

Temple University  
Department of Economics

Econometrics II  
Multicollinearity

In the context of the simple linear regression model

$$y_t = \beta_1 + x_t \beta_2 + u_t$$

$$t = 1, 2, \dots, 10$$

we have found the following data generating process

$$x_t = \begin{cases} .5 + a & \text{for } t = 1, 2, 3, 4, 5 \\ .5 - a & \text{for } t = 6, 7, 8, 9, 10 \end{cases}$$

1. Write down the 10x2 matrix X.
2. Calculate  $X'X$ .
3. Calculate  $(X'X)^{-1}$ .
4. Calculate  $(X'X)^{-1}$  for  $a = 10, 5, 1, .1$ , and 0. How does this relate to the problem of collinearity? Your answer should be intuitive.
5. Compute the characteristic roots of each  $X'X$ , for the original data and for the normalized data. To normalize the data each vector should have length one. When you examine the roots are your suspicions of question 4 confirmed?