MultilevelJAGS

Jasper Ginn

April 8, 2019

The intercept-only model

The intercept-only model for the directors data is given by the following equations:

$$\begin{aligned} \text{compensation}_{ij} &= \beta_{0j} + e_{ij} && (1) \\ \beta_{0j} &= \gamma_{00} + u_{0j} && (1) \\ \text{compensation}_{ij} &= \gamma_{00} + u_{0j} + e_{ij} && (2) \end{aligned}$$

In words, this means we expect that a director's compensation is dependent on a grand mean over all sectors (γ_{00}) with some error term that captures the variation across sectors (u_{0j}) and an error term that captures variation across directors (e_{ij}).

Alternatively, we can specify the model as follows:

$$\begin{aligned} \text{compensation}_{ij} &\sim N(\beta_{0j}, \sigma^2_e) \\ \beta_{0j} &\sim N(\gamma_{00}, \sigma^2_{u_0}) \\ \gamma_{00} &\sim N(m, s^2) \\ \sigma^2_{u_0} &\sim IG(\alpha_{2_0}, \beta_{2_0}) \\ \sigma^2_e &\sim IG(\alpha_1, \beta_1) \end{aligned}$$

To run the model in JAGS, we construct the following code

```
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 336
##    Unobserved stochastic nodes: 6
##    Total graph size: 690
##
## Initializing model
```

The values returned by JAGS allows us to calculate the *intraclass correlation coefficient*, defined as:

$$\rho = \frac{\sigma^2_{u_0}}{\sigma^2_e + \sigma^2_{u_0}}$$

In the case of the directors data, the ICC equals 0.27. This means:

1. That roughly 27% of the variance can be found at the level 2 (sector) variable.
2. That the expected correlation of two randomly picked directors in a given sector is .27.

Finally, we note that 0 is not included in the credible interval of $\sigma^2_{u_0}$, which leads us to the conclusion that a multilevel model is appropriate. (95% $CCI = [.086, 1.11]$).

The second-level