Stephanie Wu

Rate Parameter Calculation
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Solve system of equations:
1) $\exp(\alpha + \beta * 0.5 + \gamma) = 1 - VE(v)$
2) $\exp(\alpha + \beta * 50 + \gamma) = 1$

$$
\begin{aligned}
1)/2) &= \exp(\beta(-45.5)) = log(1 - VE(v)) \\
&\iff \beta = \frac{log(1 - VE(v))}{-45.5}
\end{aligned}
$$

$$
\begin{aligned}
1) * 2) &= \exp\Big(2\alpha + 50.5\beta + 2\gamma\Big) = 1 - VE(v) \\
&\iff 2(\alpha + \gamma) + 50.5\beta = log(1 - VE(v)) \\
&\iff \phi = \alpha + \gamma = \frac{log(1 - VE(v)) - 50.5\beta}{2}
\end{aligned}
$$

To find α , solve $\int_0^\infty f_v(v|z = 0) \exp(\alpha + \beta * v) dv = 1$

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\begin{aligned}
&\iff \int_0^\infty \lambda_v * \exp(-\lambda_v * v) * \exp(\alpha + \beta * v) dv = 1 \\
&\iff \exp(\alpha) * \lambda_v \int_0^\infty \exp(-(\lambda_v - \beta) * v) dv = 1 \\
&\iff \exp(\alpha) * \lambda_v (-\frac{1}{\lambda_v - \beta})(0 - 1) = 1 \\
&\iff \frac{\exp(\alpha) * \lambda_v}{\lambda_v - \beta} = 1 \\
&\iff \exp(\alpha) * \lambda_v = \lambda_v - \beta \\
&\iff \exp(\alpha) = 1 - \frac{\beta}{\lambda_v} \\
&\iff \alpha = log(1 - \frac{\beta}{\lambda_v}) \\
&\implies \gamma = \phi - \alpha
\end{aligned}
$$

Therefore, $\beta = \frac{log(1 - VE(v))}{-45.5}$

$$
\begin{aligned}
\phi &= \frac{log(1 - VE(v)) - 50.5\beta}{2} \\
\alpha &= log(1 - \frac{\beta}{\lambda_v}) \\
\gamma &= \phi - \alpha
\end{aligned}
$$