



$$\delta \sim N(0, 1)$$

$$\mu_\phi \sim |N(0, 1)|$$

$$\sigma_\phi \sim U(0, 10)$$

$$\mu_\alpha = \delta \sigma_\alpha$$

$$\sigma_\alpha \sim U(0, 10)$$

$$\alpha_i \sim N(\mu_\alpha, \sigma_\alpha^2)$$

$$\phi_{SN,i} \sim N(\mu_\phi, \sigma_\phi^2)$$

$$\phi_{SB,i} = \phi_{SN,i} + \alpha_i$$

$$\theta_{SN,i} = \Phi(\phi_{SN,i})$$

$$\theta_{SB,i} = \Phi(\phi_{SB,i})$$

$$K_{SN,i} = \mathbf{Binomial}(\theta_{SN,i}, N_{SN,i})$$

$$K_{SB,i} = \mathbf{Binomial}(\theta_{SB,i}, N_{SB,i})$$