Lec 16 Math 390 4/13/11

Non-lin linear models fit with OLS

- polynomial terms e.g. x^2 terms: slope increasing in x linearly (dependence)
- log terms $y = b_0 + b_1 \ln(x)$ this means that

b_1 represents a percent increase in the change of one unit in x. How?

$$\ln(x+1) = x - \frac{x^2}{2} + \frac{x^3}{3} - \ldots \approx x$$

$$\Rightarrow \ln(x) = \ln((x+1)-1) \approx x-1 \quad \text{e.g. } \ln(1.07) = .068 \approx .07$$

$x_f = 1.07$
$x_0 = 1.00$

% increase

$\frac{x_f}{x_0} - 1 = 0.07 = 7\%$

$$b_1 \Delta \ln(x) = b_1(\ln(x_f) - \ln(x_0)) = b_1 \ln\left(\frac{x_f}{x_0}\right) = b_1\left(\frac{x_f}{x_0} - 1\right)$$

b_1: change in y for 100% change in x (doubling)

Some variable work this way!

$$X = \begin{bmatrix} 1 & \ln(x_{11}) \\ 1 & \ln(x_{21}) \\ \vdots & \vdots \\ 1 & \ln(x_{n1}) \end{bmatrix}$$

- Interactions

$$y = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_1 x_2$$
$$= b_0 + (b_1 + b_3 x_2) x_1 + b_2 x_2$$

the slope of x_1 is linear in x_2 with coefficient b_3

$p = 3$, $df = 4$

$$\begin{bmatrix} 1 & x_{11} & x_{12} & x_{11}x_{12} \\ \vdots & \vdots & \vdots & \vdots \\ 1 & x_{n1} & x_{n2} & x_{n1}x_{n2} \end{bmatrix}$$

much more expressibility here...