

Exercises 7 · Statistical adjustment via multiple regression

To turn in: due Wednesday, March 27, 2013

Do smarter animals dream more, all else being equal? To investigate, return to the “mammalsleep” data set, in the R package “faraway” (which you might need to install). As a preliminary step, construct a proxy measure of higher-level brain activity by regressing log brain weight upon log body weight, and extracting the residuals from this regression. Let’s call this new variable “smarts” and treat it as a proxy for the intelligence of a species. You should compare these residuals to the actual animals, perhaps with the R command `cbind(mammalsleep, smarts)`, to ensure that this proxy looks sufficiently sensible to pass the sniff test.

- (A) Plot dreaming hours (Y) versus smarts (X); fit a simple linear model; and describe your findings.
- (B) An obvious potential confounder is the number of hours per night an animal sleeps. Thus the goal is to estimate the marginal effect of a change in residual brain size (smarts) upon nightly dreaming hours, adjusting for sleeping hours.

Undertake each of the following two approaches, confirming that they give the same estimate of the marginal effect of adjusted brain size.

Two stages: first regress smarts upon sleeping hours, extracting the residuals to construct an “adjusted smarts” variable. Then regress dreaming hours upon adjusted smarts.

One stage: fit a multiple-regression model

$$y_i = \beta_0 + \beta_1 x_{i,1} + \beta_2 x_{i,2} + e_i,$$

where Y is dreaming hours, and the two predictors are smarts and sleeping hours. To fit a two-variable regression model in R, one uses the syntax `lm(y ~ x1+x2, data=yourdataset)`.

- (C) Now look at the whole data set. Fit a multiple regression model that (in your judgment) correctly estimates the marginal effect of smarts on dreaming hours, adjusting for whatever combination of factors you deem necessary. Report your conclusions, along with any shortcomings you perceive in the model you decide upon. Make sure to include error bars for your estimate of the effect size.