Econ 772
Homework 3
Testing and Dummy Variables

1) Let

$$y = X\beta + Z\gamma + u,$$

and consider the restriction

$$\gamma = 0.$$

Show that the Wald statistic and the Likelihood Ratio statistic are the same.

2) Consider the model

$$y = X\beta + u$$

where $u \sim N\left(0, \sigma^2 I\right)$. Consider testing the null hypothesis,

$$H_0 : g\left(\beta\right) = 0 \text{ vs } H_A : g\left(\beta\right) \neq 0$$

where $g\left(\cdot\right)$ is a nonlinear function of β.

a) Find a consistent estimator of $g\left(\beta\right)$;

b) Find the asymptotic distribution of your estimator; and

c) Use it to construct a Wald test statistic.

3) Consider the models

$$\begin{aligned} \log W_i &= \beta_0 + \beta_1 Educ_i + \beta_2 Female_i + \beta_3 Black_i + \beta_4 Asian_i + u_{1i}; \\ \log W_i &= \alpha_0 + \alpha_1 Educ_i + \alpha_2 Male_i + \alpha_3 White_i + \alpha_4 Asian_i + u_{2i}. \end{aligned}$$

a) Write each α term as a linear function of the β terms,

$$\alpha_k = b_k'\beta;$$

.

b) Show that

$$\widehat{\alpha}_k = b_k'\widehat{\beta}$$

where $\widehat{\alpha}$ and $\widehat{\beta}$ are OLS estimates.

c) Show that the R^2 for both equations are identically the same.