# Revision 1

**Problem 1**. Consider the model:

$$\log(price) = \beta_0 + \beta_1 sqrft + \beta_2 bdrms + u$$

The estimated model is:

$$\widehat{\log(price)} = 11.67 + 0.000379\ sqrft + 0.0289\ bdrms \quad (1)$$

$$(0.10) \quad (0.000043) \qquad (0.0296) \quad (2)$$

$$n = 88, \quad R^2 = 0.588$$

(a) What is the percentage change in price when a 150-foot bedroom is added to the house? Denote this percentage change by $\hat{\theta}100\%$.

(b) What regression do you have to run to obtain directly a standard error for $\hat{\theta}$?

(c) What is the predicted average house price when $sqrft = 300$ and $bdrms = 5$?

(d) You are worried about the functional form of your model and would like to investigate the possibility of having quadratic terms in your model. Therefore you conduct a RESET test. The $R^2$ from the restricted regression is 0.60, and the $R^2$ from the unrestricted regression is 0.72.

i. Write the restricted model and the unrestricted model.

ii. Write the null and alternative hypotheses.

iii. Compute the relevant statistic for the RESET test and decide whether you reject or fail to reject the null hypothesis at 5% significance level.

**Problem 2.** Consider the simple linear regression model:

$$y_t = \beta_0 + \beta_1 x_t + u_t,$$

where $u_t$ is a white noise with mean zero and variance $\sigma_u^2$. The OLS estimator can be written as

$$\hat{\beta}_1 = \beta_1 + SST_x^{-1} \sum_{t=1}^{T} x_t u_t,$$

where $SST_x = \sum_{t=1}^{T} x_t^2$.

(a) Compute $Var(\hat{\beta}_1)$ conditional on the regressors $x_1, \ldots, x_T$.

(b) Assume that:

$$u_t = \rho u_{t-1} + e_t, \; t = 1, \ldots, T-1, \quad |\rho| < 1, e_t \; i.i.d.(0, 1).$$

i. What is the name of this model?

ii. Derive $Cov(u_t, u_{t+h})$. [*Hint: Use the fact that* $Cov(u_t, u_{t+h}) = Cov(u_t, u_{t-h})$].

iii. Compute $Var(\hat{\beta}_1)$. Briefly compare it with the variance in (a).

iv. What regression do you need to run to obtain the GLS estimator?