

## Experience Rating Formula

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$$\mathbf{Mod} = \mathbf{ZR} + \mathbf{(1-Z)}$$

**Z** = credibility

**R** = ratio of actual loss experience to expected loss experience

## Calculating the Mod

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$$\frac{(\# \text{ of claims with rating}) / (\text{on-level EP for rating at 'B' rates})}{(\# \text{ of claims in total for class}) / (\text{class total on-level EP at 'B' rates})}$$

## Calculating R assuming Poisson frequency

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<b>Years claim-free</b>	<b>R</b>
1+	0
0	$\frac{1}{Pr(X \geq 1)} = \frac{1}{1 - e^{-\lambda}}$

where  $\lambda = \frac{\text{\# of claims from class}}{\text{earned car years of insureds in class}}$

## When to use a premium base for frequency

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Hazam states that a premium base only eliminates maldistribution if:

1. High frequency territories are also high average premium territories.
2. Territorial (rate) differentials are proper.

## Poisson formula

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$$Pr(X = k) = \frac{\lambda^k e^{-\lambda}}{k!}$$

## Conclusions of paper

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1. The experience of a single car for 1 year has significant and measurable credibility for experience rating.
2. Individual risk experience is more credible when there is more variance in loss experience within a risk class, which occurs in less refined risk classification systems.
3. The credibilities for varying years of experience should increase in proportion to the # of years of experience.

# Credibility for 2 and 3 years of experience relative to 1 year

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The credibility increases in proportion to the # of years only for low credibilities.

The closer the credibilities for 2 and 3 years of experience are to 2 and 3 times the 1 year credibility, then the less variation in insured's probability of an accident. This could be due to:

1. Less risks entering/exiting the portfolio.
2. Risk characteristics not changing much over time.

## Bühlmann Credibility

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Suppose  $X$  is a random variable with some distribution with parameter  $\Theta$ , and  $\Theta$  itself is a random variable with some distribution and additional parameters. In that case, the credibility of a sample of  $n$  observations from  $X$  is given by:

$$Z = \frac{n}{n+k}$$

$n$  = # of claims in sample

$$k = \frac{E[\text{Var}(X|\Theta)]}{\text{Var}(E[X|\Theta])}$$