PERSATUAN AKTUARIS INDONESIA
(THE SOCIETY OF ACTUARIES OF INDONESIA)

STANDARD METHOD
PROVISION OF ADVERSE DEVIATION

PAD Task Force Team

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Scope

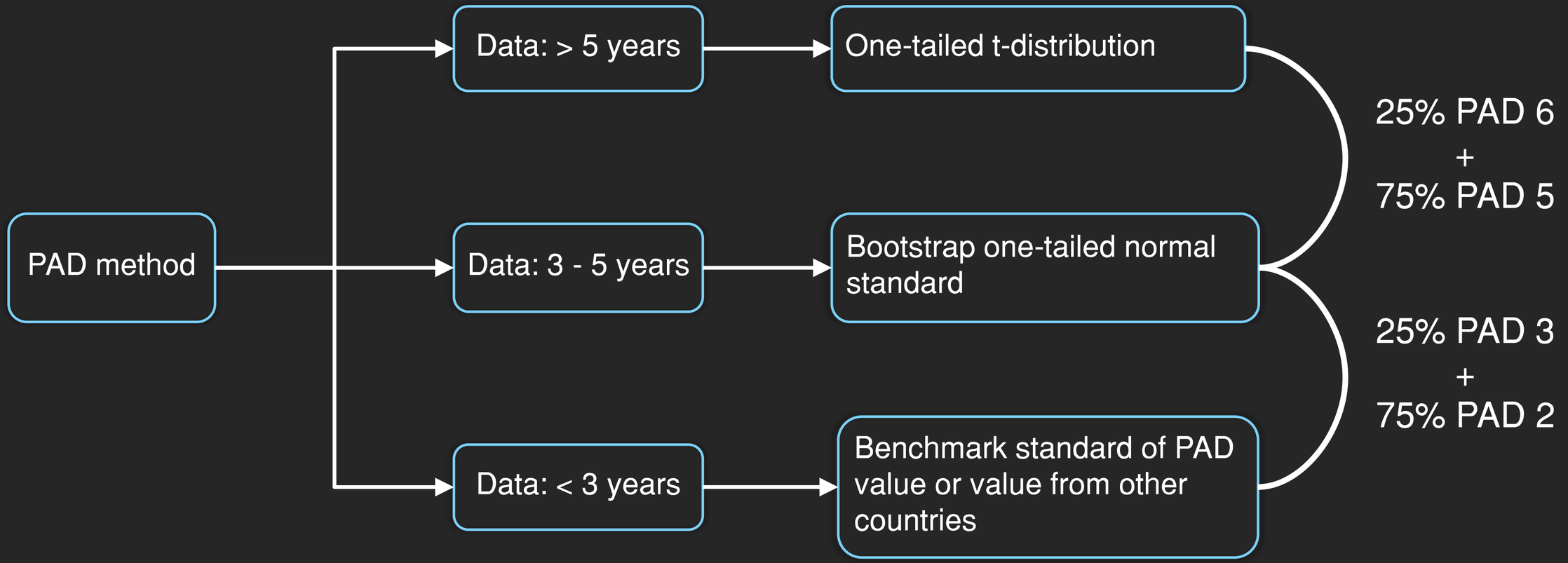
Life Insurance Product

Products
Traditional
Unit Link
Credit Life

Variables
Mortality
Morbidity
Lapse
Expense

Special Cases
Single Premium
Annuity
Term ROP

Calculation Methods of PAD

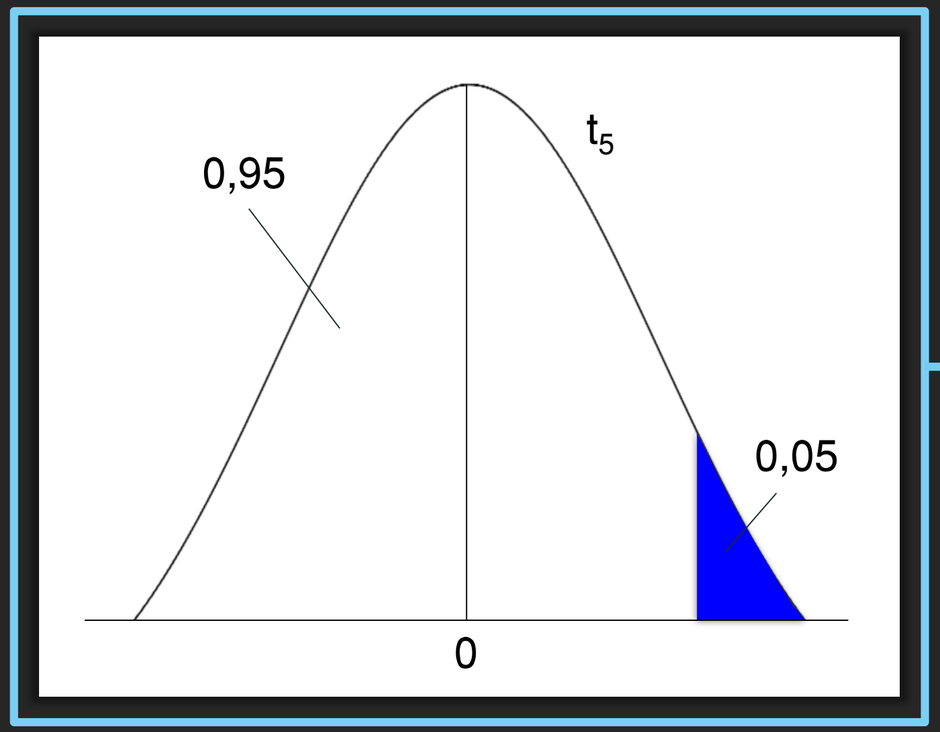


One-Tailed t-Distribution

Method 1

One Tailed t-Distribution

Method 1



- Assume that A/E have t-distribution
- Set the confidence interval to 75% and 95%
- A/E table of mortality, morbidity, lapse, or expense
- Calculate sample mean and its standard error
- Critical Value of t-distribution for α = 25% and α = 5% with df = n - 1
- Calculate PAD value

Calculating PAD Value

One Tailed t-Distribution

$$\text{PAD} = \frac{x_{\alpha,n-1} - \bar{x}}{\bar{x}} = \frac{\bar{x} + t_{\alpha,n-1} \cdot \frac{s}{\sqrt{n}} - \bar{x}}{\bar{x}} = \frac{\bar{x} + t_{\alpha,n-1} \cdot \frac{s}{\sqrt{n}}}{\bar{x}} - 1 = \frac{t_{\alpha,n-1} \cdot \frac{s}{\sqrt{n}}}{\bar{x}}$$

Implementation : BE × (1+PAD)

$$\text{PAD} = x_{\alpha,n-1} - \bar{x} = \bar{x} + t_{\alpha,n-1} \cdot \frac{s}{\sqrt{n}} - \bar{x} = t_{\alpha,n-1} \cdot \frac{s}{\sqrt{n}}$$

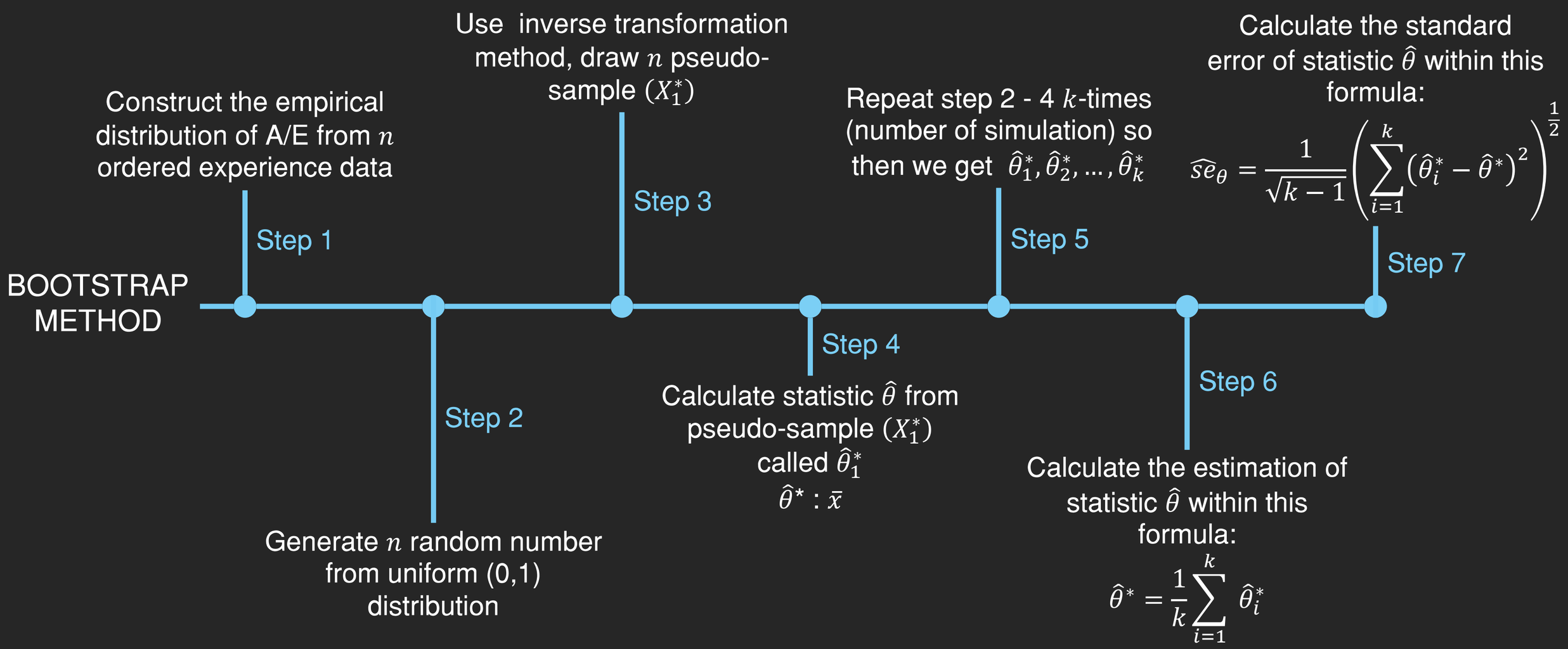
Implementation : BE + PAD

One-Tailed Standard Normal with Bootstrapping Data

Method 2

Bootstrap Method

One-Tailed Standard Normal



Reference Data - PAD Value from Other Countries

Method 3

Reference Data

PAD Value from Other Countries

If the experience data owned by the insurance company are not sufficient, we strongly propose to either use standard PAD value from the data of insurance market experience (represented by 10 life insurance companies) or use benchmark PAD value from other countries

Assumption	Thailand	Malaysia	Australia
Mortality	17%	10% - 25%	10% - 40%
Morbidity	17%	10% - 25%	10% - 40%
Expense	5%	5%	2.5% - 20%
Lapse	12%	25%	25% - 100%

Simulation

Simulation

Experience Data : More than 5 years

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
A/E	97%	79%	92%	88%	87%	88%	87%	89%	83%	85%

Count (n) = 10
Mean = 87%
Standard Deviation = 5%

Student-t Distribution

Confidence Interval 75%

Degree of Freedom = 9
t-Value = 1.23
$\bar{x} + t_{\alpha,n-1} \cdot s/\sqrt{n}$ = 89%

PAD = 2%

Confidence Interval 95%

Degree of Freedom = 9
t-Value = 2.26
$\bar{x} + t_{\alpha,n-1} \cdot s/\sqrt{n}$ = 91%

PAD = 4%

Simulation

Experience Data : Between 3 to 5 years

Year	2011	2012	2013	2014	2015
A/E	89%	70%	72%	94%	88%

Count (n) = 5
Mean = 83%
Standard Deviation = 11%

Student-t Distribution

Confidence Interval 75%

Degree of Freedom = 4
t-Value = 1.34
$\bar{x} + t_{\alpha,n-1} \cdot s/\sqrt{n}$ = 89%

PAD = 8%

Confidence Interval 95%

Degree of Freedom = 4
t-Value = 2.78
$\bar{x} + t_{\alpha,n-1} \cdot s/\sqrt{n}$ = 96%

PAD = 16%

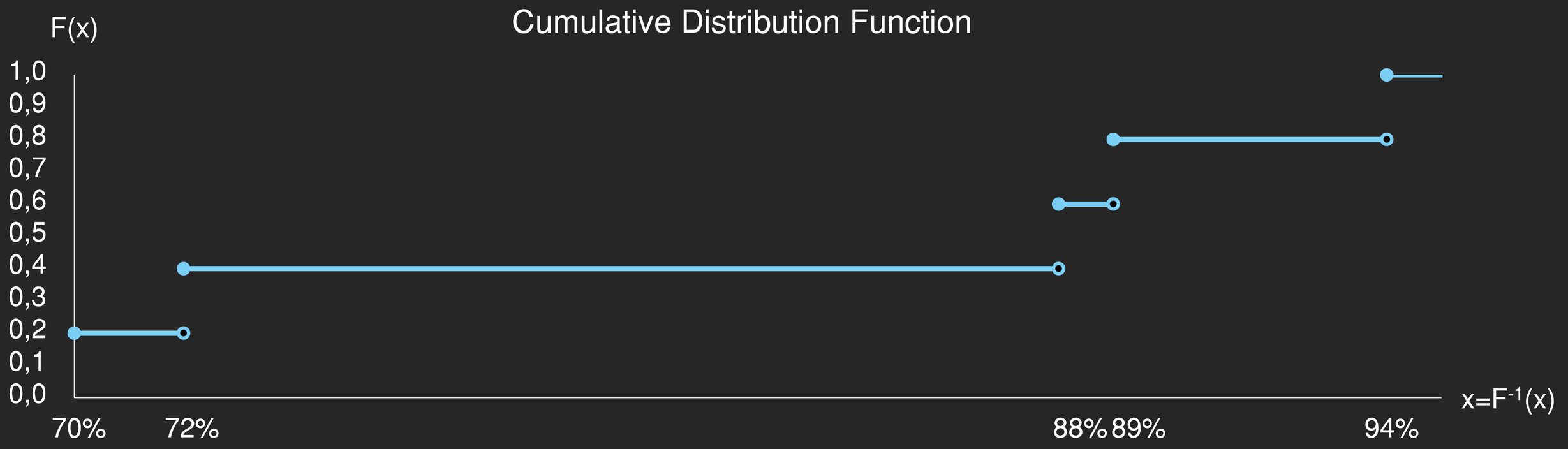
Simulation

Experience Data : Between 3 to 5 years

Year	2011	2012	2013	2014	2015
A/E	89%	70%	72%	94%	88%

Bootstrap

Data	70%	72%	88%	89%	94%
n	1	1	1	1	1
CDF	0.2	0.4	0.6	0.8	1

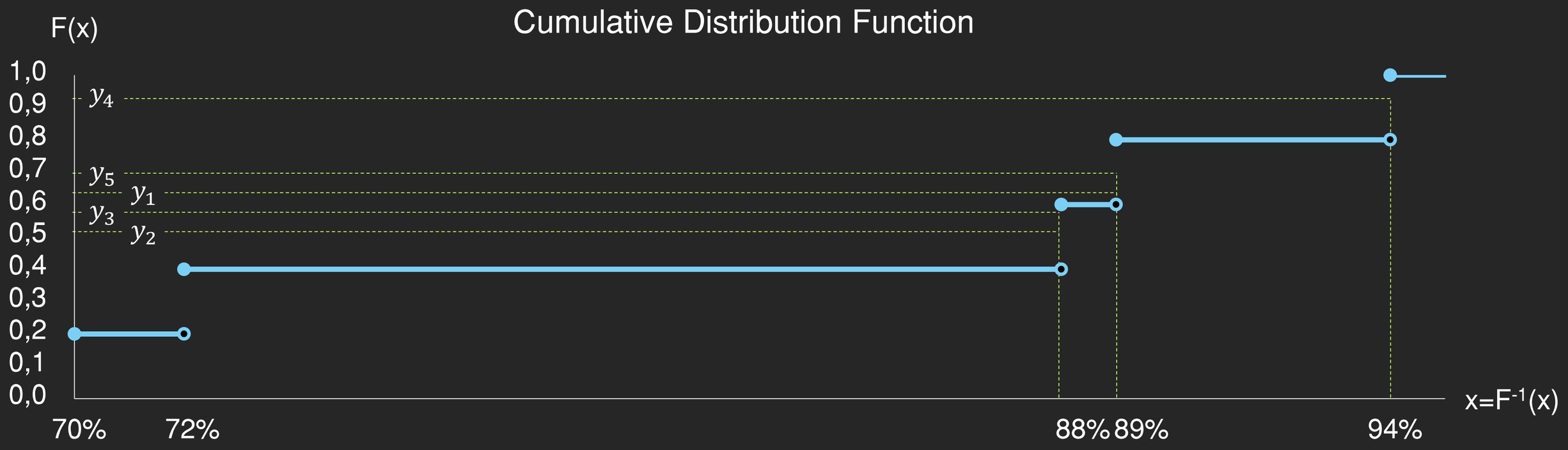


Simulation

Experience Data : Between 3 to 5 years

			x_1	x_2	x_3	x_4	x_5	$\bar{x}_i$	s_i
Simulation I	Uniform (0,1)	y=F(x)	0.64	0.52	0.58	0.91	0.69		
	Sample	$F^{-1}(x)$	89%	88%	88%	94%	89%	90%	3%

Repeated by $k = 10$ times



Simulation

Experience Data : Between 3 to 5 years

							$\bar{x}_i$
Simulation I	Uniform (0,1)	0.64	0.52	0.58	0.91	0.69	
	Sample	89%	88%	88%	94%	89%	90%
Simulation II	Uniform (0,1)	0.67	0.25	0.80	0.50	0.94	
	Sample	89%	72%	89%	88%	94%	86%
Simulation III	Uniform (0,1)	0.86	0.68	0.10	0.41	0.71	
	Sample	94%	89%	70%	88%	89%	86%
Simulation IV	Uniform (0,1)	0.25	0.64	0.46	0.25	0.47	
	Sample	72%	89%	88%	72%	88%	82%
Simulation V	Uniform (0,1)	0.79	0.06	0.92	0.80	0.56	
	Sample	89%	70%	94%	89%	88%	86%
Simulation VI	Uniform (0,1)	0.57	0.71	0.34	0.90	0.51	
	Sample	88%	89%	72%	94%	88%	86%
Simulation VII	Uniform (0,1)	0.28	0.25	0.80	0.80	0.43	
	Sample	72%	72%	89%	89%	88%	82%
Simulation VIII	Uniform (0,1)	0.91	0.14	0.25	0.08	0.97	
	Sample	94%	70%	72%	70%	94%	80%
Simulation IX	Uniform (0,1)	0.38	0.45	0.80	0.51	0.73	
	Sample	72%	88%	89%	88%	89%	85%
Simulation X	Uniform (0,1)	0.97	0.71	0.87	0.60	0.96	
	Sample	94%	89%	94%	88%	94%	92%

Mean = 86%

Standard Error ($\widehat{se}$) = 4%

Normal Distribution

Confidence Interval 75%

z-Value = 0.67

$\bar{x} + z_\alpha \cdot se$ = 88%

PAD = 3%

Confidence Interval 95%

z-Value = 1.64

$\bar{x} + z_\alpha \cdot se$ = 91%

PAD = 7%

Comparison

Experience Data : Between 3 to 5 years

One-tailed t-distribution Method

Confidence Interval 75%

PAD = 8%

Confidence Interval 95%

PAD = 16%

Bootstrap one-tailed normal standard

Confidence Interval 75%

PAD = 3%

Confidence Interval 95%

PAD = 7%

Summary

1. Life insurance companies that have more than 5 years experience data can use One-tailed t-Distribution method

2. Companies that have experience data between 3 - 5 years can use these two methods below:
   1. Using One-Tailed t-Distribution method
   2. Using alternative method with Bootstrapping experience data, and the result data are assumed have a normal standard distribution

3. In the case of the experience data owned by insurance companies are insufficient (less than 3 years of experience data), it is advisable to use a standard PAD value

4. Minimum Exposure Policy data are 10.000 data

Reference

1. Kellison, S.G., and London, R, L. 2011. Risk Models and Their Estimation. ACTEX Publications.
2. Hogg, R.V., McKean, J.W., and Craig, A.T. 2005. Introduction to Mathematical Statistics. Pearson Prentice Hall.
3. Teugels, J.L., and Sundt, B. 2004. Encyclopedia of Actuarial Science. Wiley.
4. Broverman, S.A. 2013. ACTEX C/4 Study Manual. ACTEX Publications.

THANK YOU!

Any Questions?

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