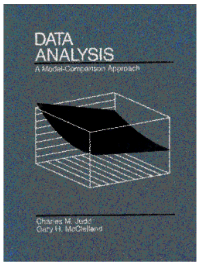
Judd, C.M., & McClelland, G.H. (1989). Data Analysis: A Model Comparison Approach. HBJ.



Brief Lecture Notes for Chapter 8. Multiple Regression: Models with Multiple Continuous Predictors

Gary McClelland

Why?

1. **one predictor at a time is inefficient**
2. **may need more than 1 simultaneously**
3. **including more predictors in model may give more power for question of interest**

use fatrate models as an example

MODELs of the form:

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \cdots + \beta_{p-1} X_{i,p-1} + \varepsilon_i$$

***partial regression coefficient*, better notation is**

$$\beta_{1.23\ldots p-1} \qquad \beta_{2.134\ldots p-1}$$

New Problem: <u>Redundancy</u> among predictors
couldn't have been a problem with simple reg

e.g., JANTEMPC measured in Cent. and
JANTEMPF measured in F.---complete redundancy

more common, partial redundancy
JANTEMP and DECTEMP or
JANTEMP and JANSNOW

we will have to be alert for redundancy and learn to interpret models which involve redundancy, but that is ONLY new problem

Statistical Inference

nothing new!

can ask a lot more questions, but MODEL C/A comparisons, PRE, and F* are *exactly* as before

Estimation:

find b's so that

$$\hat{Y}_i = b_0 + b_1 X_{i1} + \cdots + b_{p-1} X_{i,p-1}$$

SSE is minimized.

Line of simple reg generalizes to plane,
see Ex 8.1, p. 154.

$$b_0 = \bar{Y} - b_1 \bar{X}_1 - b_2 \bar{X}_2 - \cdots$$

***If no redundancy*, then just like in Chpt 6:**

$$b_j = \frac{\sum (X_{ij} - \bar{X}_j)(Y_i - \bar{Y})}{\sum (X_{ij} - \bar{X}_j)^2}$$

***If redundancy*, then it is a mess!**
We will let computer do it!

To give you an idea of the mess, here is the least-squares estimate for one coefficient when there are two predictors.

$$b_1 = \frac{(\sum x_1 y)(\sum x_2^2) - (\sum x_2 y)(\sum x_1 x_2)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1 x_2)^2}$$

where $x_1 = (X_1 - \overline{X}_1)$, etc.

So, for two or more predictors we will be happy to let the computer do the estimation.

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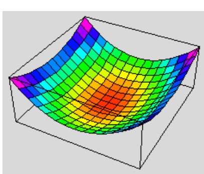
Do detailed example using SAS output

- -
Do UN & IP example (Section 8.5) to illustrate meaning of partial regression coefficients.



http://psych.colorado.edu/~mcclella/grad_stat/welcome.html