

a

## Nonparametric Rate Smoothing

*Penalized Likelihood*

$$\Psi = \ln L - \lambda \Phi$$

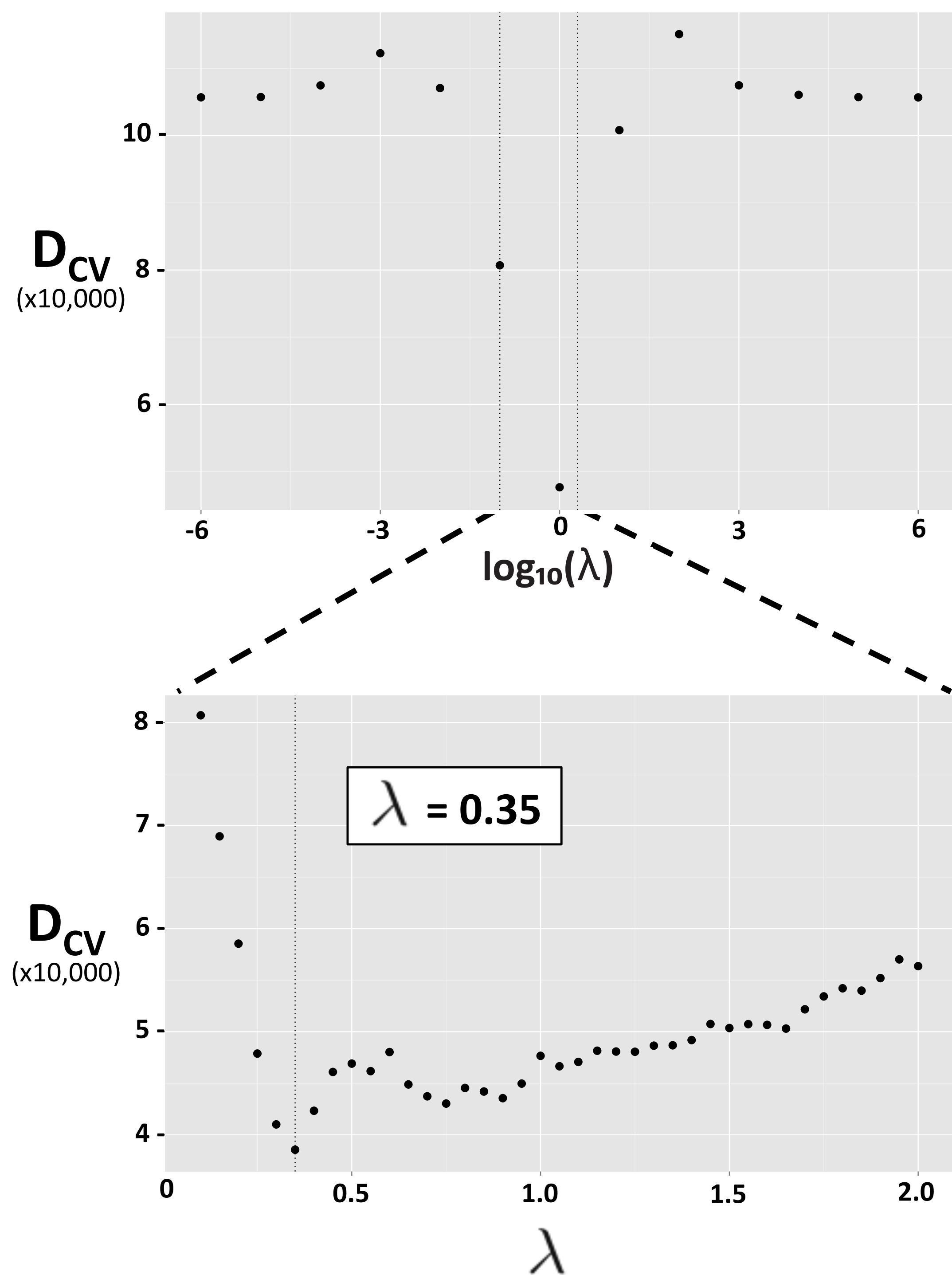
$$\Phi = \sum |\hat{r}_k - \hat{r}_j|^p$$

### Cross-Validation

*Optimal Value of Lambda*

$$D_i^2 = \sum_{j=1}^{n-2} \frac{(\hat{t}_j - \hat{t}_j^{-i})^2}{\hat{t}_j}$$

$$D_{CV} = \sum_i D_i^2$$



b

## Node Calibration

Penalized-Likelihood ( $\lambda = 0.35$ )

Calibrations from Brady et al. (2014)

$\mu$  [95% CI]

### Calibration:

Neivamyrmex: 37.23 [28.04, 46.04] ★

### Verification:

Cheliomyrmex: 29.18 [21.66, 37.79]

Labidus: 24.42 [17.12, 32.31]

Nomamyrmex: 17.78 [10.89, 24.65]

