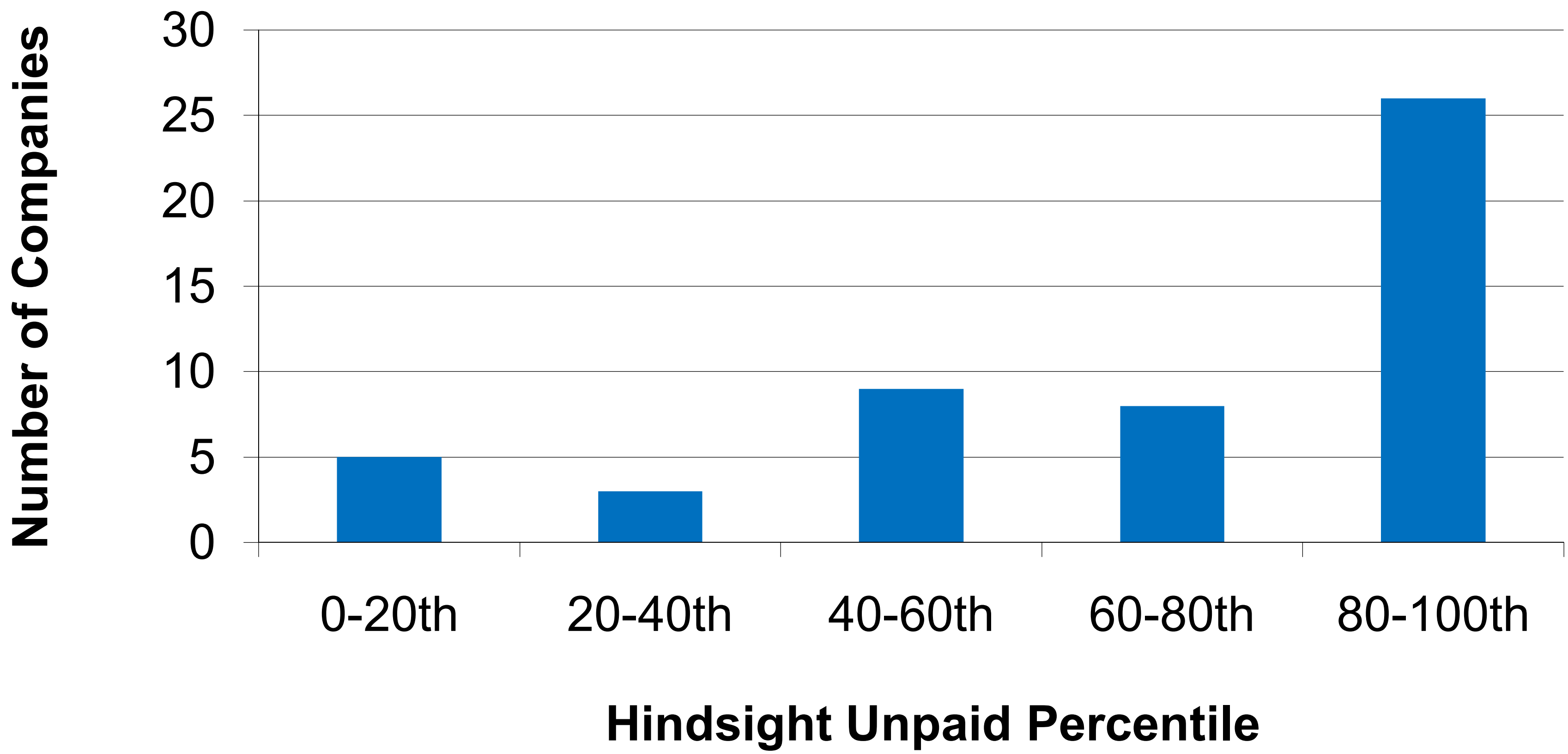
Tests so far

1. Homeowners 12/2000
2. Homeowners 12/1996
3. Homeowners, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003

Homeowners as of 12/2000 Histogram of the Hindsight Unpaid Percentile



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Remove systemic risk

- Multiply by 1.12

- Average $\left\{ \dfrac{\text{actual unpaid}}{\text{mean unpaid}} \right\}$

- Correct for industry-wide under-reserving

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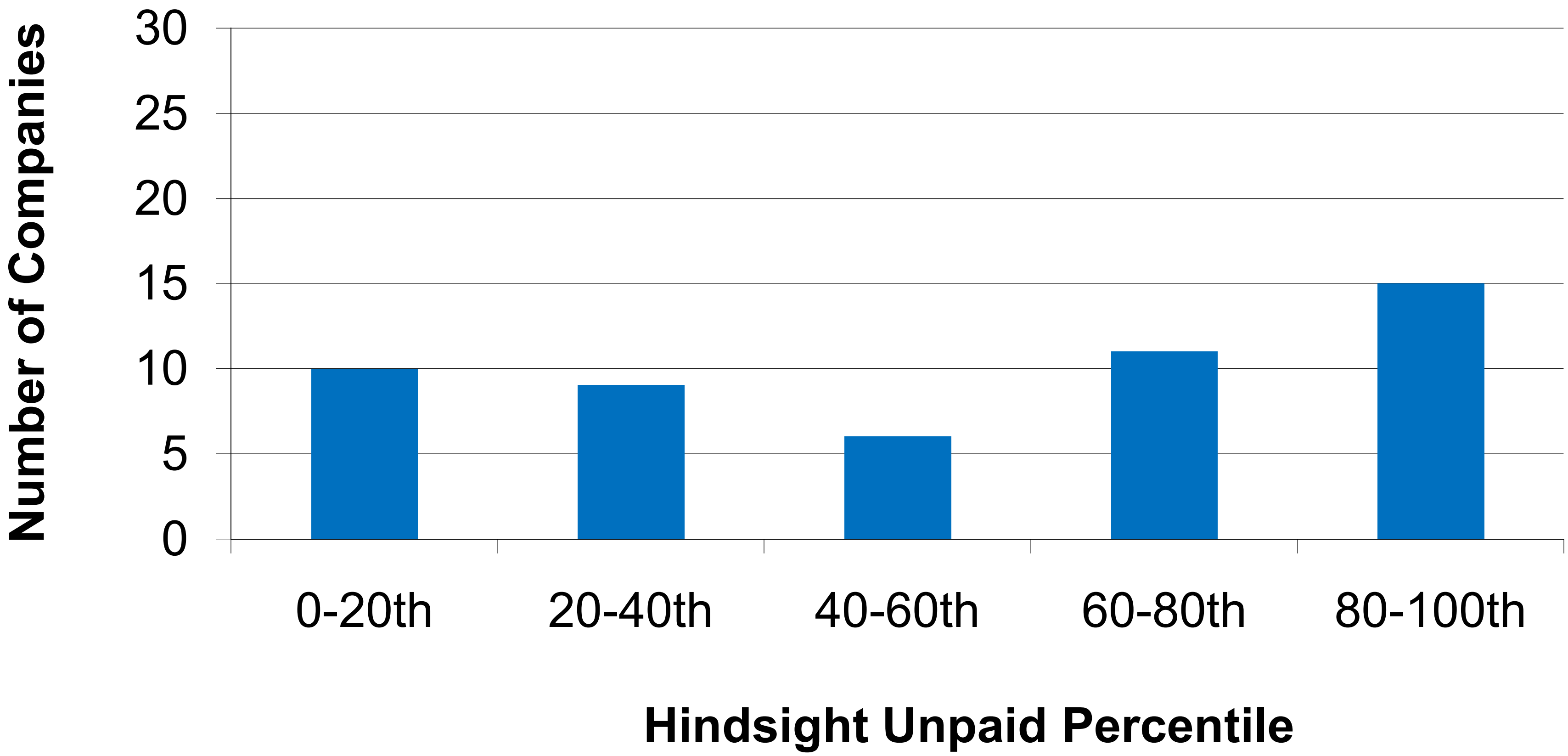
Homeowners as of 12/2000
Scaled Histogram of the Hindsight Unpaid Percentile



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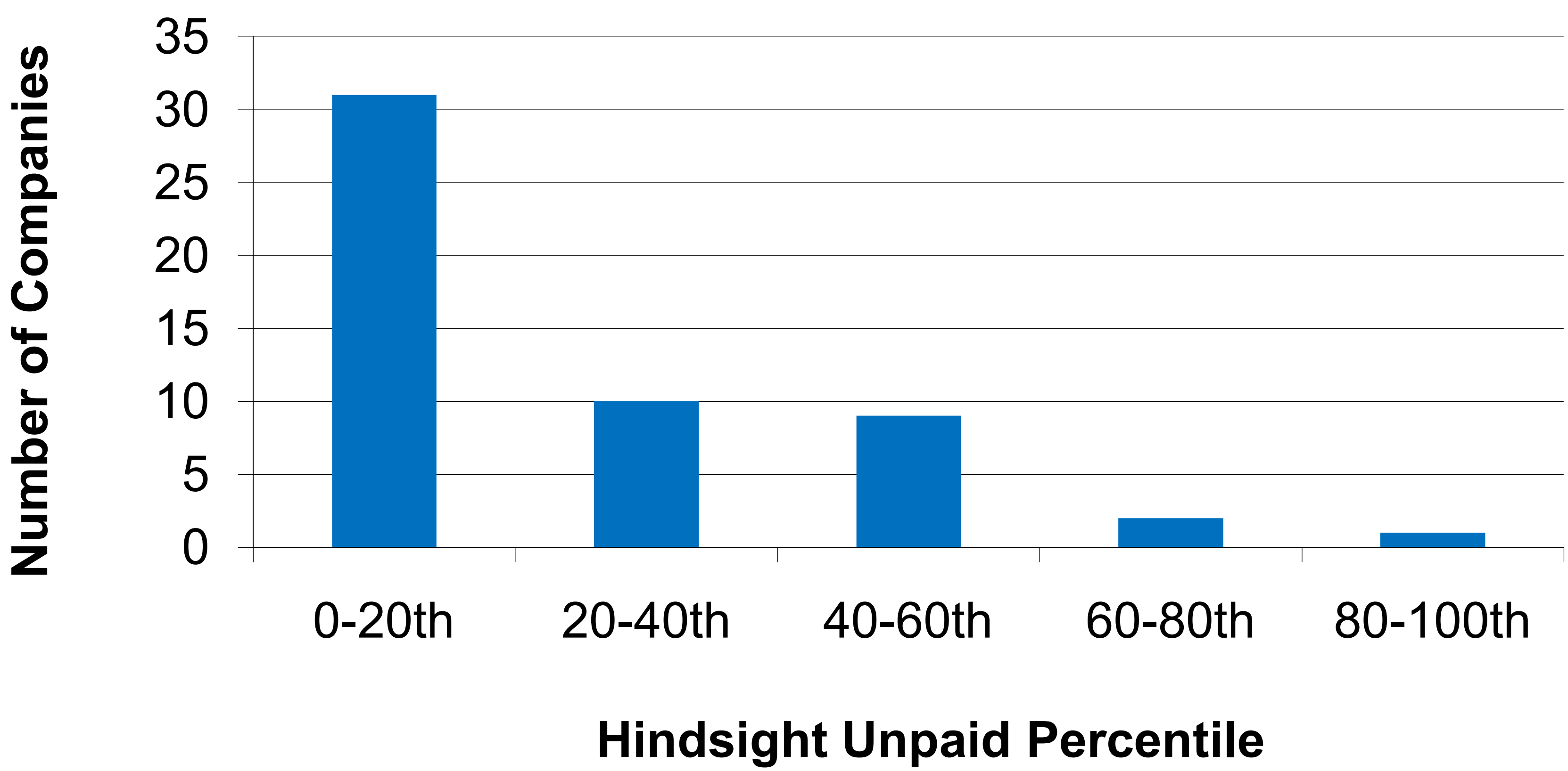
Homeowners as of 12/1996 Histogram of the Hindsight Unpaid Percentile



Remove Systemic Risk

- Multiply by 0.81

- Average $\left\{ \dfrac{\text{actual unpaid}}{\text{mean unpaid}} \right\}$

- Correct for industry-wide over-reserving

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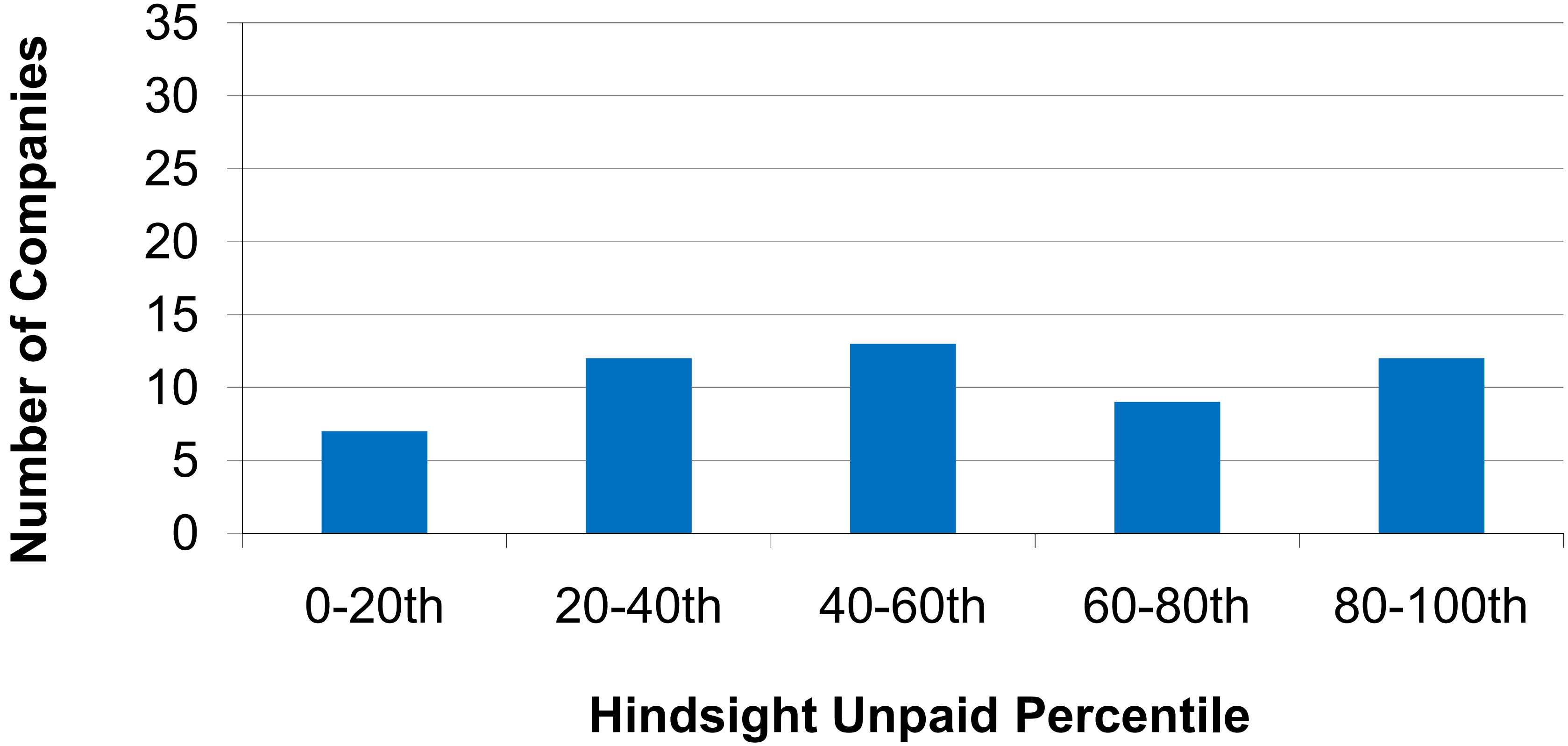
Homeowners as of 12/1996
Scaled Histogram of the Hindsight Unpaid Percentile



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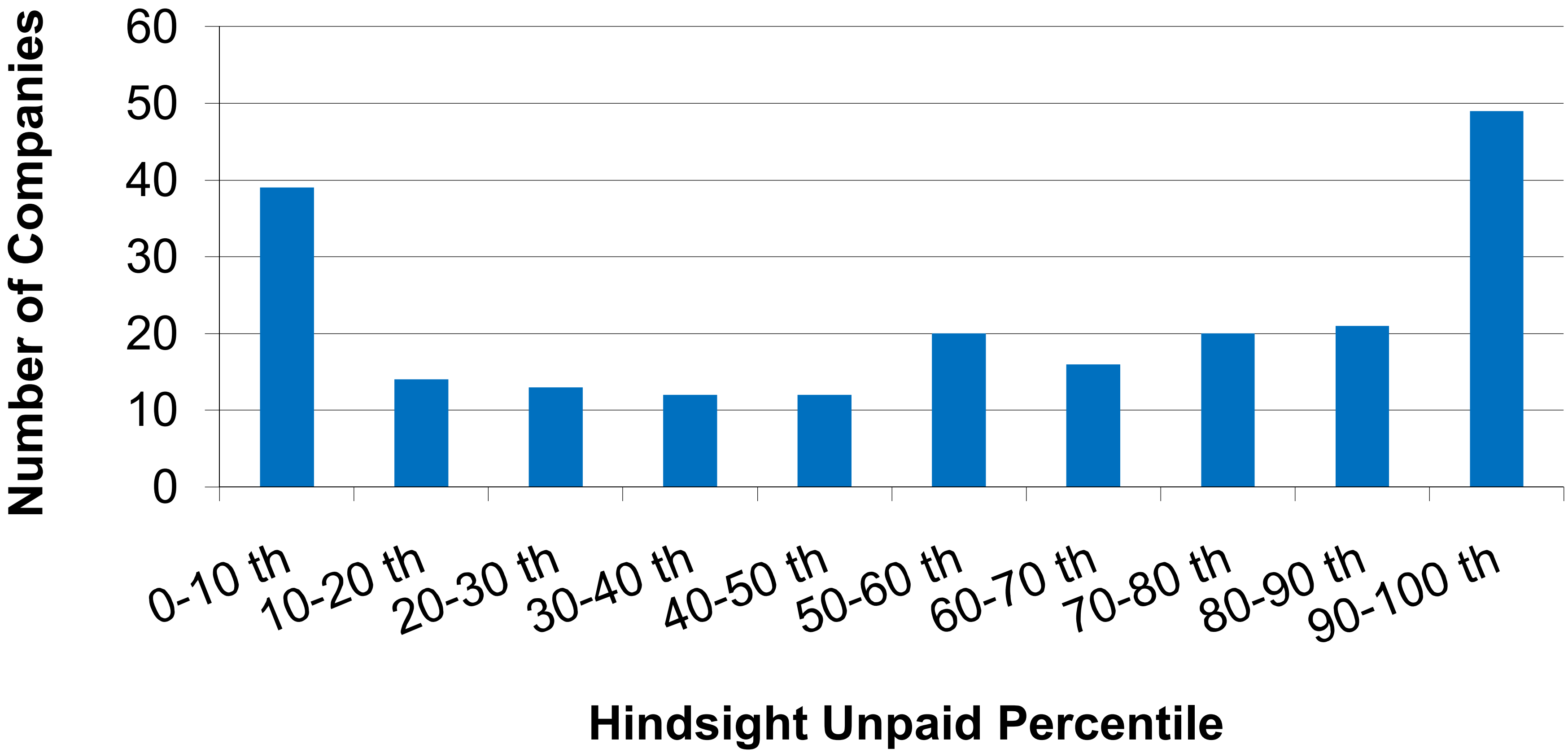
Homeowners
AY 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003
Histogram of the Hindsight Unpaid Percentile



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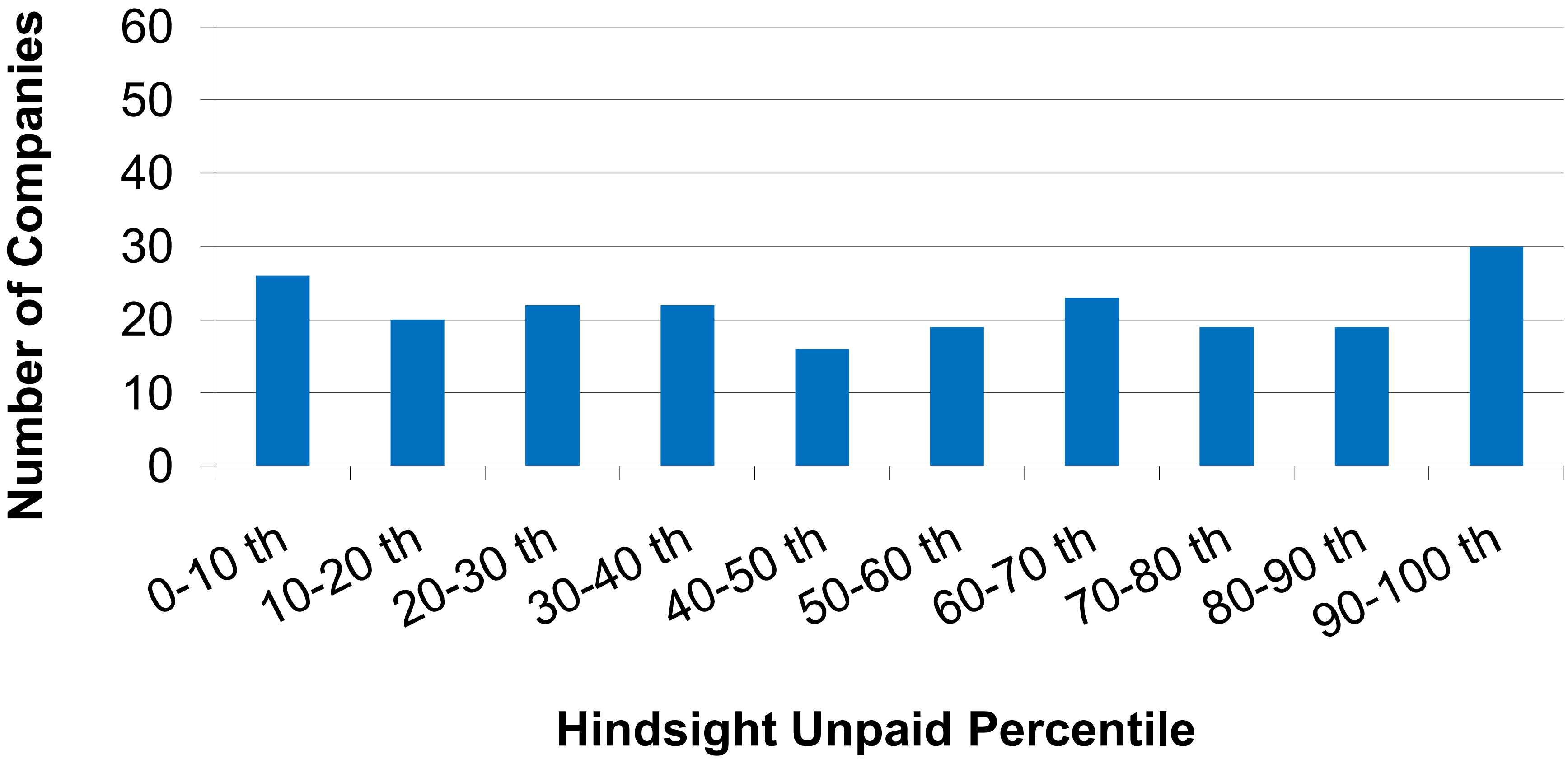
Homeowners – Adjusted by Actual
AY 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003
Histogram of the Hindsight Unpaid Percentile



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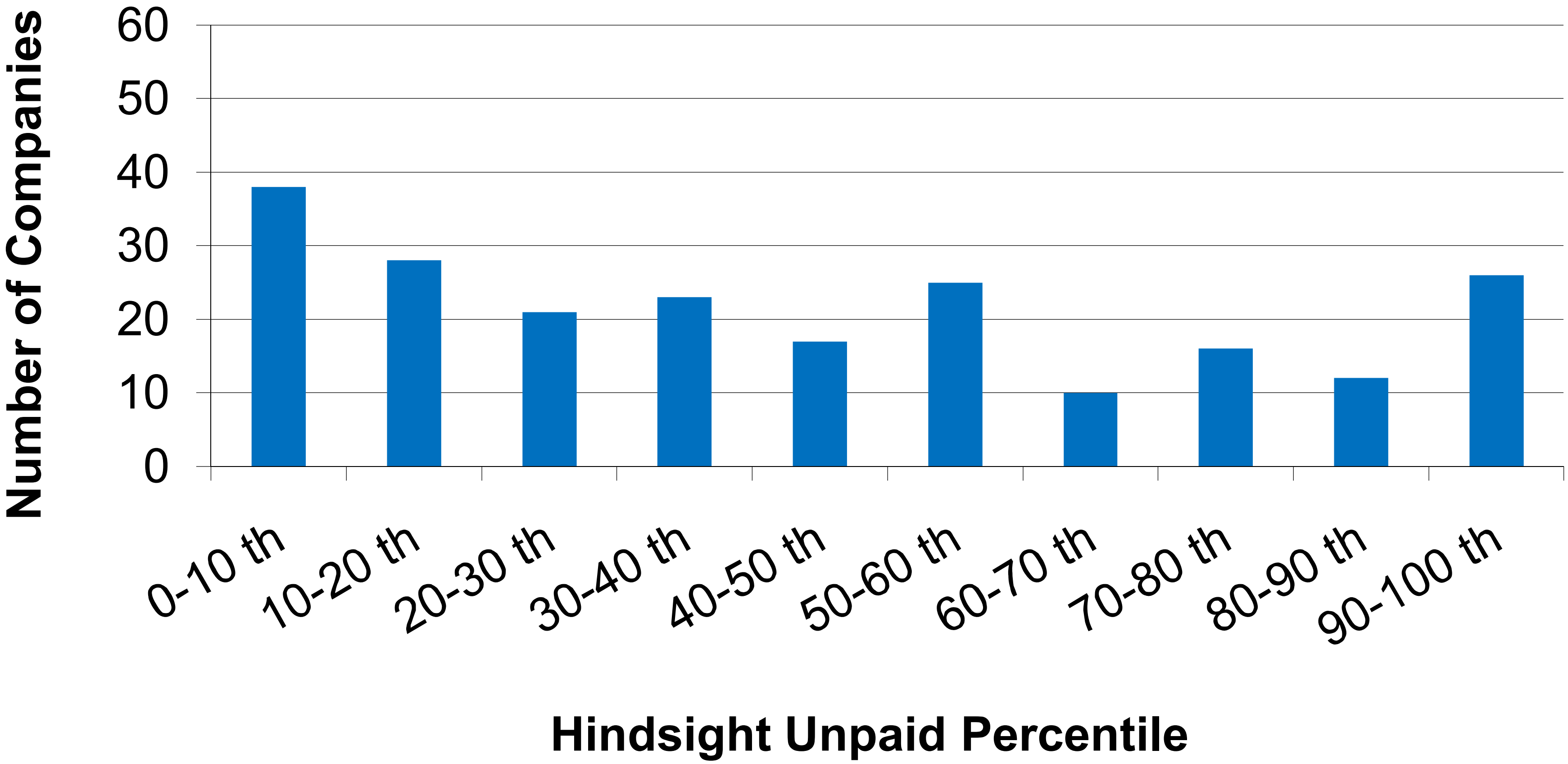
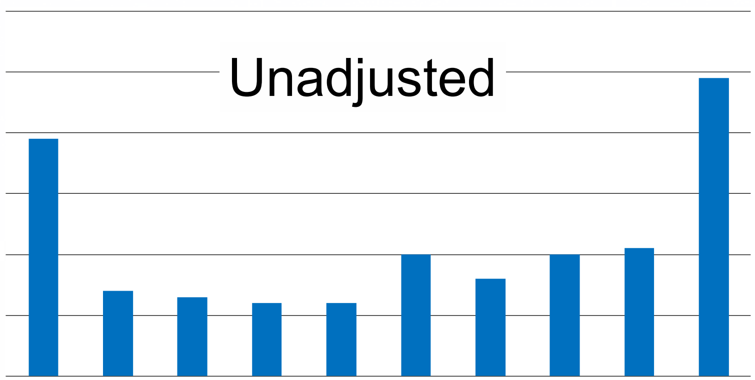
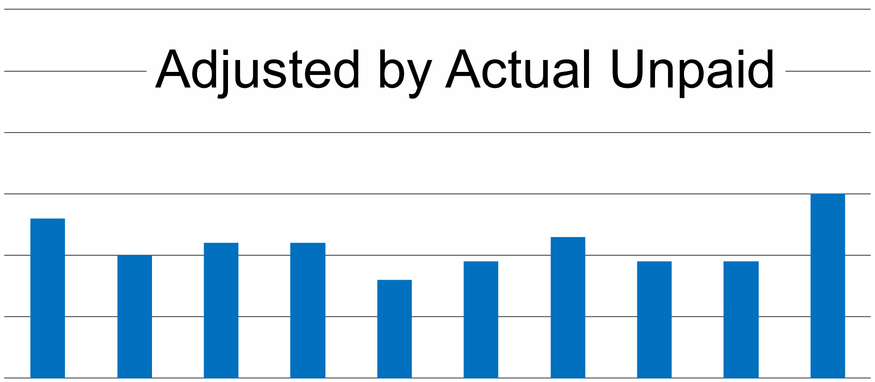
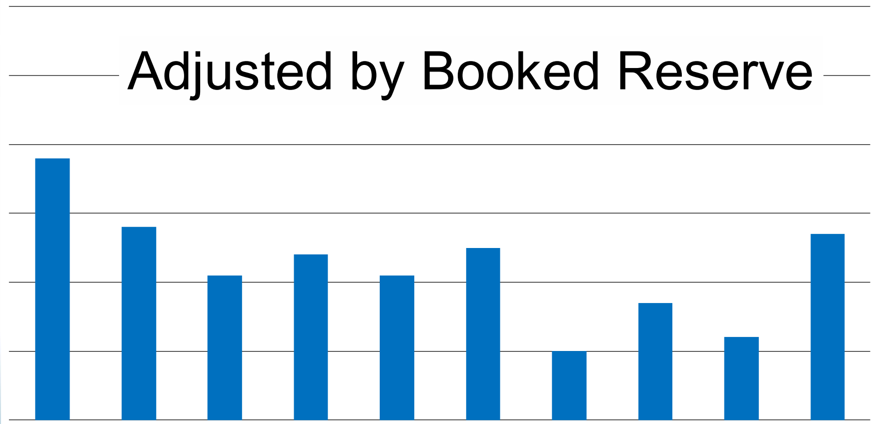
Homeowners – Adjusted by Booked
AY 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003
Histogram of the Hindsight Unpaid Percentile



Homeowners
AY 1996-2003
Histogram of the Hindsight Unpaid Percentile







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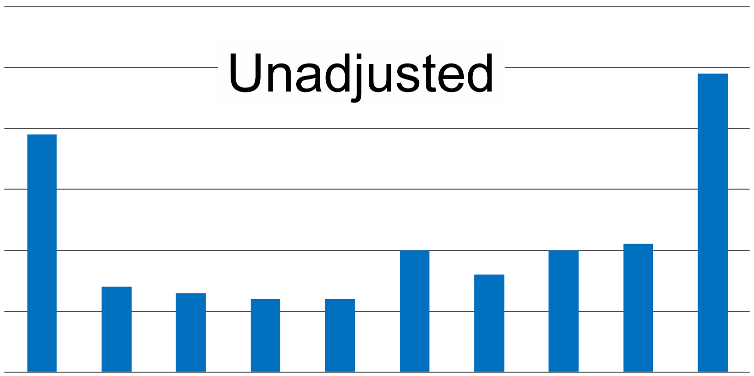
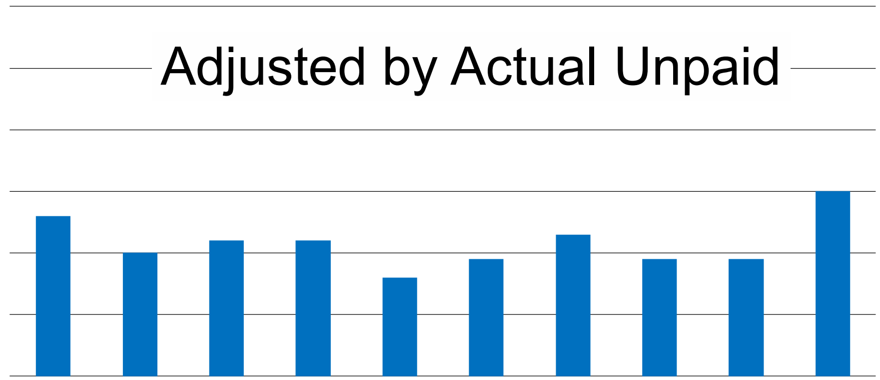
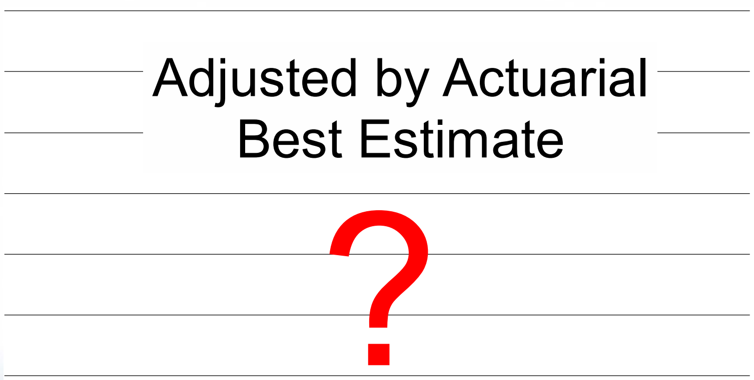
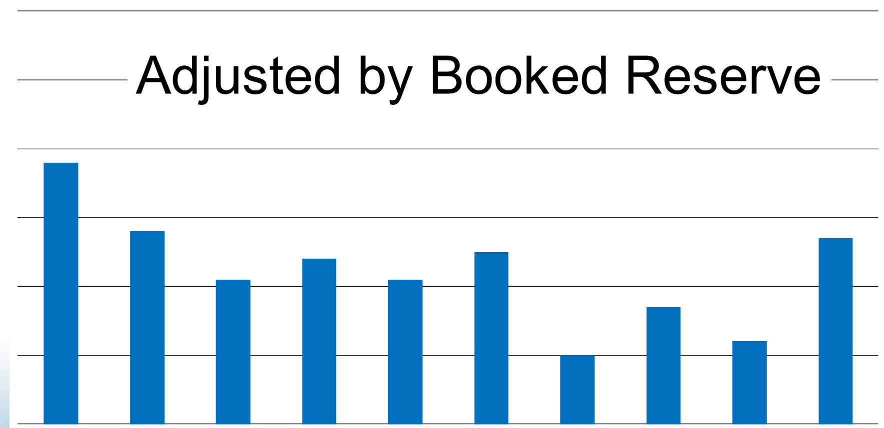
Homeowners
AY 1996-2003
Histogram of the Hindsight Unpaid Percentile









1. Reserve risk theory
2. Testing of Bootstrap Model
3. **Conclusions**

Institute of Actuaries of Australia

Stochastic models only cover independent risk

- fits away past systemic episodes
- if not fit away, is outcome suitable?
- cannot cover model risk / data error

Systemic Risk

Framework for systemic risk

- qualitative
- use of score cards

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Total Risk Modeling

- Independent risk -> stochastic models
- Systemic risk -> qualitative methods

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"Neoclassical **actuarial science** radically oversimplifies both the individuals and the system — and gets a lot of mileage by doing that…But the temptation is always to keep on applying these extreme simplifications, even where the evidence clearly shows that they're wrong. What **actuaries** have to do is learn to resist that temptation. But doing so will, inevitably, lead to a much messier, less pretty view"

Me, channelling Paul Krugman