

# No reality please, we're actuaries

1. Back-testing
2. Analysis of the results
3. Two methods to account for systemic risk



**“No reality please, we’re economists”**

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“The physicist’s discipline is that ...a theory does not become accepted until it’s tested and verified time and time again. ...In economics, we don’t do that.

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Well, it may be beautiful, but it’s wrong... That’s ...the criticism of economics. ...we need to be more empirically based.”

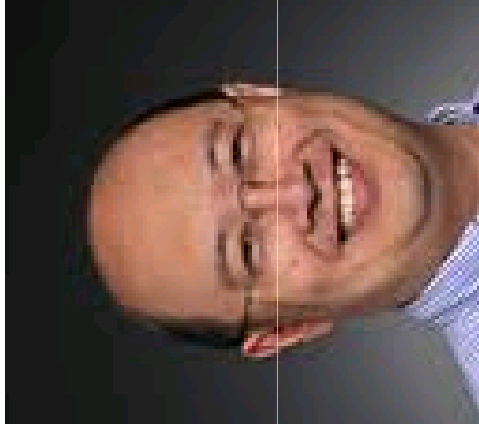
## “No reality please, we’re economists”

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Andrew Lo  
Director of the MIT laboratory  
for financial engineering



**“No reality please, we’re re-economists actuaries”**

# “No reality please, we’re economists actuaries”

- CAS database of actuarial research enquiry (DARE):



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- CAS database of actuarial research enquiry (DARE):
- “Reserve Variability” 119 papers

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- Testing these models.....

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- CAS database of actuarial research enquiry (DARE):
- “Reserve Variability” 119 papers
- “Uncertainty and Ranges” 116 papers
- Testing these models.....3 papers

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# 1. Back-testing: Create a distribution

DATA:

Homeowners  
Company A  
Net Paid Loss & ALAE  
as of 12/2000

10 x 10

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## DATA:

Homeowners  
Company A  
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as of 12/2000

10 x 10

## MODEL:

ODP bootstrap of the paid chain-ladder  
method  
England and Verrall (2002)  
No tail factor (unpaid to 120 months)



# 1. Back-testing: Create a distribution

DATA:

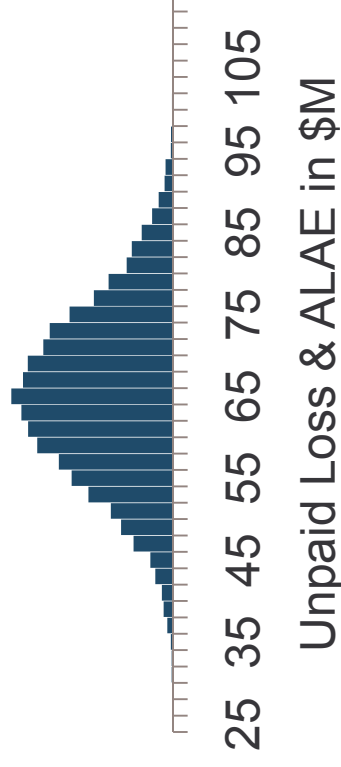
Homeowners  
Company A  
Net Paid Loss & ALAE  
as of 12/2000



MODEL:

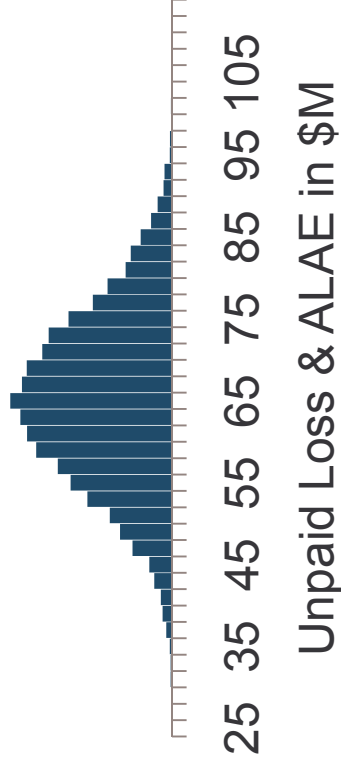
ODP bootstrap of the paid chain-ladder  
method  
England and Verrall (2002)  
No tail factor (unpaid to 120 months)

RESERVE DISTRIBUTION:  
for all AYs



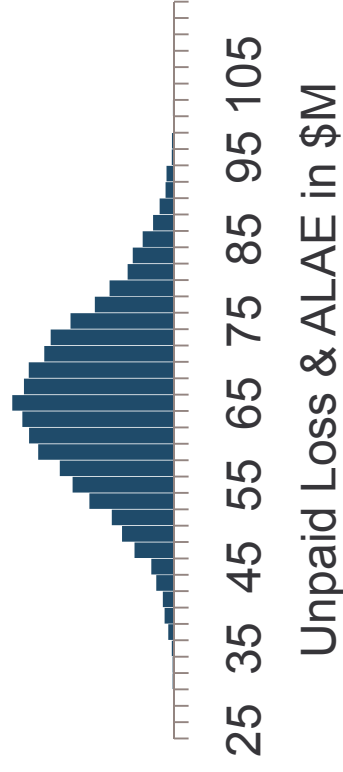
# 1. Back-testing: test the distribution

RESERVE DISTRIBUTION:  
for all AYs

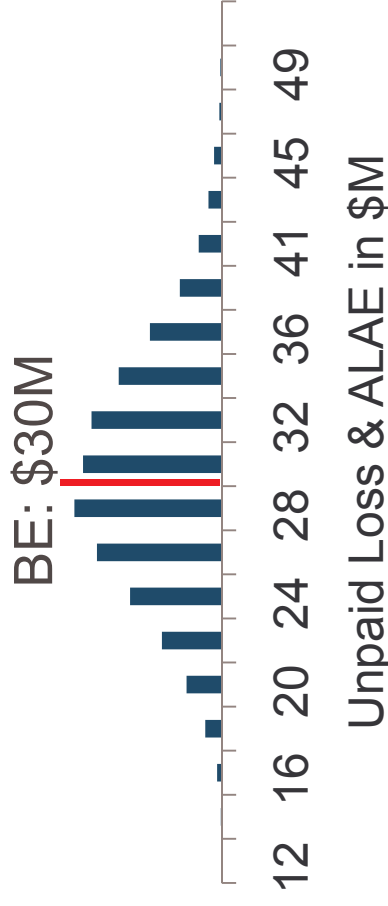


# 1. Back-testing: test the distribution

RESERVE DISTRIBUTION:  
for all AYs

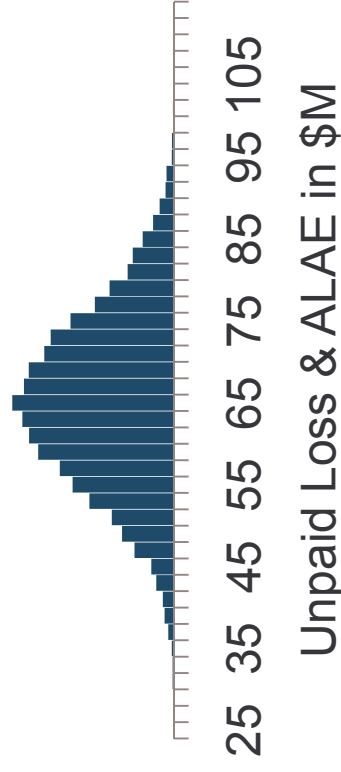


RESERVE DISTRIBUTION:  
for AY 2000

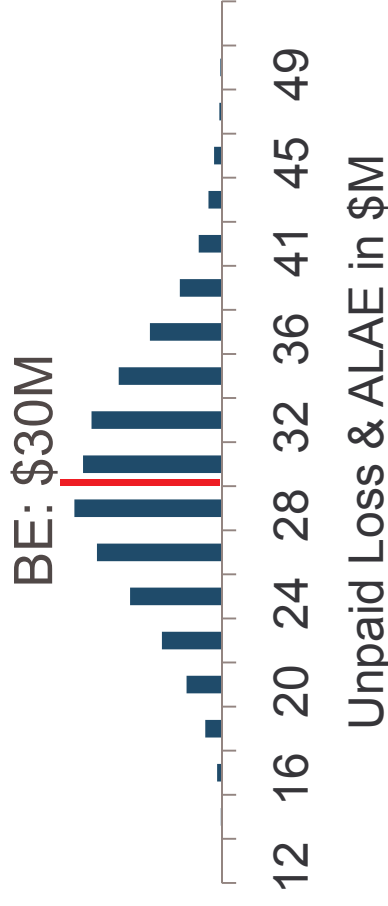


# 1. Back-testing: test the distribution

RESERVE DISTRIBUTION:  
for all AYs



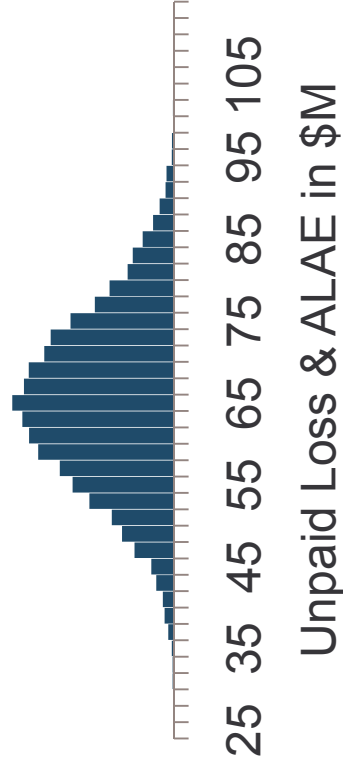
RESERVE DISTRIBUTION:  
for AY 2000



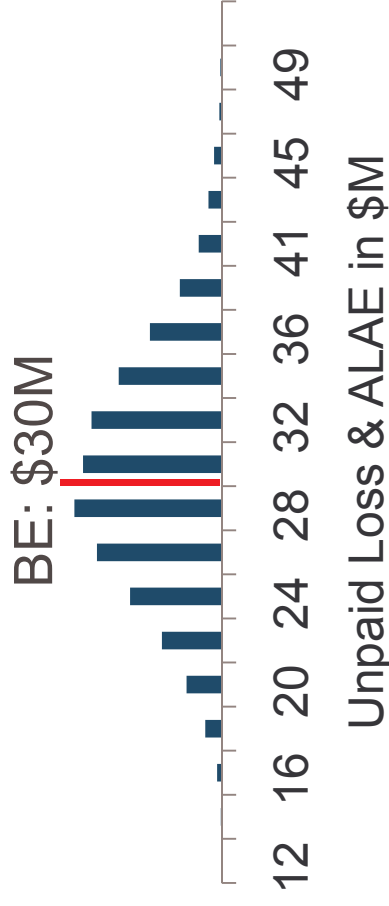
HINDSIGHT RESERVE = \$59M paid at 120 months  
less \$14M paid at 12 months

# 1. Back-testing: test the distribution

RESERVE DISTRIBUTION:  
for all AYs



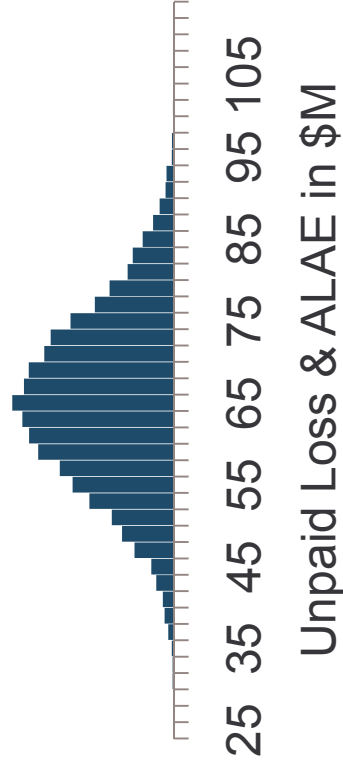
RESERVE DISTRIBUTION:  
for AY 2000



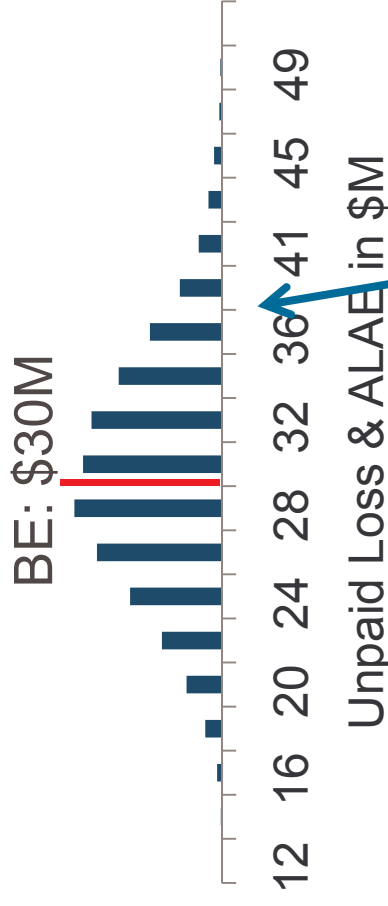
HINDSIGHT RESERVE = \$38M

# 1. Back-testing: test the distribution

RESERVE DISTRIBUTION:  
for all AYs



RESERVE DISTRIBUTION:  
for AY 2000



HINDSIGHT RESERVE = \$38M at the 91<sup>st</sup> percentile

# 1. Back-testing: results

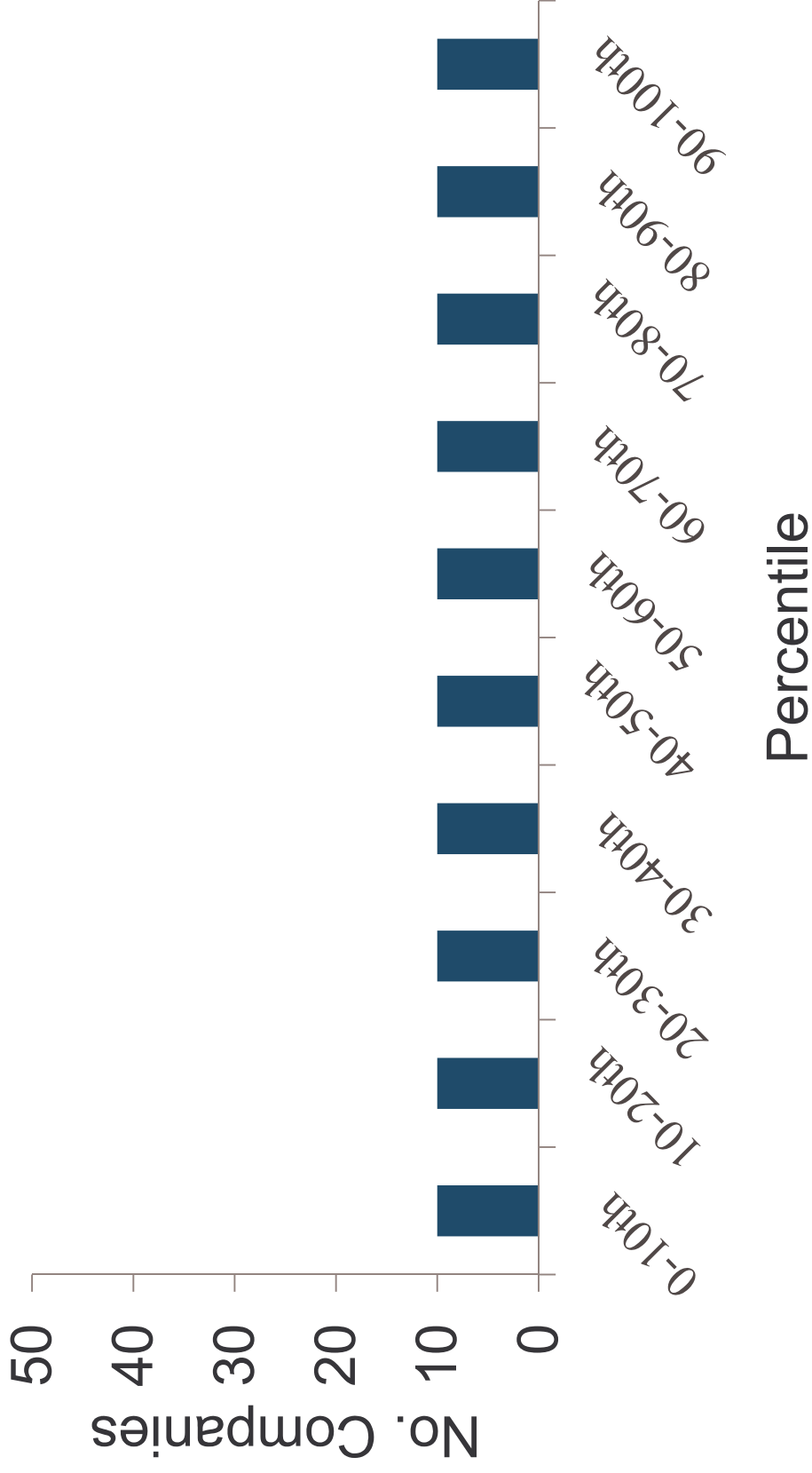
Company	Percentile
Company A	91%

# 1. Back-testing: results

Company	Percentile
Company A	91%
Company B	55%
Company C	88%
Company D	92%
Company E	39%
Company F	75%
Company G	67%
...	...

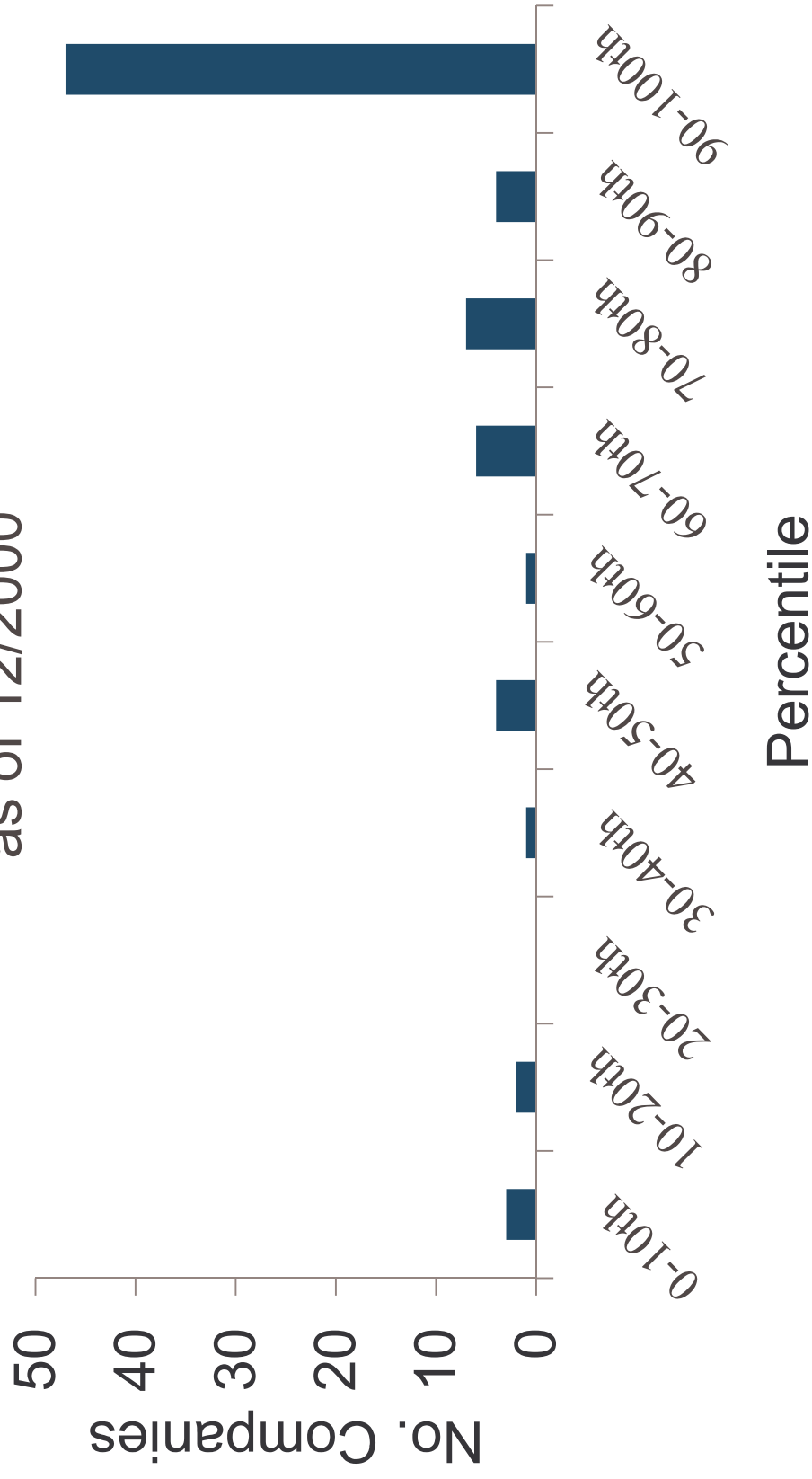


# 1. Back-testing: ideal histogram of percentiles



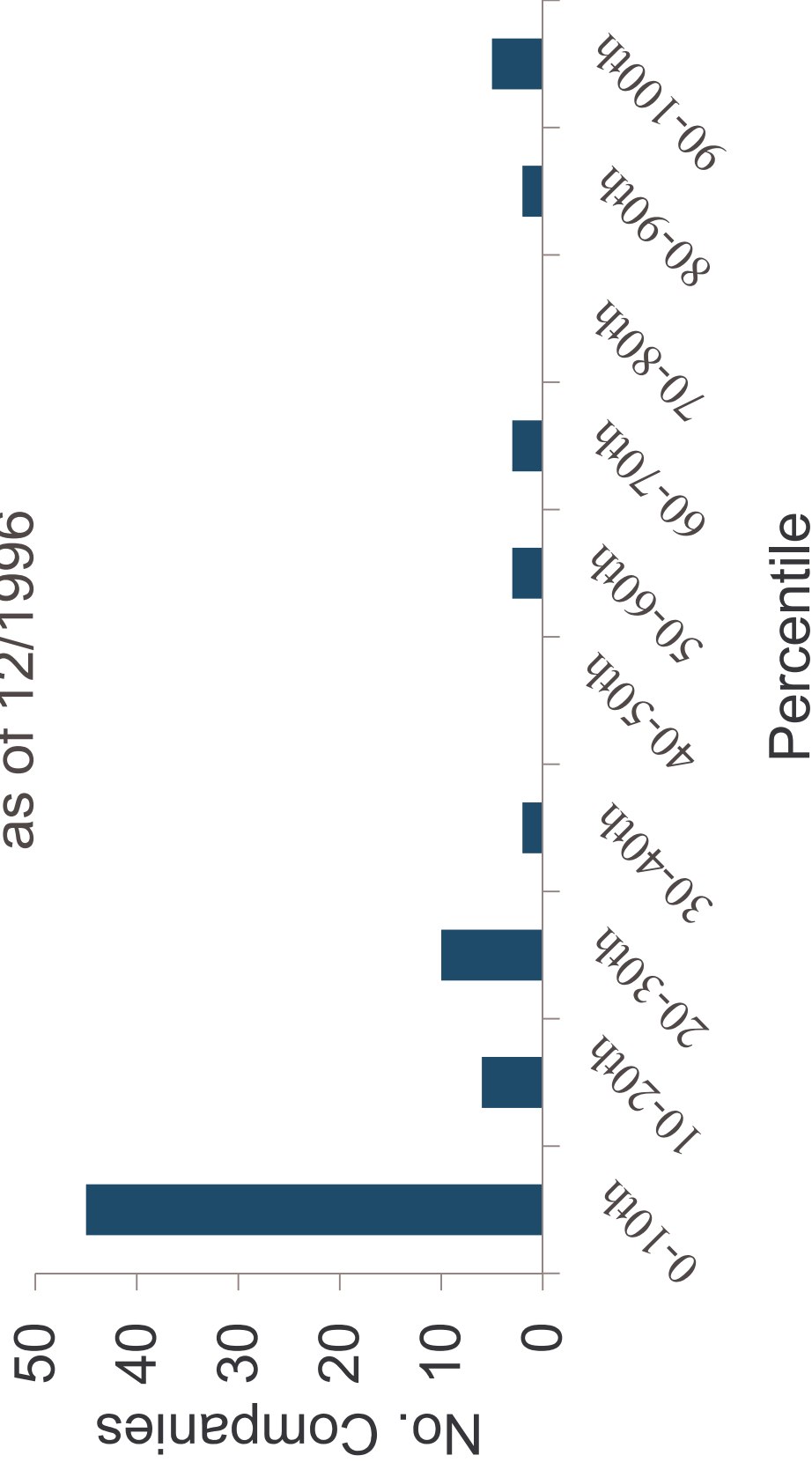
# 1. Back-testing: Actual histogram of percentiles

Histogram of percentiles for Homeowners  
as of 12/2000



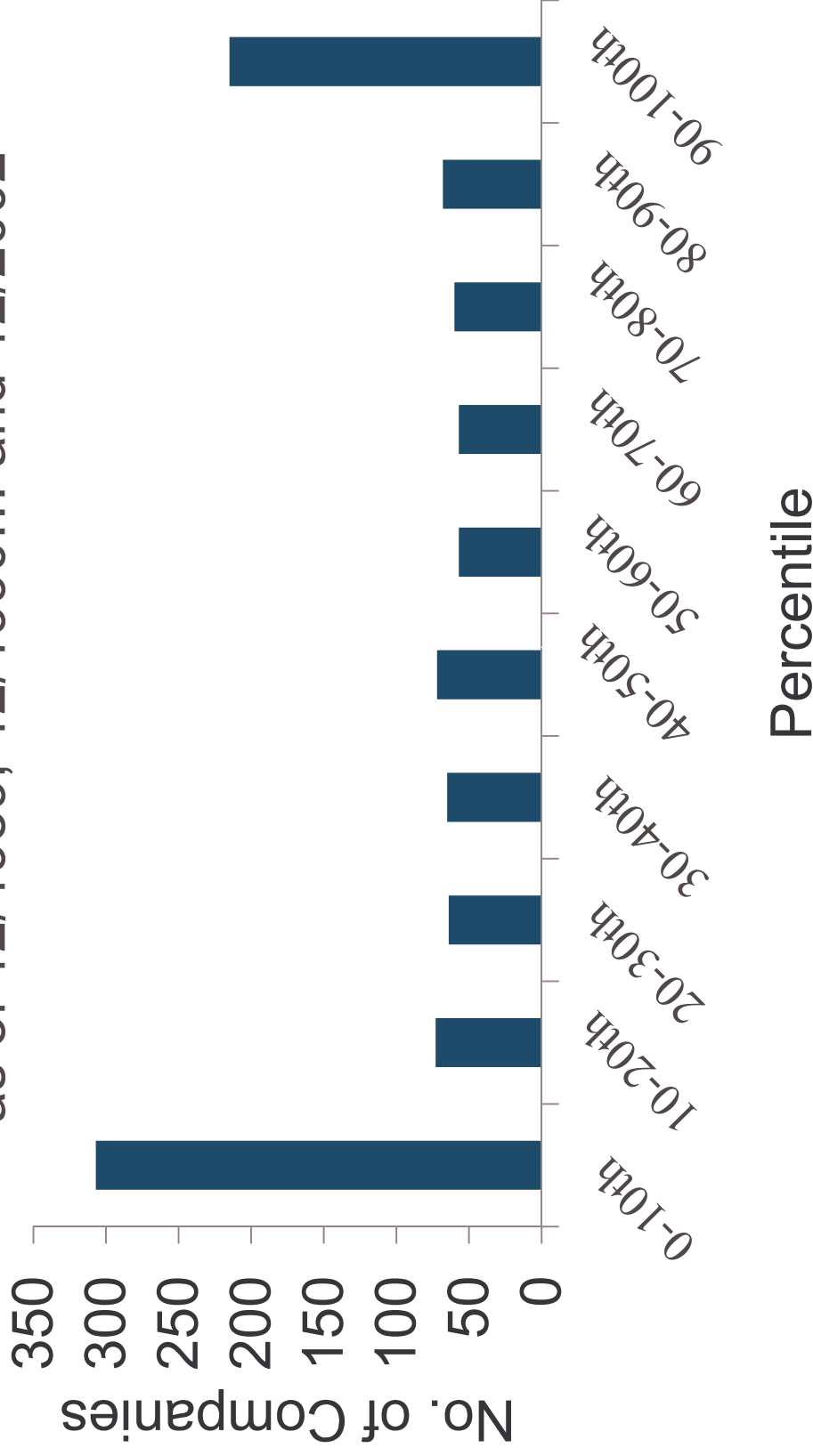
# 1. Back-testing: ideal histogram of percentiles

Histogram of percentiles for Homeowners  
as of 12/1996

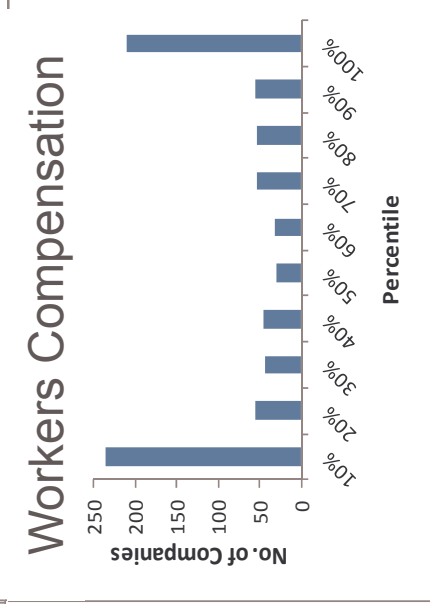
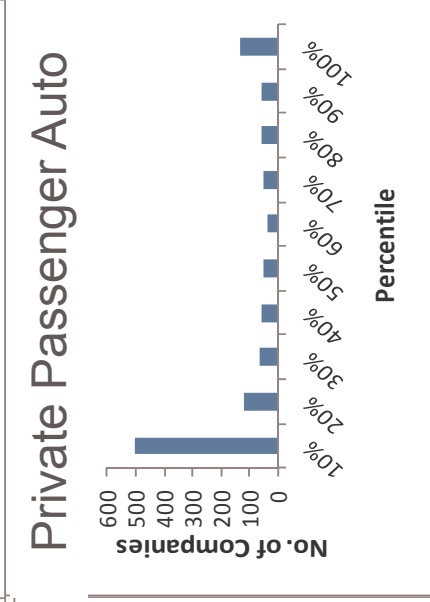
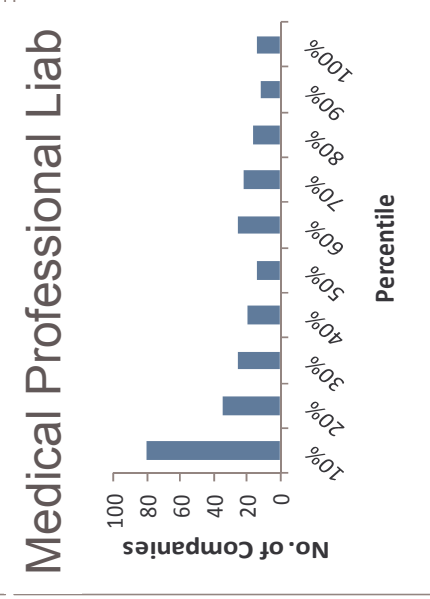
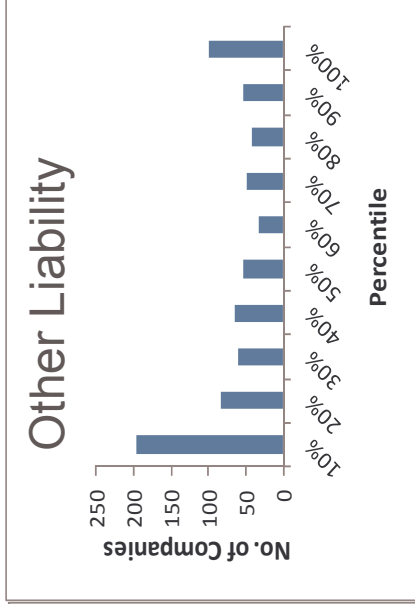
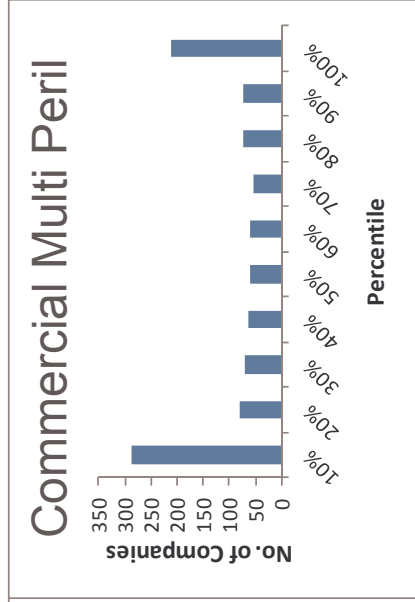
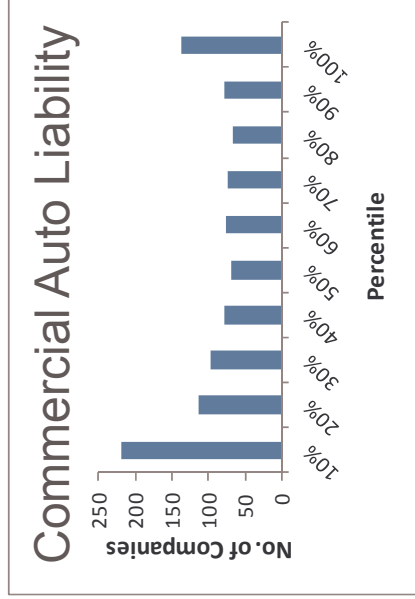


# 1. Back-testing: ideal histogram of percentiles

Histogram of percentiles for Homeowners as of 12/1989, 12/1990... and 12/2002



# 1. Back-testing: histogram of percentiles by line



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# Why are we seeing these results?



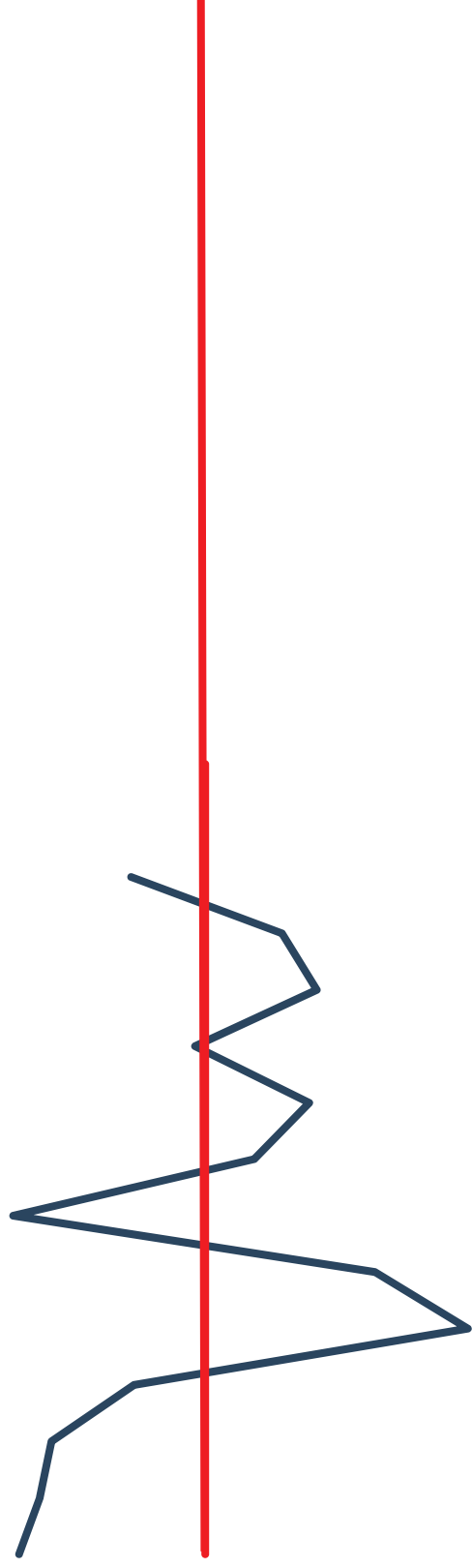
## Why are we seeing these results?

- In an Institute of Actuaries of Australia: “A Framework for Assessing Risk Margins,” the sources of uncertainty into two parts:..

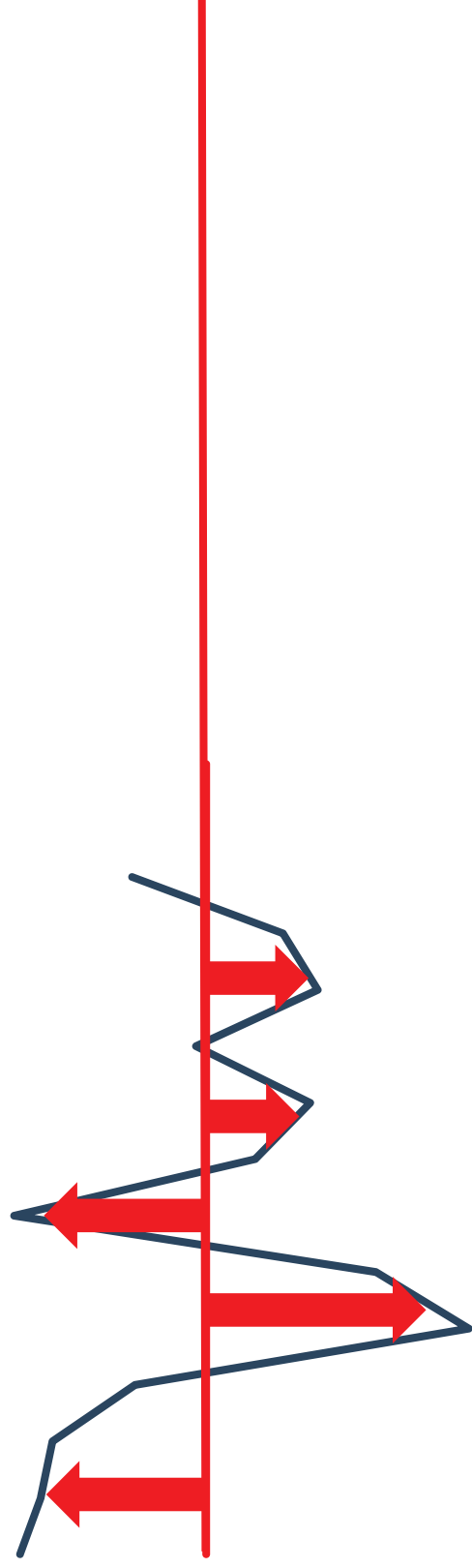
## Why are we seeing these results?

- In an Institute of Actuaries of Australia: “A Framework for Assessing Risk Margins,” the sources of uncertainty into two parts:..
  - Independent risk
  - Systemic risk

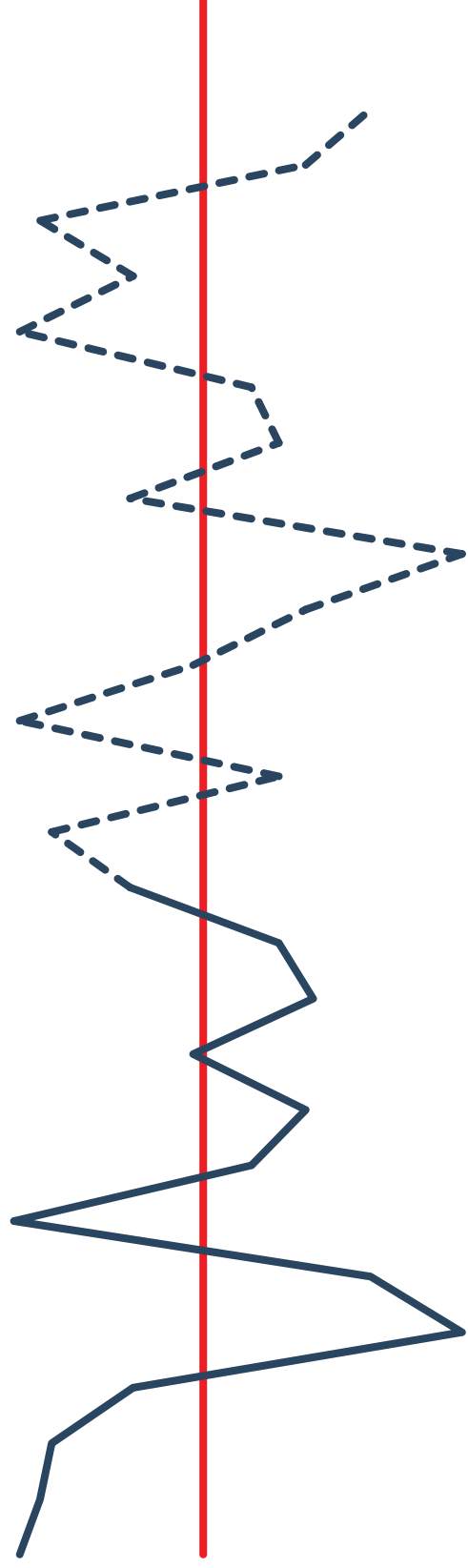
# How the bootstrap model works



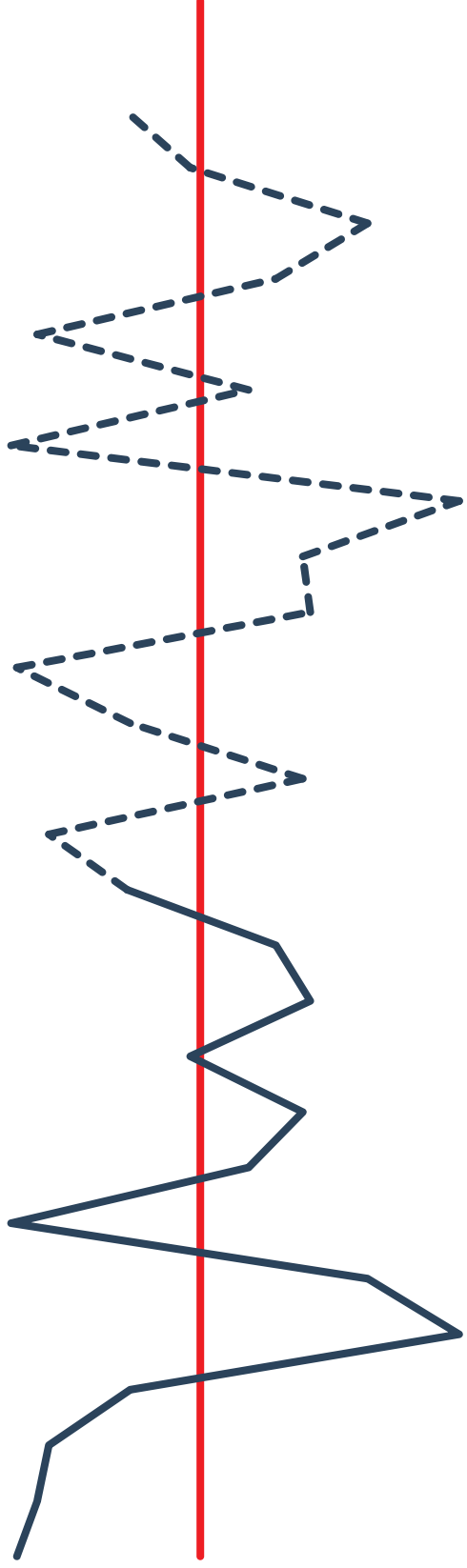
# How the bootstrap model works



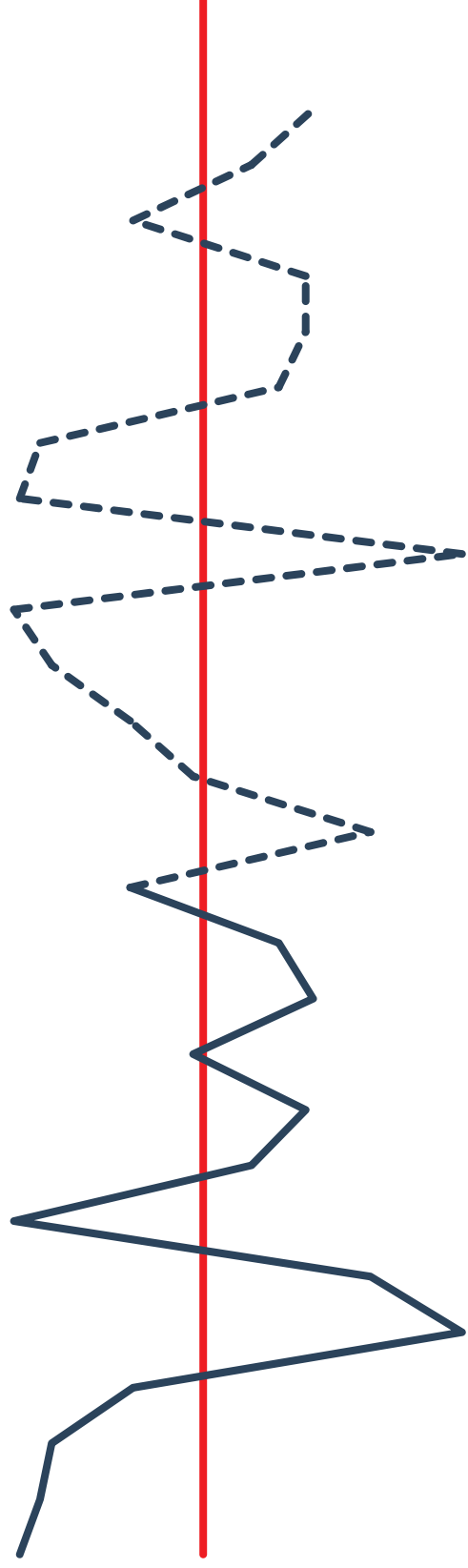
# How the bootstrap model works



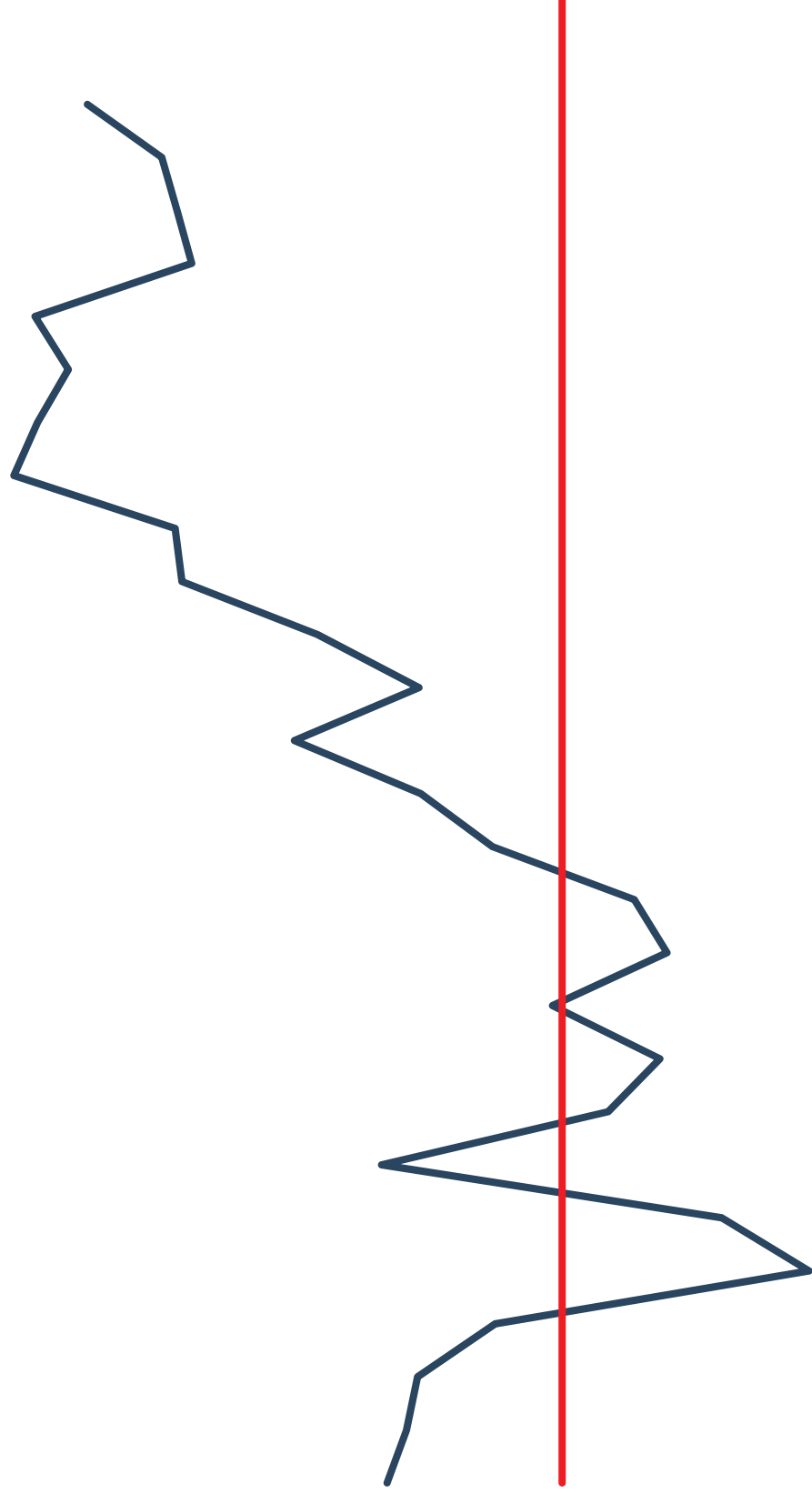
# How the bootstrap model works



# How the bootstrap model works



...systemic risk!





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# No reality please, we're actuaries

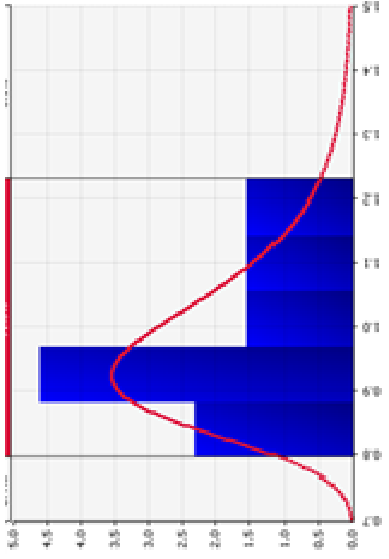
1. Back-testing
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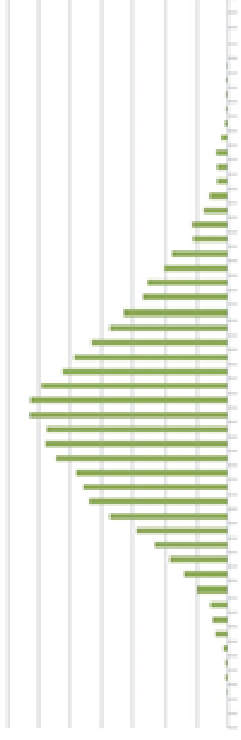
### 3. Two methods to account for systemic risk

- a) The systemic risk distribution method
- b) Wang transform adjustment

# The systemic risk distribution method



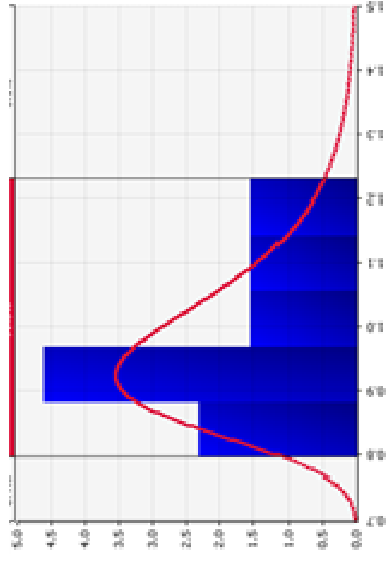
Systemic Risk Distribution



Independent Risk Distribution

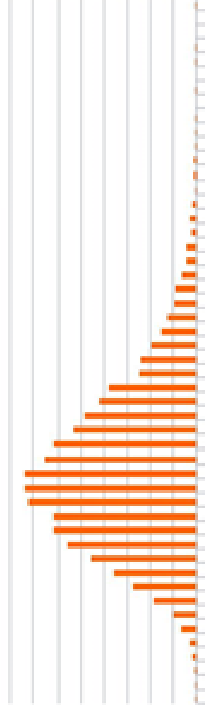


# The systemic risk distribution method



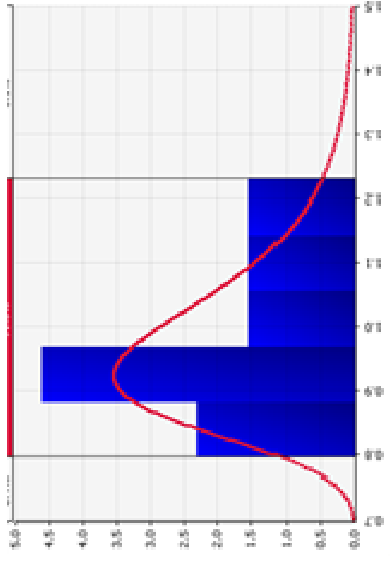
Systemic Risk Distribution

**X**



Independent Risk Distribution

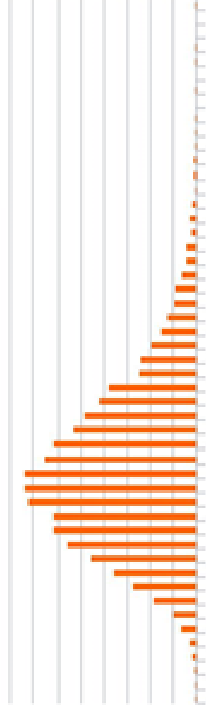
# The systemic risk distribution method



Systemic Risk Distribution

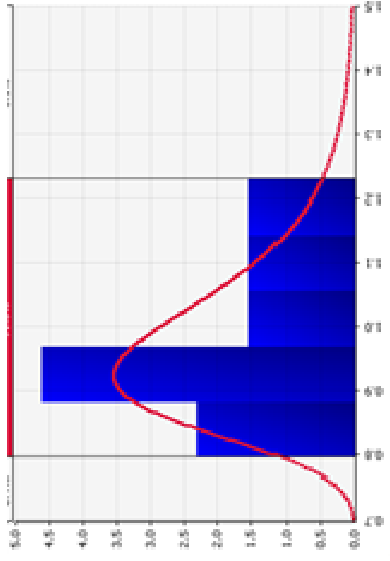
1.13

X



Independent Risk Distribution

# The systemic risk distribution method

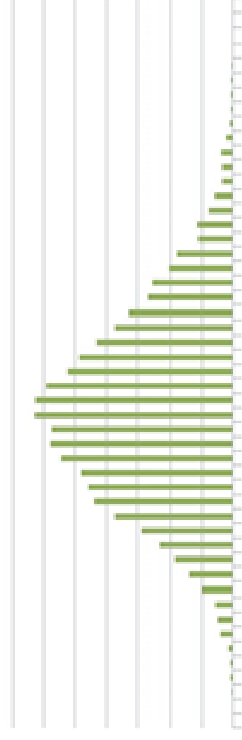


Systemic Risk Distribution

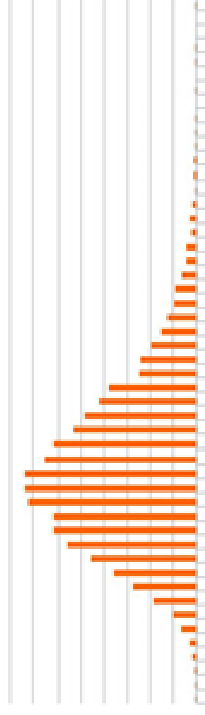
1.13

X

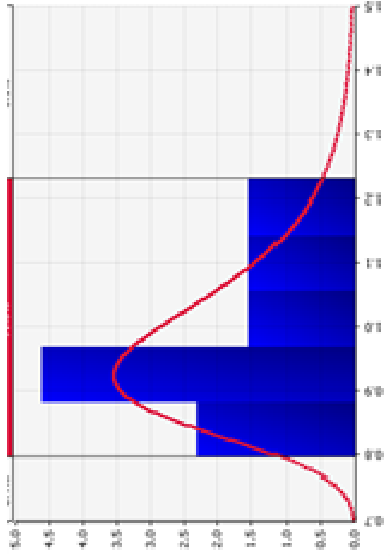
\$32 million



Independent Risk Distribution



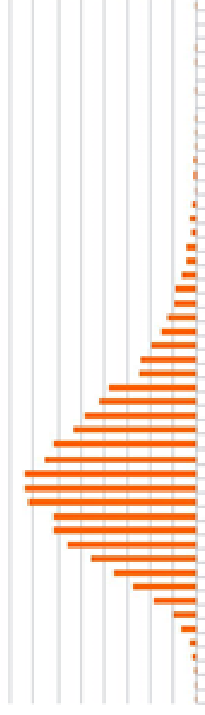
# The systemic risk distribution method



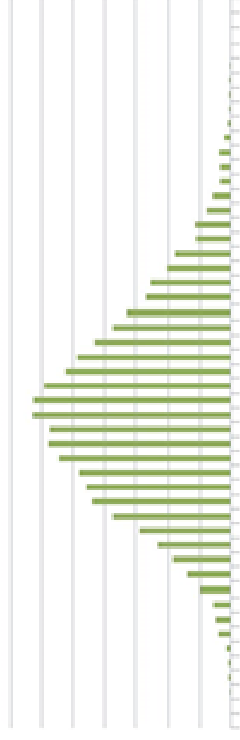
Systemic Risk Distribution

1.13

X



\$36 million

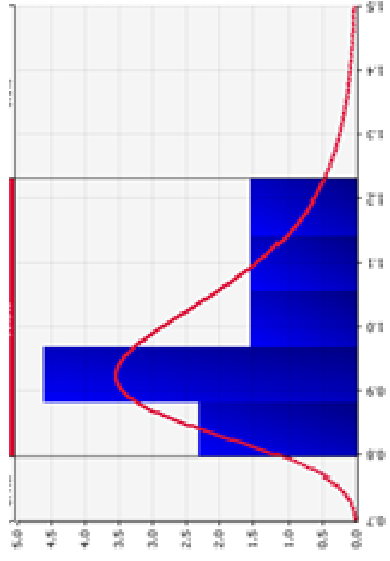


Independent Risk Distribution

\$32 million



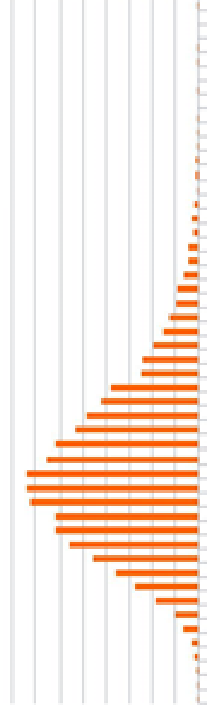
# The systemic risk distribution method



Systemic Risk Distribution

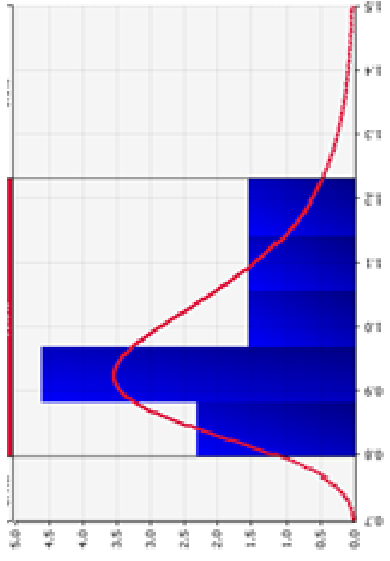
0.95

X



Independent Risk Distribution

# The systemic risk distribution method

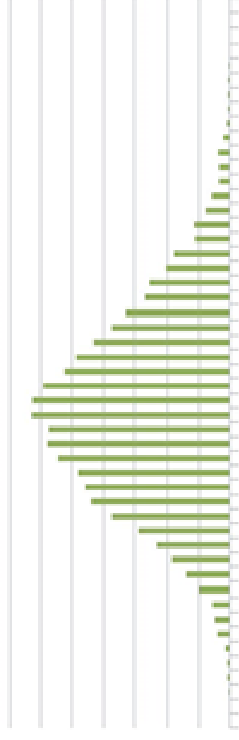


Systemic Risk Distribution

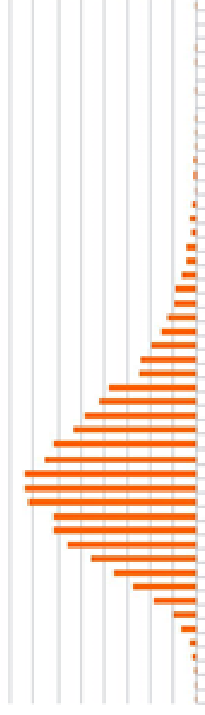
0.95

X

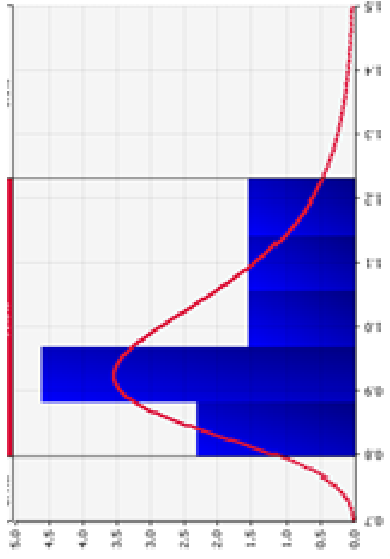
\$29 million



Independent Risk Distribution



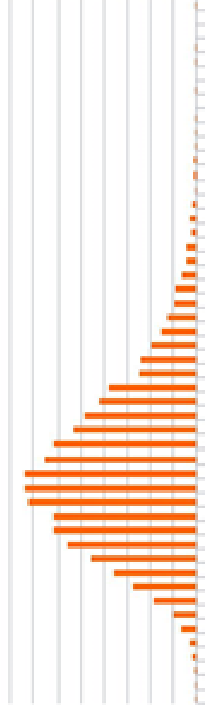
# The systemic risk distribution method



Systemic Risk Distribution

0.95

X

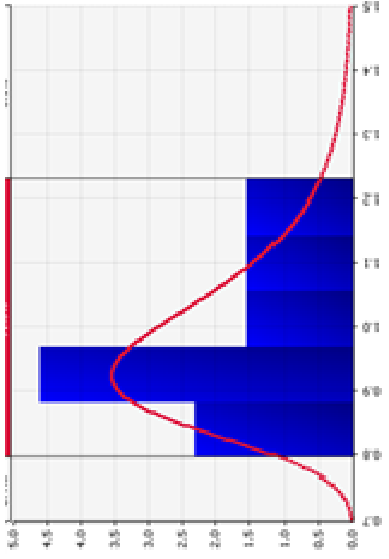


Independent Risk Distribution

\$29 million

\$28 million

# The systemic risk distribution method

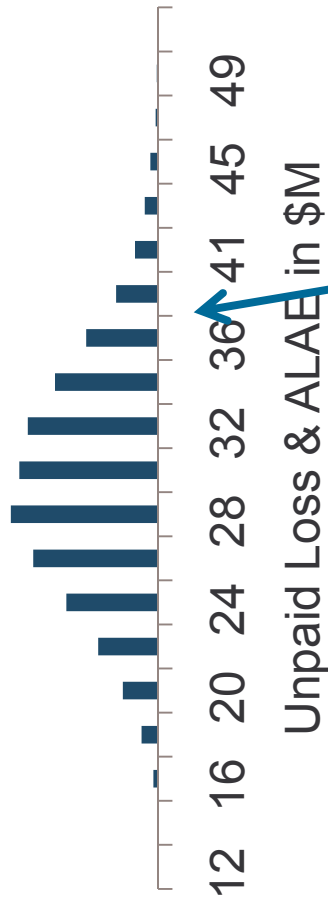


Systemic Risk Distribution



# Deriving the Systemic Risk Distribution

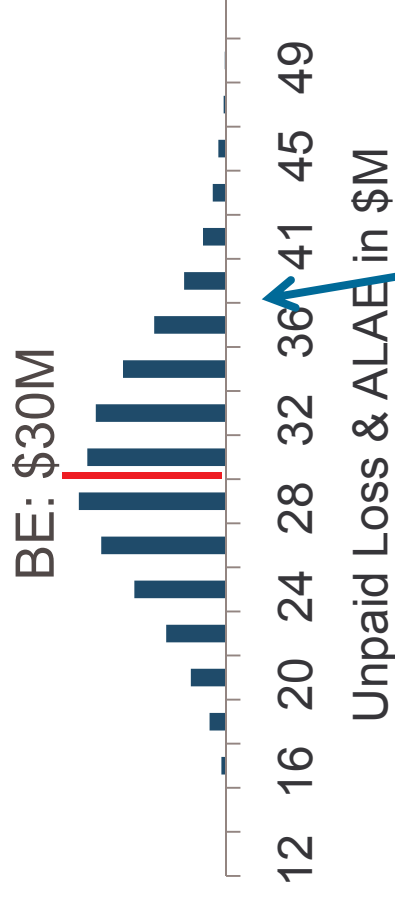
RESERVE DISTRIBUTION:  
for AY 2000



HINDSIGHT RESERVE = \$38M at the 91<sup>st</sup> percentile

# Deriving the Systemic Risk Distribution

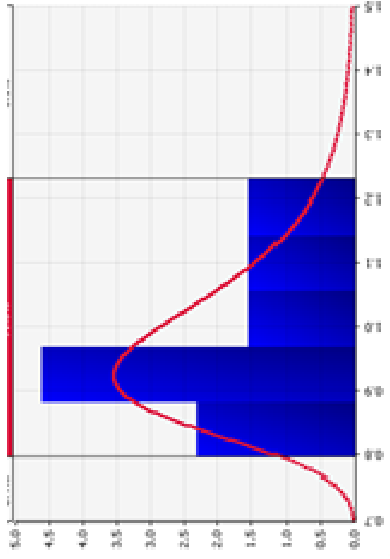
RESERVE DISTRIBUTION:  
for AY 2000



HINDSIGHT RESERVE = \$38M at the 91<sup>st</sup> percentile

SYSTEMIC RISK FACTOR = \$38M / \$30M  
= 1.27

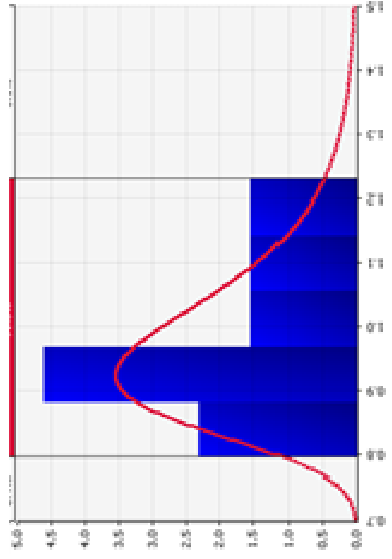
# The systemic risk distribution method



Company	Systemic Risk Factor
Company A	1.27

## Systemic Risk Distribution

# The systemic risk distribution method

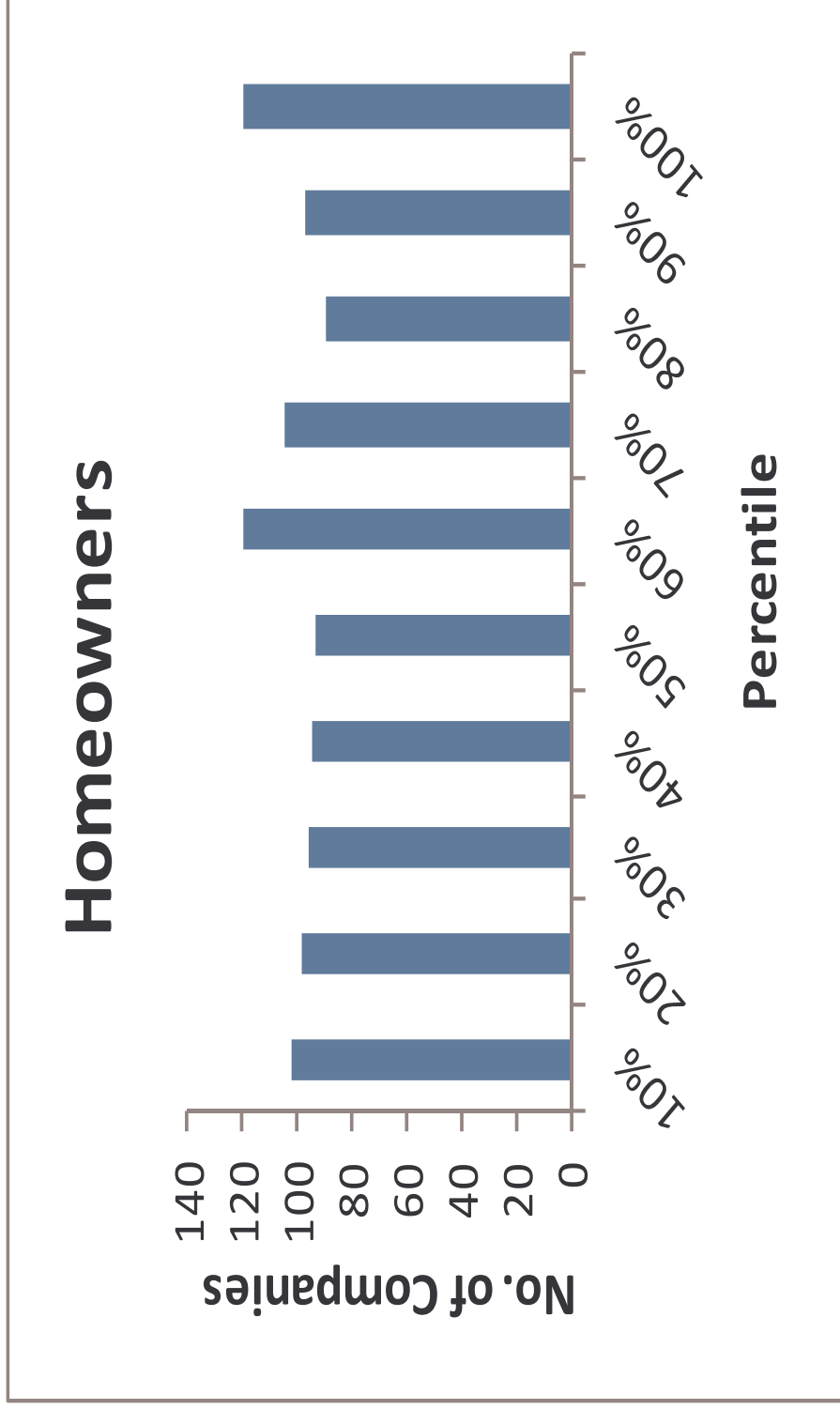


Systemic Risk Distribution

Company	Systemic Risk Factor
Company A	1.27
Company B	1.15
Company C	0.86
Company D	0.92
Company E	1.08
Company F	1.35
Company G	1.22
...	...



# The systemic risk distribution method



### 3. Two methods to account for systemic risk

- a) The systemic risk distribution method
- b) Wang transform adjustment