Economics 471: Introductory Econometrics

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Midterm II – Answers

1. (a) The *only* parameter estimate which is effected is the parameter estimate on β_2. If x_{2i}, $i = 1, 2, \dots, n$ are each multiplied by the same constant c, then its coefficient β_2 is divided by c.
   (b) Similarly, *only* the standard error for β_2 is multiplied by c.
   (c) t and F-stats do not change for any of the variables.
   (d) If y_i, $i = 1, 2, \dots, n$ are each multiplied by the same constant c, then *all* of the parameters are multiplied by c.
   (e) Similarly, *all* of the standard errors are divided by c.
   (f) Again, the t and F-stats are unaffected.

2. It is perfectly accpetable to use the F-test statistic $F = \frac{(SSR_r - SSR_u)/q}{(1-SSR_u)/(n-k-1)}$ where relevant
   (a) unrestricted model:6, restrcted model:2

   $$F = \frac{\left(R_u^2 - R_r^2\right)/q}{\left(1 - R_u^2\right)/(n-k-1)} = \frac{(0.073 - 0.050)/2}{(1 - 0.073)/(1289 - 3 - 1)} = 15.9412 > F(3, 1285) = 2.08$$

   thus we reject the null at the five percent level
   (b) unrestricted model:5, restrcted model:2

   $$F = \frac{\left(R_u^2 - R_r^2\right)/q}{\left(1 - R_u^2\right)/(n-k-1)} = \frac{(0.064 - 0.050)/1}{(1 - 0.064)/(1289 - 1 - 1)} = 19.25 > F(1, 1284) = 2.71$$

   thus we reject the null at the five percent level
   (c) **A** $= 0$. $R^2 = \frac{SSE}{SST}$, $SSE = \sum_{i=1}^{n} \left(\widehat{y}_i - \overline{y}\right)^2$, $y_i = \beta_1 + u_i \Rightarrow \widehat{y}_i = \widehat{\beta}_1 = \overline{y} \Rightarrow SSE = 0 \Rightarrow R^2 = 0$. **B** – no value for F
   (d) **C** $= 7.899$. $\widehat{\sigma} = \sqrt{\widehat{\sigma}^2} = \frac{1}{n-k-1} SST$, $SST = \frac{SSR}{1-R^2} = \frac{76288}{1-0.050} = 80303.158$, $\widehat{\sigma}^2 = \frac{1}{1289-1-1} 80303.158 = 62.395$, $\widehat{\sigma} = \sqrt{62.395} = 7.899$,
   D $= 67.736$. $F = \frac{R^2/q}{(1-R^2)/n-k-1} = \frac{0.050/1}{(1-0.050)/(1289-1-1)} = 67.736$

3. (a) $\frac{\partial y}{\partial income} = 0.0635 - 2 * 0.0002 * income = 0.0635 - 0.0004 * income$ – it depends on the level of income

   (b) $E\left(Rent|Income, SquareFoot, View = 1\right) - E\left(Rent|Income, SquareFoot, View = 0\right) = 1000.26$ – going from an apartment with an obstructed view to one with an unobstructed view increases your predicted rent by approximately one-thousand dollars per year

   (c) $\bar{R}^2 = 1 - \frac{\left(1-R^2\right)(n-1)}{n-k-1} = 1 - \frac{(1-0.1555)107}{103} = 0.1227$

   (d) $H_0 : \beta_{Income} = \beta_{Income^2} = \beta_{SquareFoot} = \beta_{View} = 0$, H_1 : the null is not true

$$\begin{aligned} F &= \frac{R^2/q}{\left(1-R^2\right)/n-k-1} = \frac{0.1555/4}{\left(1-0.1555\right)/103} \\ &= 4.7414 > F(4, 103) \end{aligned}$$