STA501: Data-based Decision Making

Problem Set 2

Question 1. Increases in oil prices have been blamed for several recessions in developed countries. Let GDP_t denote the value of quarterly gross domestic product in Switzerland and let $Y_t = 100 \times \ln(GDP_t/GDP_{t-1})$ be the quarterly percentage change in GDP.

Arguably, oil prices adversely affect the economy only when they jump above their values in the recent past: Hence, let O_t the percentage point difference between oil prices at date t and their maximum value during the past year (i.e., $O_t = \max(0, oilpricechange)$).

$$\hat{Y} = \underset{(0.1)}{1.0} - \underset{(0.054)}{0.055}O_t - \underset{(0.057)}{0.026}O_{t-1} - \underset{(0.048)}{0.031}O_{t-2} - \underset{(0.042)}{0.109}O_{t-3} - \underset{(0.053)}{0.128}O_{t-4}$$
$$+ \underset{(0.025)}{0.038}O_{t-5} + \underset{(0.048)}{0.025}O_{t-6} - \underset{(0.039)}{0.019}O_{t-7} + \underset{(0.042)}{0.067}O_{t-8}.$$

(a) Suppose that oil prices jump 25% above their previous peak value and stay at this new higher level (so that $O_t = 25$ and $O_{t+1} = O_{t+2} = .. = 0$). What is the predicted effect on output growth for each quarter over the next 2 years?

(b) What intuition can you suggest for the researcher stopping at 8 quarters?

(c) Construct a 95% confidence interval for your answers in (a), assuming we have data from 1955 to 2020.

(d) What is the predicted cumulative change in GDP growth over eight quarters?

(e) A robust F-statistic, used to test whether the coefficients on O_t and its lags are zero, is 3.49. Are the coefficients significantly different from zero? Explain your answer. Briefly indicate why a robust F-statistic was used instead of the usual F statistic.

Question 2. Resesearcher A would like to build a model to estimate elasticity of substitution:

$$\log(\text{Demand of Sprits}) = \beta_1 + \beta_2 \log(\text{Price of Beer}) + \beta_3 \log(\text{Price of Spirits}) + u_1 \quad (1)$$

added its own price for the control of income effect. Researcher B argues that the demand quantity has to be scaled by price, because no scaling may create larger error.

$$\log\frac{(\text{Demand of Spirits})}{(\text{Price of Spirits})} = \alpha_1 + \alpha_2 \log(\text{Price of Beer}) + \alpha_3 \log(\text{Price of Spirits}) + u_2 \quad (2)$$

where u_1 and u_2 are disturbance terms.

(a) Evaluate the researcher A's claim

(b) Evaluate the researcher B's claim

(c) How do you interpret β_2, β_3, α_2, and α_3? Would B's R^2 be any better than A's?

(d) Researcher C proposes that demand quantity of beer must be included in the regression in order to avoid mis-specification error. Evaluate the claim

(e) Researcher D claims that there has been a sweeping trend in the country for cocktail that created a variety of mixture of beer and spirit, which has to be reflected in the regression. If you agree with her, how would you include the factor into the model and what are the needed data? Does the form of data need to be pre-processed, if you continue to use logged form of regression?