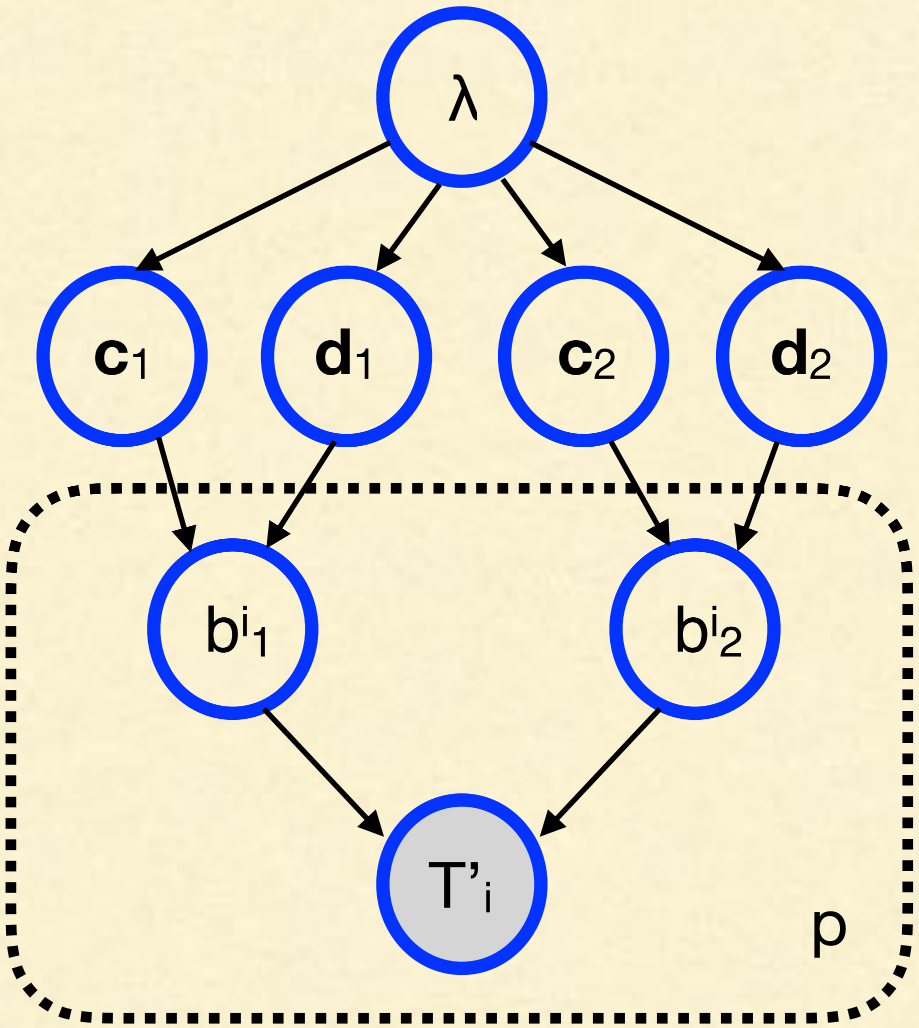
A HIERARCHICAL BAYESIAN APPROACH - THE MODEL



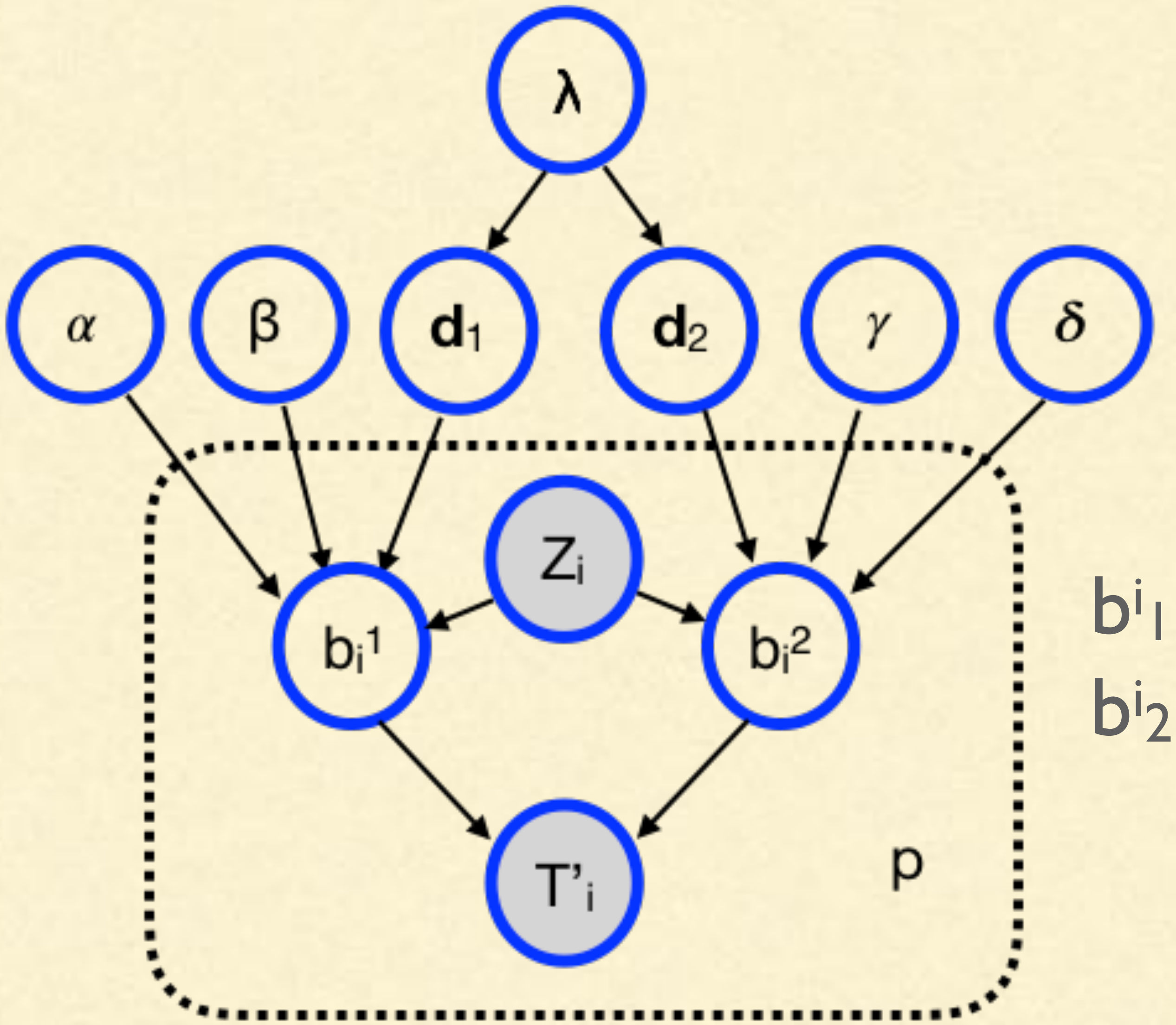
$c_1 \sim \text{Exponential}(\lambda)$
$d_1 \sim \text{Exponential}(\lambda)$
$c_2 \sim \text{Exponential}(\lambda)$
$d_2 \sim \text{Exponential}(\lambda)$

$b^i{}_1 \mid c_1, d_1 \sim \text{Beta}(c_1, d_1)$ i.i.d.
$b^i{}_2 \mid c_2, d_2 \sim \text{Beta}(c_2, d_2)$ i.i.d.

$\theta_i = X_i\, b^i{}_1 + (1 - X_i) b_{2i}$
$T'_i \mid b^i{}_1\, b^i{}_2, X_i \sim \text{Binomial}(N_i, \theta_i)$

King, Rosen, and Tanner

WITH COVARIATES



$$p(\alpha) = p(\beta) = p(\gamma) = p(\delta) \propto 1$$

$$d_1 \sim \text{Exponential}(\lambda)$$
$$d_2 \sim \text{Exponential}(\lambda)$$

$$b^i{}_1 \mid Z_i, d_1, \alpha, \beta \sim \text{Beta}(d_1 \exp(\alpha+\beta Z_i), d_1)$$
$$b^i{}_2 \mid Z_i, d_2, \gamma, \delta \sim \text{Beta}(d_2 \exp(\gamma+\delta Z_i), d_2)$$

$$\theta_i = X_i\, b_{1i} + (1-X_i)\, b^i{}_2$$
$$T'_i \sim \text{Binomial}(N_i, \theta_i)$$

Note: $\log \mathbb{E}(b_{1i})/(1-\mathbb{E}(b_{1,i})) = \alpha+\beta Z_i$