I

Likelihood of the Response Data
Production from system, s, in period t

$$prod_i \sim N(\hat{y}_i, \sigma)$$

II

Decomposition of Fitted Data
Intercept and slope that vary by system plus month-of-year dummies that control for seasonality
and vary by county

$$\hat{y}_i = a_s + b_s \, months\_operation_i + \mathbf{month_c}$$

III

System level parameters and decomposition of slope term
Slope terms modelled with location parameter that is a linear function of system-level variables

$$a_s \sim N(\mu^a, \sigma^a)$$

$$b_s \sim N(\mu_s^b, \sigma_s^b)$$

$$\mathbf{month_c} \sim N(\mu^{month}, \sigma^{month})$$

$$\mu_s^b = \mu_l^{lease} + \mu_s^{sect} + \mu_m^{manuf} + \beta^{fy} first\_prod\_year_s + \beta^{size} csi\_rating_s + \beta^{cost} cost_s$$

IV

Meta-parameters
Regularizing higher level distributions

$$\mu^k \sim Cauchy(0,1) \quad k \in \{lease, sect, manuf, a, mon\}$$

$$\beta^i \sim Cauchy(0,1) \quad i \in \{fy, size, cost\}$$

$$\sigma_s^b \sim half-Cauchy(x_0, \gamma)$$

$$\sigma^f \sim half-Cauchy(0,5) \quad f \in \{a, \mu, \beta\}$$