

Solution for the old exam

Model: $y(\text{contract}) = \beta_0 + \beta_1 * \text{city} + \beta_2 * \text{brink} + e$, $n = 46$ and $p = 3$

1. $H_0 : \beta_1 = \beta_2 = 0$ v.s. H_1 : at least one is not zero.
2. $p - 1 = 2$
3. (a) R.S.E = $\sqrt{\frac{\text{RSS}}{n-p}}$
 (b) $F = \frac{(\text{TSS}-\text{RSS})/(p-1)}{\text{RSS}/(n-p)}$
 (c) $R^2 = 1 - \frac{\text{RSS}}{\text{TSS}}$
 $\text{RSS} = 159.3419 * 10^6$, $\text{TSS} = 223.8494 * 10^6$
 $R^2 = 0.2882$
4. Total collection is 109324.72\$ less when brink collects it. So the amount the employees stole is 109324.72\$.
5. This data is collected over 4 years so we may need to check the auto-correlation of the errors.
6. Since log function is almost linear when range of data does not change in magnitudes.
7. From the output, t -value = -1.015 with p -value = 0.31587 which implies we cannot reject the null hypothesis that the regression parameter corresponding to the Examination variable in this model is zero. We can say the effect of the Examination on Fertility in this model is not significant when other predictors (Agriculture, Education, Catholic and Infant. Mortality) are included in the model.
8. R.S.E = $\sqrt{\text{RSS}/(n-p)}$. So $\text{RSS} = 2104.8262$.
9. Pretty good - In social science. Lecture note page 22.
10. We can perform lack of fit test in two cases. One, when we know σ^2 or two, when we have repeated y for one or more fixed x . Neither of this information is given in this data.
11. $\text{TSS} = \text{RSS}/(1 - R^2) = 7178.8070$
 $\text{RSS} = 2104.8286$
 $F = \frac{(\text{TSS}-\text{RSS})/(p-1)}{\text{RSS}/(n-p)} = 19.7673$
12. No. The magnitude itself of the coefficient is not important.
13. No. This is an ecological regression, the observation is aggregated, so the conclusion can not be extended to individuals.
14. No. Normal assumption is made on error in the model, not on the data value (response).