

# Are you properly calculating your ceded reinsurance loss reserves?

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## Casualty Loss Reserve Seminar

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## Reinsurance contract types

- Quota share
  - Straight forward percentage
  - Contains caps or corridors
- Per risk/per occurrence excess of loss
  - Plain vanilla coverage
  - Aggregate limits, corridors, annual aggregate deductibles
- Aggregate excess of loss
- Loss portfolio transfer

# Approaches used for various reinsurance contract types

- Quota Share
  - Straight forward
    - Estimate gross ultimate loss, then apply quota share percentage to estimate ceded ultimate loss
  - Contract contains loss corridors, caps, etc.
    - Estimate ceded losses directly to specifically reflect portions of quota share with reinsurance protection versus portions retained net.
    - Must consider full distribution of gross losses in order to reflect the true ceded losses

- Excess of Loss (Per Risk/Per Occurrence)
  - Straight forward
    - Estimate gross ultimate loss and net ultimate loss using different loss development factors, then subtract the net ultimate loss from the gross ultimate loss to estimate ceded ultimate loss
    - Estimate ceded losses directly reflecting the attachment point and limits for each year
  - Contract contains deductibles, aggregate limits, etc.
    - Estimate ceded losses directly reflecting the specific contract features.
    - Simulation method or direct consideration of the full distribution of losses in the layer to properly reflect reinsurance terms

## Approaches used for various reinsurance contract types

- Aggregate Excess of Loss/Adverse Development Cover
  - Estimate ceded ultimate losses directly based on gross ultimate losses reflecting the full distribution of gross losses.
  - Just because gross losses are below the attachment point does not mean that there is not a ceded liability
- Loss Portfolio Transfer
  - Estimate ceded ultimate losses directly based on gross ultimate losses reflecting the full distribution of gross losses.
  - Just because gross losses are below the contract limit does not mean that all of the gross liability can be ceded.
  - A net liability can still exist when gross ultimate losses are below the contract limit.

## Examples: Basic Assumptions

- Gross unpaid liabilities result from identical accident years
- Premium = \$1.5 million/year
- Ultimate losses = \$1 million/year
- AY loss distribution = Lognormal ( $\mu = 13.784$ ,  $\sigma = 0.25$ )
- Loss ratio = 66.7%
- Expected direct/gross unpaid liabilities = \$2 million
- Reserve distribution = Lognormal ( $\mu = 14.489$ ,  $\sigma = 0.20$ )
- Loss development patterns as follows:

	12	24	36	48	60	72	84
Paid %	29.0%	40.0%	62.5%	80.0%	90.9%	97.6%	100.0%
Reported %	50.0%	66.7%	90.9%	95.2%	100.0%	100.0%	100.0%

## Gross paid loss triangle

Acc Yr	12	24	36	48	60	72	84
2003	290,000	400,000	625,000	800,000	909,091	975,610	1,000,000
2004	290,000	400,000	625,000	800,000	909,091	975,610	
2005	290,000	400,000	625,000	800,000	909,091		
2006	290,000	400,000	625,000	800,000			
2007	290,000	400,000	625,000				
2008	290,000	400,000					
2009	290,000						
Acc Yr	12-24	24-36	36-48	48-60	60-72	72-84	84-Ult
2003	1.379	1.563	1.280	1.136	1.073	1.025	
2004	1.379	1.563	1.280	1.136	1.073		
2005	1.379	1.563	1.280	1.136			
2006	1.379	1.563	1.280				
2007	1.379	1.563					
2008	1.379						
Incremental	1.379	1.563	1.280	1.136	1.073	1.025	1.000
Cumulative	3.448	2.500	1.600	1.250	1.100	1.025	1.000

## Gross reported loss triangle

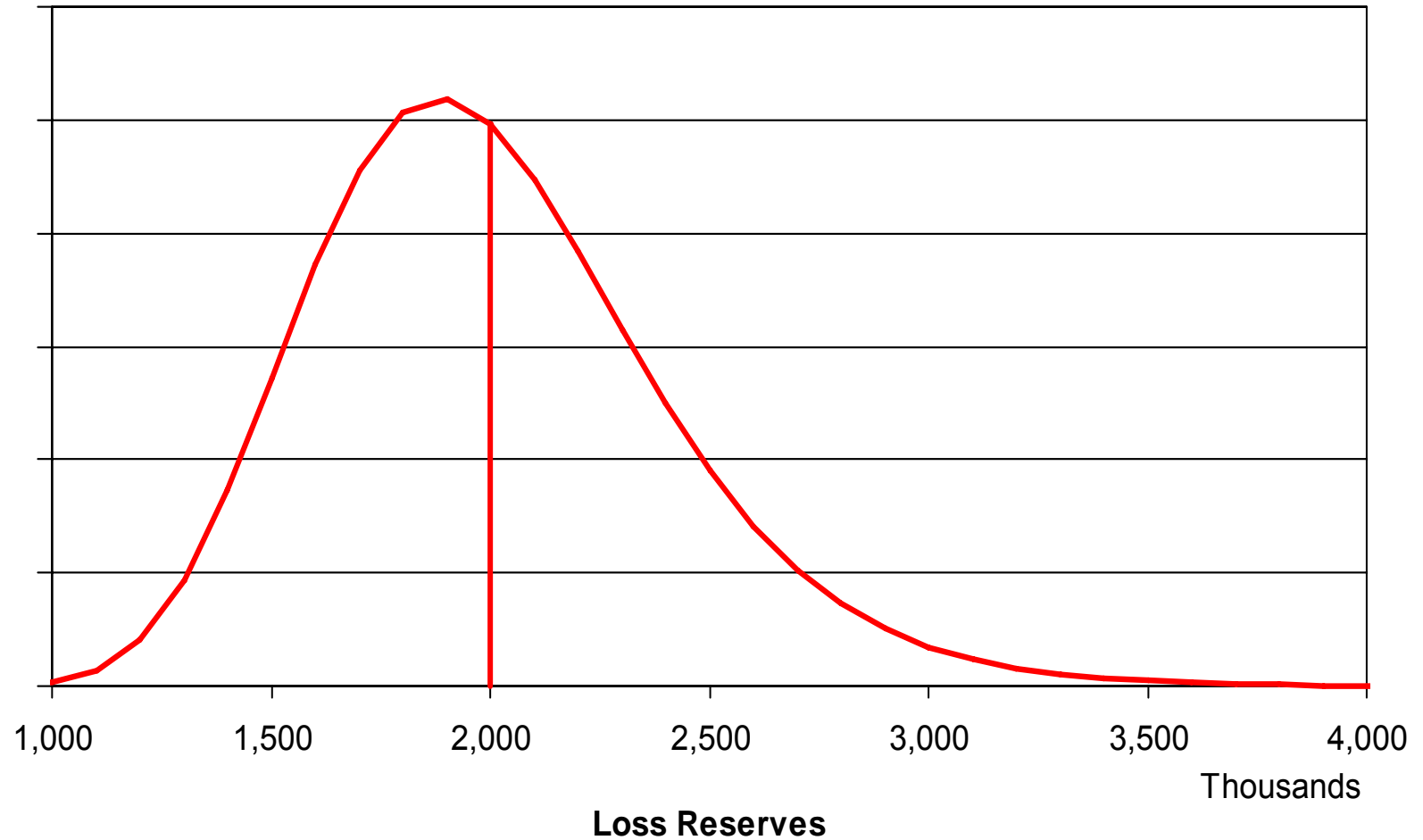
Acc Yr	12	24	36	48	60	72	84
2003	500,000	666,667	909,091	952,381	1,000,000	1,000,000	1,000,000
2004	500,000	666,667	909,091	952,381	1,000,000	1,000,000	
2005	500,000	666,667	909,091	952,381	1,000,000		
2006	500,000	666,667	909,091	952,381			
2007	500,000	666,667	909,091				
2008	500,000	666,667					
2009	500,000						
Acc Yr	12-24	24-36	36-48	48-60	60-72	72-84	84-Ult
2003	1.333	1.364	1.048	1.050	1.000	1.000	
2004	1.333	1.364	1.048	1.050	1.000		
2005	1.333	1.364	1.048	1.050			
2006	1.333	1.364	1.048				
2007	1.333	1.364					
2008	1.333						
Incremental	1.333	1.364	1.048	1.050	1.000	1.000	1.000
Cumulative	2.000	1.500	1.100	1.050	1.000	1.000	1.000



## Gross estimate of ultimate losses

<b>Acc Yr</b>	<b>Paid Losses</b>	<b>Reported Losses</b>	<b>Ultimate Losses</b>	<b>Case Reserves</b>	<b>IBNR</b>	<b>Total Unpaid Liabilities</b>
2003	1,000,000	1,000,000	1,000,000	-	-	-
2004	975,610	1,000,000	1,000,000	24,390	-	24,390
2005	909,091	1,000,000	1,000,000	90,909	(0)	90,909
2006	800,000	952,381	1,000,000	152,381	47,619	200,000
2007	625,000	909,091	1,000,000	284,091	90,909	375,000
2008	400,000	666,667	1,000,000	266,667	333,333	600,000
2009	290,000	500,000	1,000,000	210,000	500,000	710,000
<b>Total</b>	<b>4,999,701</b>	<b>6,028,139</b>	<b>7,000,000</b>	<b>1,028,438</b>	<b>971,861</b>	<b>2,000,299</b>

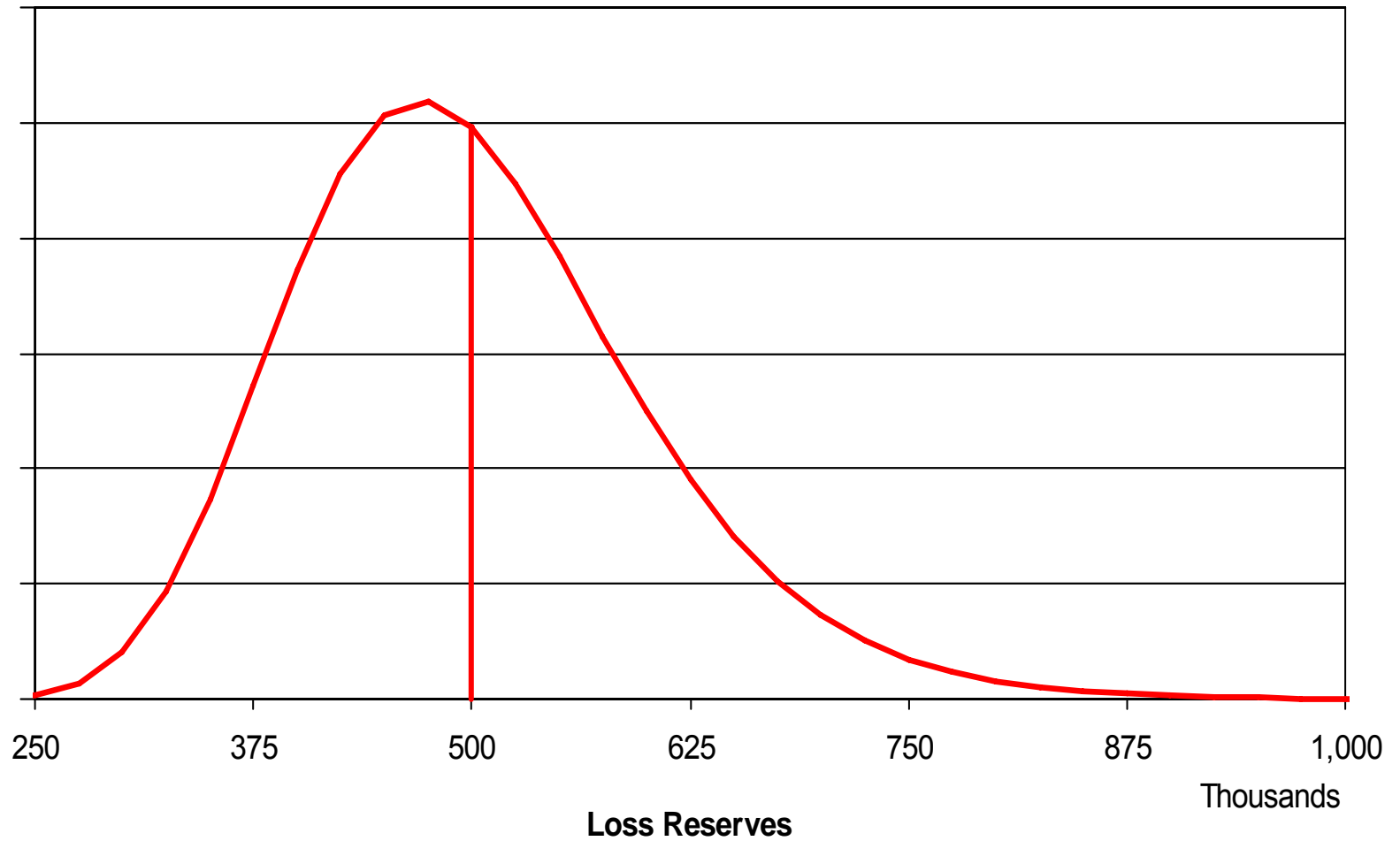
# Gross unpaid loss liabilities distribution



## Example #1: Quota share

- Assume 25% quota share of business
- Premium = \$375,000/year
- Ultimate losses = \$250,000/year
- Loss ratio = 66.7%
- Expected ceded unpaid liabilities = \$500,000
- Unpaid liabilities dist. = Lognormal ( $\mu = 13.102$ ,  $\sigma = 0.20$ )
- Appropriate methods:
  - Apply quota share percentage to gross losses
  - No need to separately use loss development or B-F
  - Easy and straight forward cession

## Ceded loss reserve distribution



## Example #2: Quota Share with corridor

- Assume 25% quota share of business
- Premium = \$375,000/year
- Ultimate losses = \$250,000/year
- Loss ratio = 66.7%
- Loss ratio corridor between 70% and 75%
  - Cedant retains liability in this 5% corridor
- **Are the expected ceded unpaid liabilities still = \$500,000?**

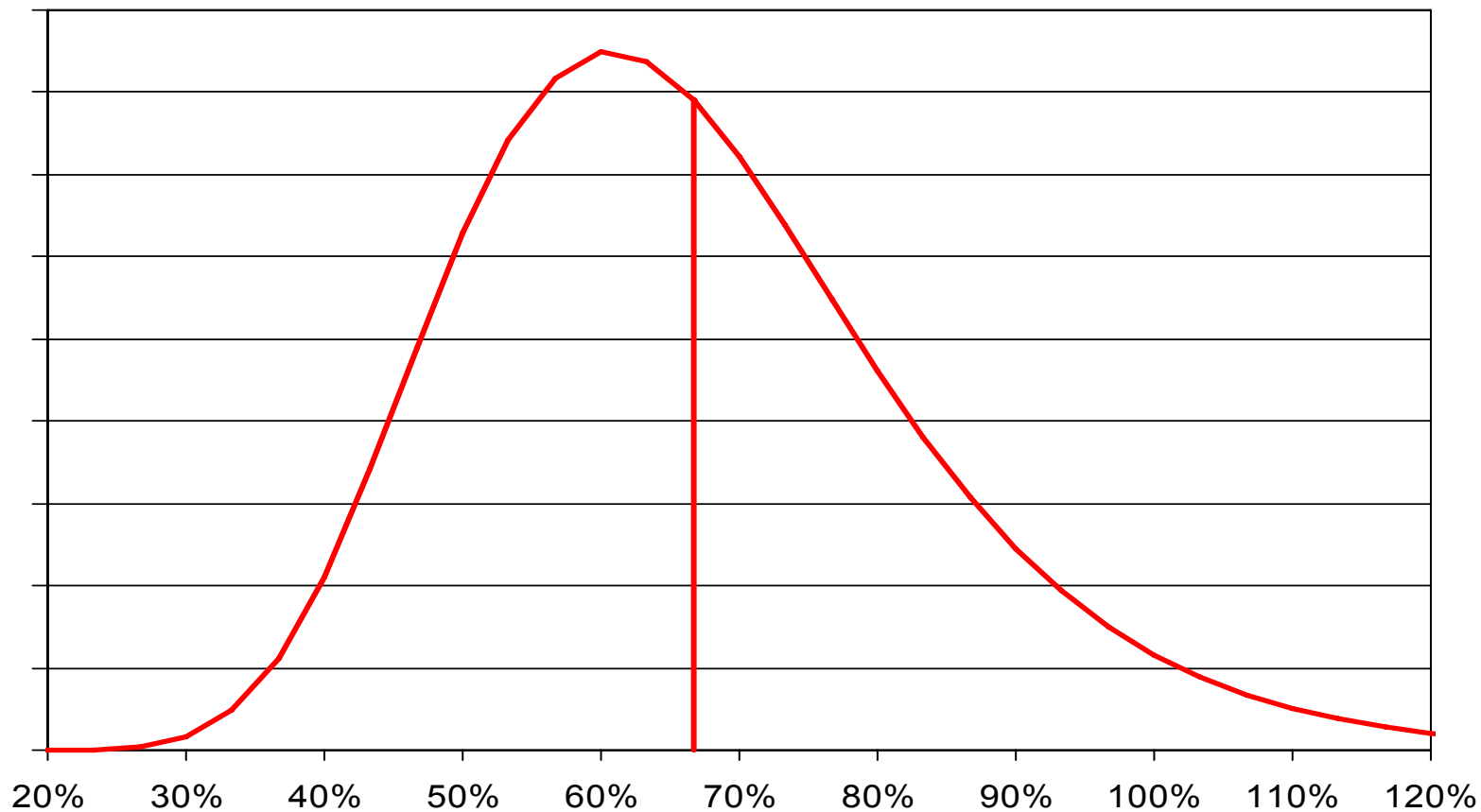
## Example #2: Quota Share with corridor

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- Premium = \$375,000/year
- Ultimate losses = \$250,000/year
- Loss ratio = 66.7%
- Loss ratio corridor between 70% and 75%
  - Cedant retains liability in this 5% corridor
- **Are the expected ceded unpaid liabilities still = \$500,000?**

**NO, The \$500,000 represents the cession of the expected gross reserves instead of the expected ceded reserves. How do we handle this in order to get the correct number?**

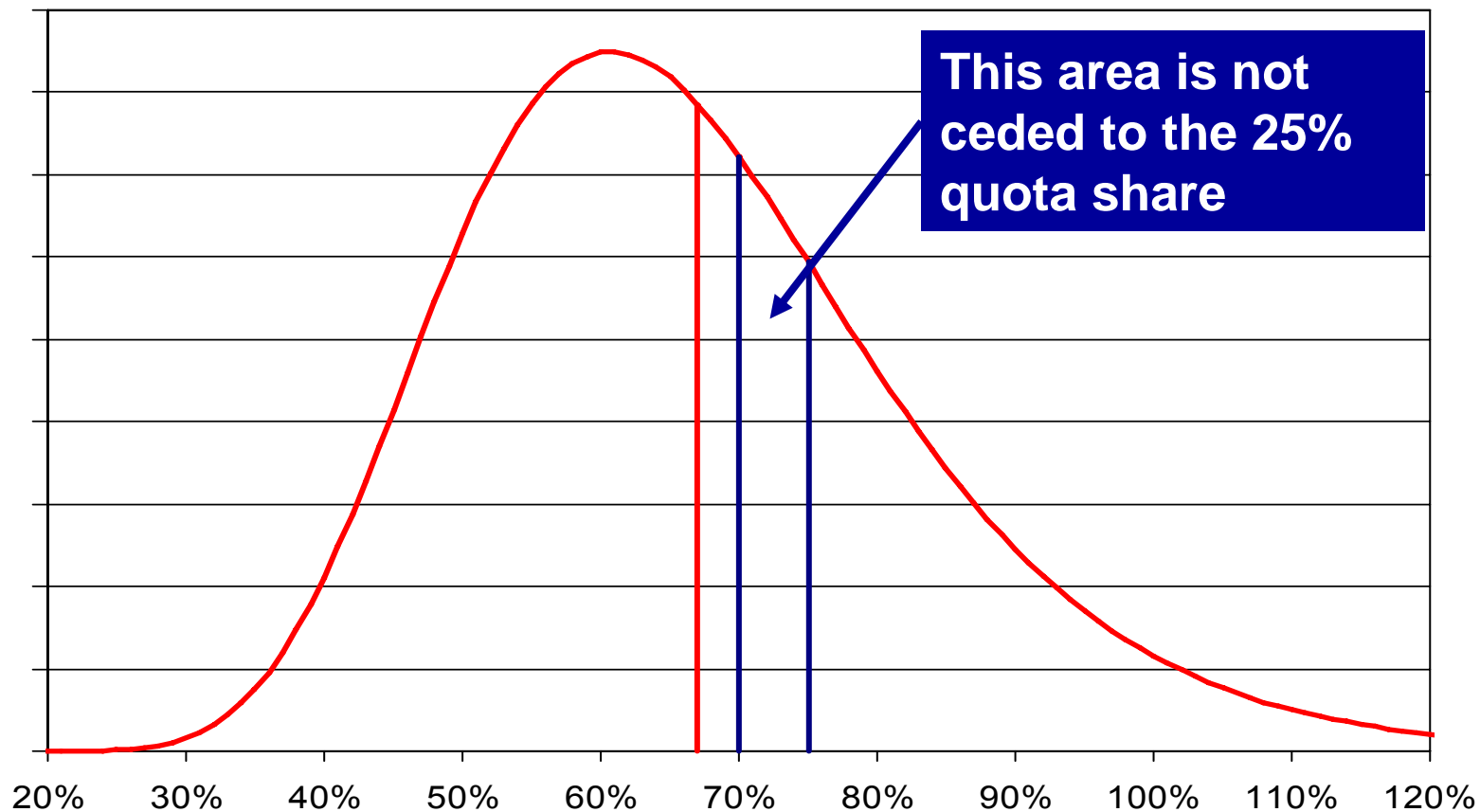
# Accident year gross ultimate loss ratio distribution

Expected Loss Ratio = 66.7% @ 55<sup>th</sup> percentile  
 Corridor Attachment = 70.0% @ 63<sup>nd</sup> percentile  
 Corridor Limit = 75% @ 72<sup>nd</sup> percentile



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## Accident year gross and ceded losses

- Gross  $E(X) = \$1,000,000$
- Gross Limited Expected Value @ 70% loss ratio = \$921,112
- Gross Limited Expected Value @ 75% loss ratio = \$945,365
  
- Quota Share w/o corridor  $E(X) = 25\% \times 1,000,000 = \$250,000$
- Quota Share LEV @70% LR = \$230,278
- Quota Share LEV @75% LR = \$236,341
- $E(X)$  between 70% and 75% = \$6,063
- Quota Share w/corridor  $E(X) = \$250,000 - \$6,063 = \$243,937$

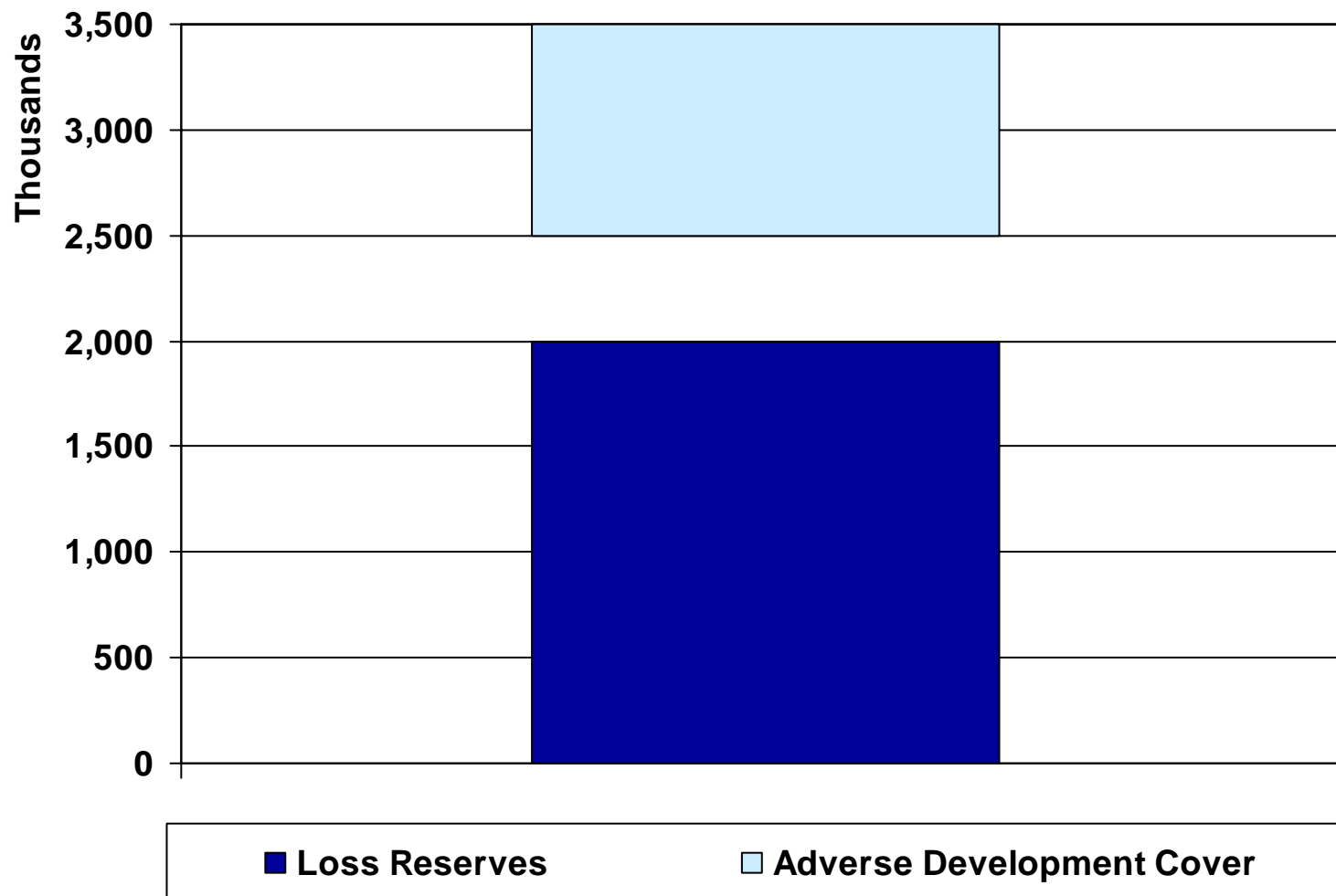
## Impact on loss reserves

- In order to calculate the correct ceded unpaid liabilities, one must consider the variability of the liabilities for each year to determine the appropriate adjustment.
- As accident years mature there is less variability in the unpaid liabilities and therefore less chance that the corridor will be reached

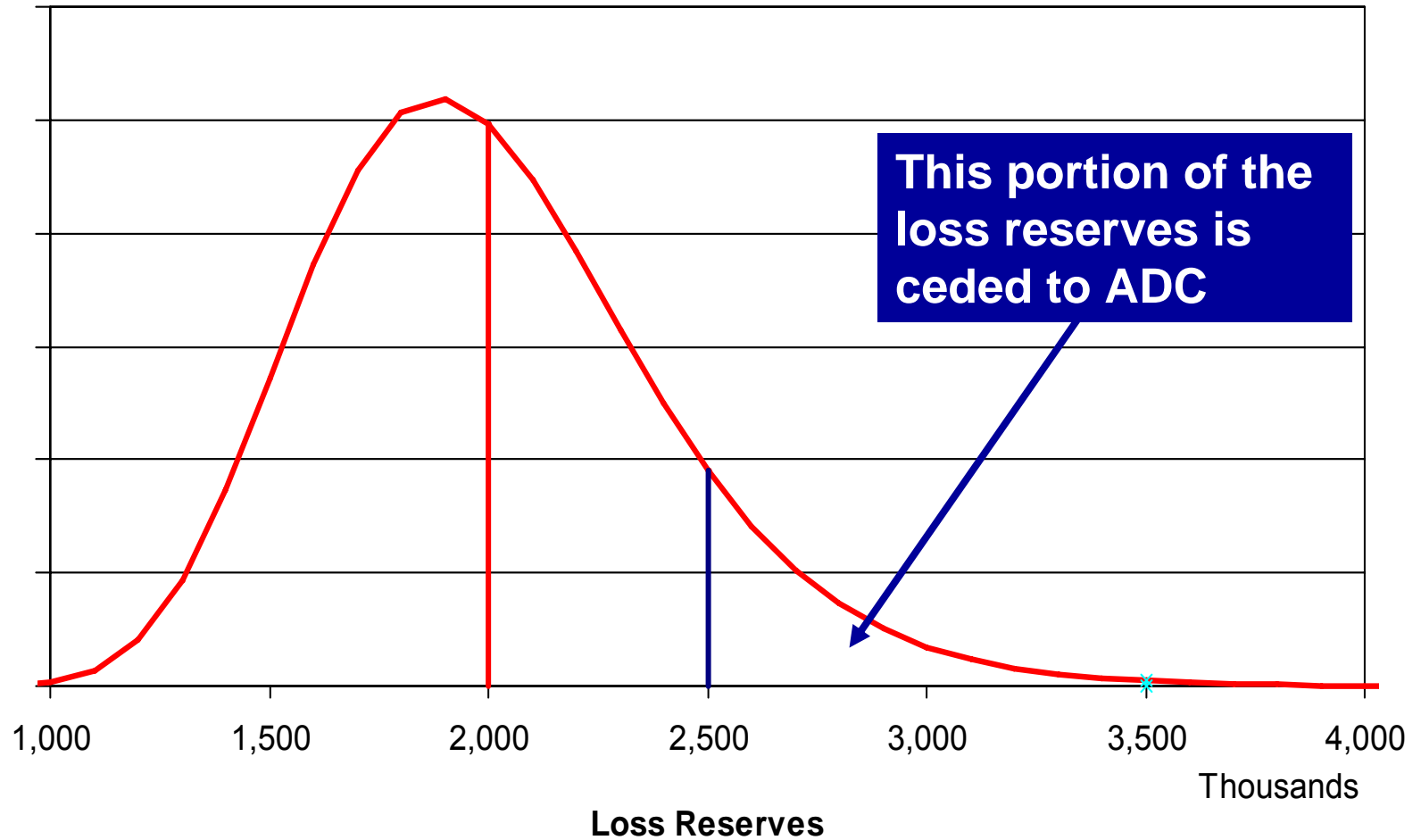
## Example #3: Adverse development cover

- Assume gross expected unpaid loss liabilities of \$2 million
- Adverse development cover is purchased that attaches excess of \$2.5 million with a \$1 million limit
- How much should the company reflect as a ceded reserve for this contract?
  - Zero
  - Something greater than zero that reflects the expected value of the losses that could potentially reach the reinsurance

# Example #3: Adverse development cover



# Gross unpaid loss liabilities distribution



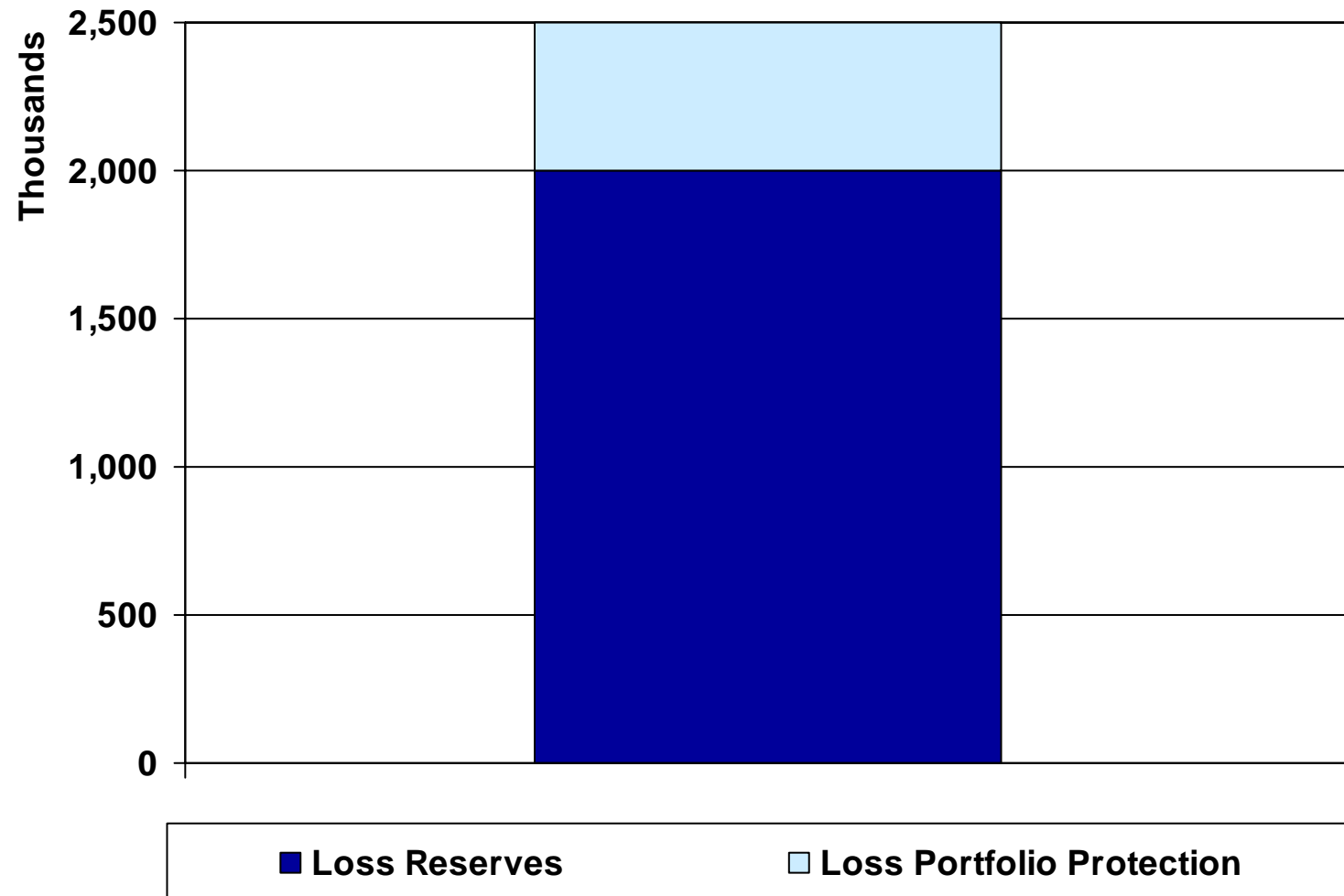
## Adverse development cover ceded unpaid liabilities

- Gross  $E(X) = \$2,000,000$
- Gross Limited Expected Value @ \$2.5m = \$1,970,352
- Gross Limited Expected Value @ \$3.5m = \$1,999.596
  
- ADC  $E(X)$  between \$2.5m and \$3.5 m = \$29,245
- Net  $E(X) = \$1,970,755$

## Example #4: Loss Portfolio Transfer

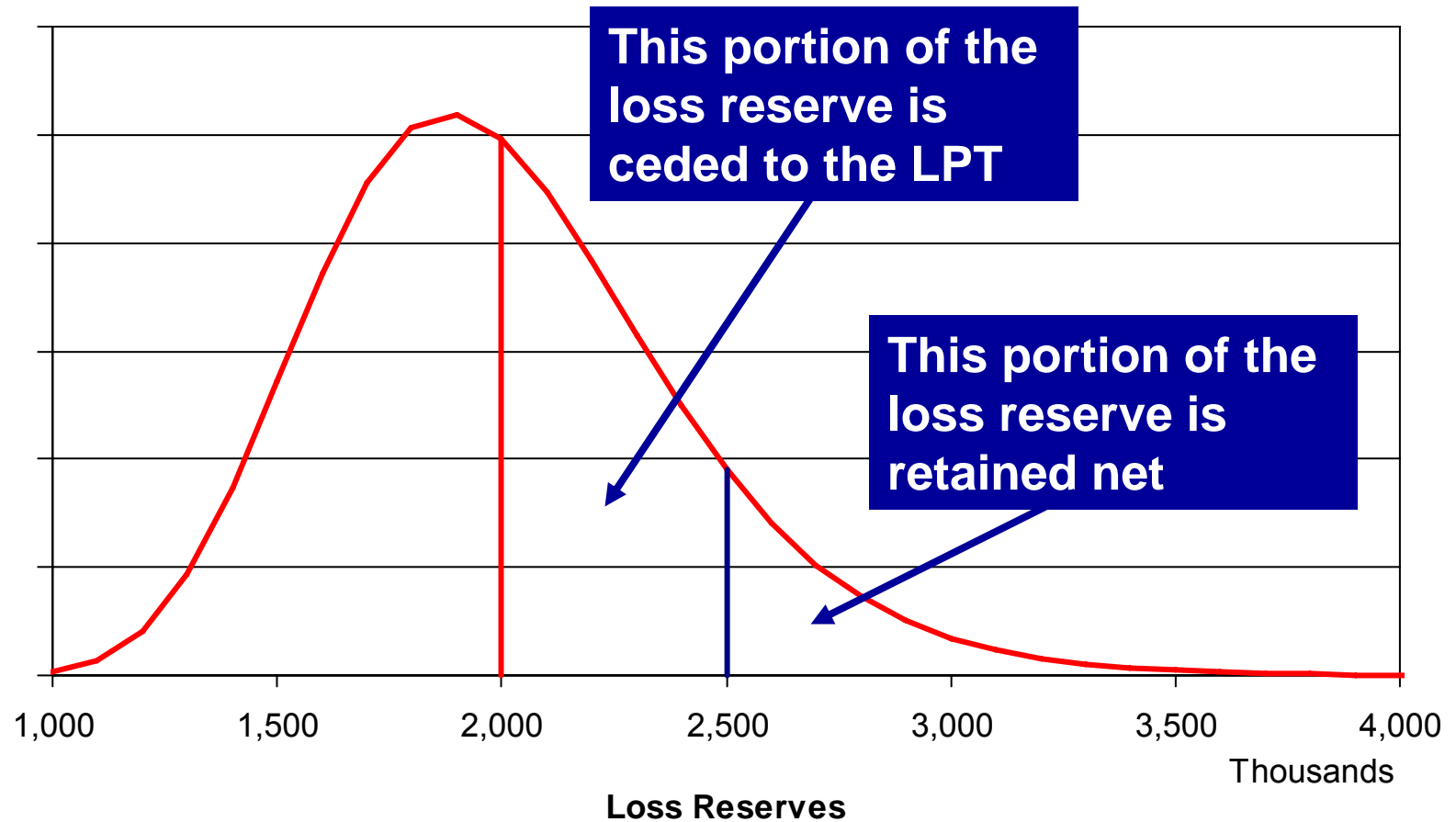
- Assume gross expected loss reserves of \$2 million
- Loss portfolio transfer is purchased with a \$2.5 million limit
- How much should the company reflect as a ceded reserve for this contract?
  - \$2 million
  - Something less than \$2 million that reflects that the company still retains a potential liability

## Example #4: Loss Portfolio Transfer





# Gross unpaid loss liabilities distribution



## Loss portfolio transfer cover ceded and net liabilities

- Gross  $E(X) = \$2,000,000$
- Limited Expected Value @ \$2.5m = \$1,970,352
  - Equivalent to the reserve ceded to the LPT
- Retained net reserves = \$29,648

## Other Issues

- Data availability
  - Individual claim data availability
  - Appropriate loss triangles and/or loss development factors
- Ceded loss reserves **should not** reflect the cession of the expected value of the gross loss liabilities
- Ceded loss reserves **should** reflect the expected value of the ceded loss liabilities
- Reserve ranges
  - Gross – Ceded  $\neq$  Net
  - Stochastic Modeling

## Other Issues

- There is significant debate over the appropriate accounting treatment
- Some believe the ceded reserves should be “consistent” with the gross liabilities but yet it can overstate or understate the ceded reserves and therefore impact the net reserves
- Mirroring of assumed and ceded liabilities
- When you sign a loss reserve opinion, what are you “opining” on?