

Poisson Regression

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Regression: Outcomes are Counts

- Poisson process model roughly applies
- Examples: Relationship of explanatory variables to
 - Number of children
 - Number of typos in a short document
 - Number of workplace accidents in a short time period
 - Number of marriages
- For large λ , CLT says a normality assumption is okay, but not constant variance
- Yes I know, we could stabilize the variance with a square root transformation.

Linear Model for $\log \lambda$

- $\log \lambda = \beta_0 + \beta_1 x_1 + \dots + \beta_{p-1} x_{p-1}$
- Implicitly for $i = 1, \dots, n$
- Everybody in the sample has a different $\lambda = \lambda_i$
- Take exponential function of both sides
- Substitute into Poisson likelihood
- Maximum likelihood as usual
- Likelihood ratio tests, etc.

$$\log \lambda = \beta_0 + \beta_1 x_1 + \dots + \beta_{p-1} x_{p-1}$$

- Increase x_k with everything else held constant, and
 - $\log \lambda$ increases by β_k
 - λ is multiplied by e^{β_k}

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