LDF CURVE-FITTING AND STOCHASTIC RESERVING

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1. The Method: A Brief Overview
2. Advantages/Disadvantages of the Model
3. Example (Excel File)
4. Appendix

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The Method: A Brief Overview

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The **goals** of the model are as follows:

1. Describe loss emergence in a mathematical model to assist in estimating needed reserves

2. Calculate the variability around the estimated reserves

3. Estimate tail factor

The Method: A Brief Overview

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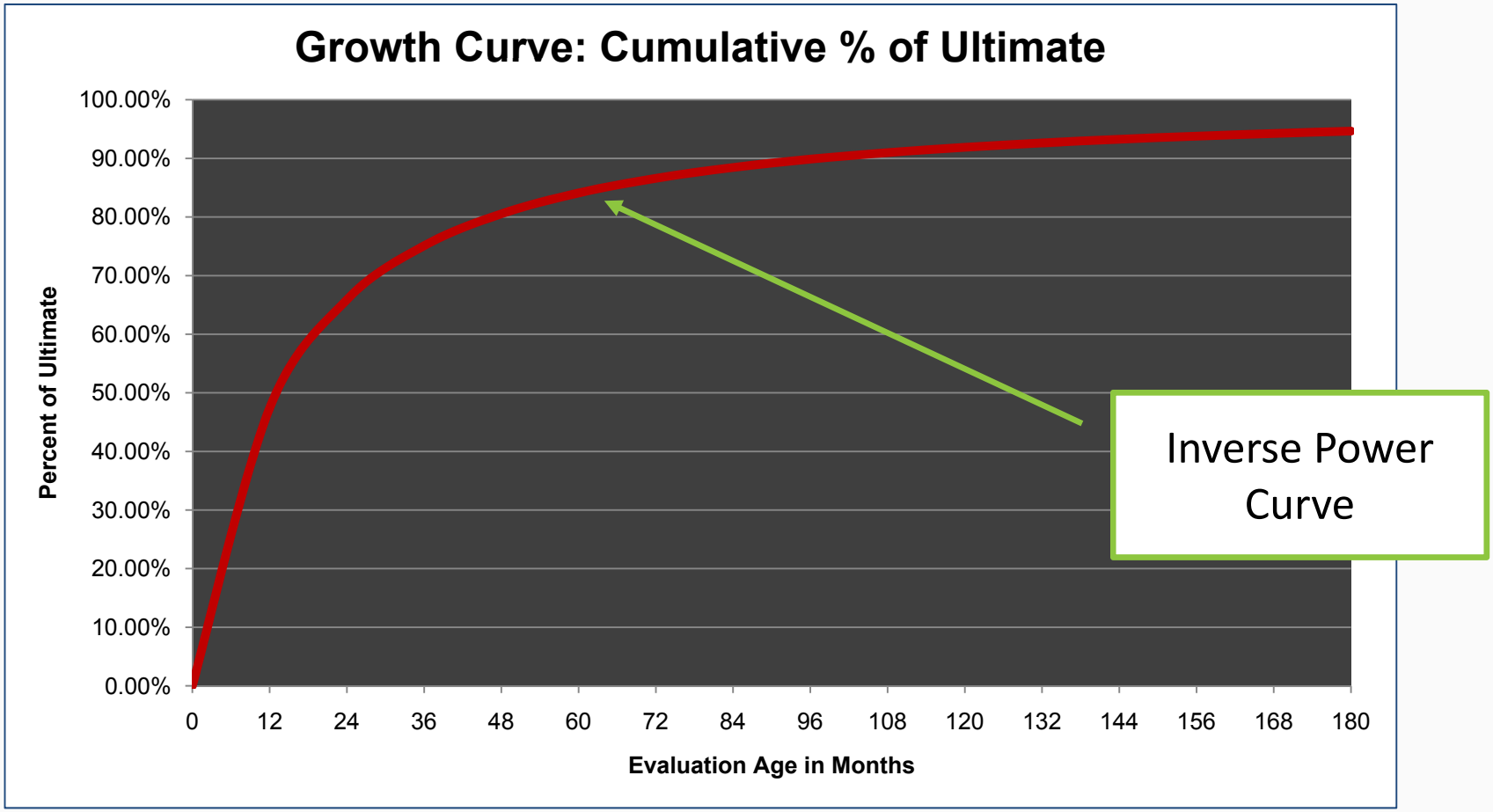
The model utilizes the **Inverse Power Curve**.



The Method: A Brief Overview

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The **Model Game Plan** is as follows:

1. Convert loss development triangle to an incremental basis

The Method: A Brief Overview

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The **Model Game Plan** is as follows:

2. For each "cell" of the triangle, we have

$c_{i,t}$ = actual loss for AY *i,* between ages *t* and *t-1*

$\mu_{i,t}$ = expected loss for AY *i,* between ages *t* and *t-1*

The Method: A Brief Overview

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The **Model Game Plan** is as follows:

2. For each "cell" of the triangle, we have

Actual				
AY	12	24	36	48
2006	$C_{2006,12}$	$C_{2006,24}$	$C_{2006,36}$	$C_{2006,48}$
2007	$C_{2007,12}$	$C_{2007,24}$	$C_{2007,36}$	
2008	$C_{2008,12}$	$C_{2008,24}$		
2009	$C_{2009,12}$			

Expected				
AY	12	24	36	48
2006	$\mu_{2006,12}$	$\mu_{2006,24}$	$\mu_{2006,36}$	$\mu_{2006,48}$
2007	$\mu_{2007,12}$	$\mu_{2007,24}$	$\mu_{2007,36}$	
2008	$\mu_{2008,12}$	$\mu_{2008,24}$		
2009	$\mu_{2009,12}$			

The Method: A Brief Overview

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The **Model Game Plan** is as follows:

3. These $\mu_{i,t}$ are treated as the mean of a distribution.

The Method: A Brief Overview

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3. These $\mu_{i,t}$ are treated as the mean of a distribution.

   How do we estimate these $\mu_{i,t}$?

   - Cape Cod Method

     Requires exposure base (more information → more accurate)

     Number of Parameters: **3**

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The **Model Game Plan** is as follows:

3. These $\mu_{i,t}$ are treated as the mean of a distribution.

   How do we estimate these $\mu_{i,t}$?

   - LDF Method

     Each AY reserve is estimated independently

     Number of Parameters: **n + 2**

The Method: A Brief Overview

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The **Model Game Plan** is as follows:

4. Parameters are estimated via **M**aximum **L**ikelihood **E**stimation (MLE)

- *The distribution for **each cell** uses an Overdispersed-Poisson*
- *The Cape Cod and LDF method are exact MLE results*

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Advantages/Disadvantages of the Model

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The use of a continuous curve gives this model some **advantages**:

1. Smoothing of Development Pattern
2. Interpolation & Extrapolation
3. Handle irregular evaluation dates
   (e.g., latest diagonal less than 12 months from penultimate diagonal)
4. Avoid OverParameterization

Advantages/Disadvantages of the Model

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The use of a continuous curve gives this model some **disadvantages**:

1. Need curve-fitting engine (answers not in “real time”)
2. Less precise estimate of parameter variance
3. May not fit well unless the “right” curve form is used

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Example (Excel File)

Let us look at an example in Excel.

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Parameterization of the **Inverse Power Curve**

$$G(t|\theta,\omega) = \frac{1}{1+\left(\frac{\theta}{t}\right)^{\omega}}$$

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Estimating the expected loss in each cell ($\mu_{i,t}$) for **Cape Cod**

Formulation:

$$\mu_{i,t} = Premium_i \times ELR \times [G(t|\theta,\omega) - G(t-1|\theta,\omega)]$$

Parameters:

ELR	expected loss ratio for all years
θ	"scale" parameter of *G(t)*
ω	"shape" parameter of *G(t)*

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Estimating the expected loss in each cell ($\mu_{i,t}$) for **LDF Method.**

Formulation:

$$\mu_{i,t} = Ultimate_i \times [G(t|\theta,\omega) - G(t-1|\theta,\omega)]$$

Parameters:

$Ultimate_i$ expected ultimate loss for accident year *i*

θ "scale" parameter of *G(t)*

ω "shape" parameter of *G(t)*

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