

Economics 468

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Assignment 2

The file located at the URL

<https://russell-davidson.arts.mcgill.ca/e468/e468.as2.21.dat>

contains 100 observations on four variables, \mathbf{x}_1 , \mathbf{x}_2 , \mathbf{x}_3 , and \mathbf{x}_4 .

Consider the DGP

$$\mathbf{y} = \mathbf{u} \sim N(\mathbf{0}, \sigma^2 \mathbf{I}), \quad \sigma = 20,$$

and the classical normal linear regression model

$$\mathbf{y} = \beta_0 \boldsymbol{\iota} + \sum_{i=1}^4 \mathbf{x}_i \beta_i + \mathbf{u}.$$

Conduct a simulation experiment in which you check that the probability of rejection of the true null hypothesis that

$$\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$$

by an F test at significance level $\alpha = 0.05$ is equal to α . At the same time estimate the family-wise error rate as given by the procedure, based on the Bonferroni inequality, where the probability of rejection of the null hypothesis that none of the individual t tests for the individual nulls that $\beta_i = 0$, $i = 1, 2, 3, 4$ rejects at level $\alpha/4$. Next, do the same thing, using the procedure advocated by Simes, in which the P values for the individual tests are sorted from smallest to largest, yielding

$$P_{(1)} \leq P_{(2)} \leq \dots \leq P_{(4)},$$

and rejection corresponds to at least one event $P_{(i)} < i\alpha/4$.

This should show that both the Bonferroni-based procedure and that of Simes are conservative, but that Simes' procedure is less so than that based on the Bonferroni inequality.