Exercise Session 3

The data file *collegetown* contains observations on 500 single-family houses sold in Baton Rouge, Louisiana, during 2009–2013. The data include sale price (in thousands of dollars), *PRICE*, and total interior area of the house in hundreds of square feet, *SQFT*.

a. Plot house price against house size in a scatter diagram

gnuplot price sqft --output=display

b. Estimate the linear regression model *PRICE* = $\beta_1 + \beta_2 SQFT + e$. Interpret the estimates. Draw a sketch of the fitted line.

```
             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const       -115.424     13.0882      -8.819    1.95e-017 ***
  sqft          13.4029     0.449164    29.84     5.92e-113 ***

Mean dependent var   250.2369   S.D. dependent var   171.4765
Sum squared resid     5262847   S.E. of regression   102.8006
R-squared            0.641317   Adjusted R-squared   0.640596
F(1, 498)            890.4114   P-value(F)           5.9e-113
Log-likelihood      -3024.863   Akaike criterion     6053.726
Schwarz criterion    6062.155   Hannan-Quinn         6057.033
```

If the size of the house increases by one unit, price increases by 13.4 thousand dollars

Check for the first observation what the y-hat is

c. Estimate the quadratic regression model *PRICE* = $\alpha_1 + \alpha_2 SQFT^2 + e$. Compute the marginal effect of an additional 100 square feet of living area in a home with 2000 square feet of living space.
genr sqft2=sqft^2
ols price const sqft2

Take a derivative wrt sqft in *PRICE* = $\alpha_1 + \alpha_2 SQFT^2 + e$:

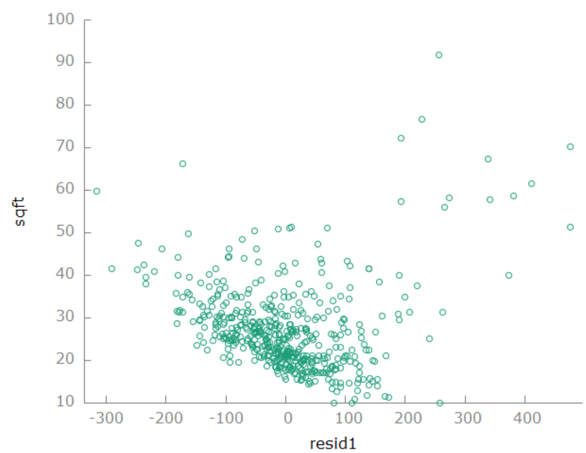
$$\frac{\partial PRICE}{\partial SQFT} = 2 * \alpha_2 * sqft$$

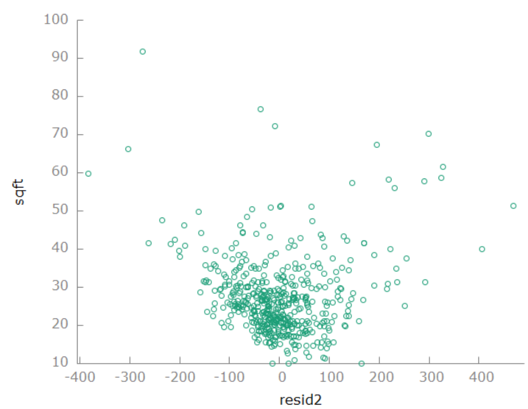
If sqft=2000 then

$$\frac{\partial PRICE}{\partial SQFT} = 2 * \alpha_2 * 2000 = 4000 * 0.18 = 720$$

If you increase the size of the house with 2000 square feet by 100 square feet, price will increase by 720 thousand dollars (initial condition matters)

d. For the regressions in (b) and (c), compute the least squares residuals and plot them against *SQFT*. Do any of our assumptions appear violated?





Assumptions don't seem violated that error terms should not be correlated with the explanatory variable. We can check correlations by running
corr resid1 sqft
corr resid2 sqft^2

e. One basis for choosing between these two specifications is how well the data are fit by the model. Compare the sum of squared residuals (*SSR*) from the models in (b) and (c). Which model has a lower *SSR*? How does having a lower *SSR* indicate a "better-fitting" model?

The second model has lower SSR. Lower SSR means that there is less variation unexplained in the model. SSR is tightly related with the goodness of fit measure in fact R^2= 1-SSR/SST, therefore, larger SSR will deliver worse goodness of fit.

Solutions are also available as script file *collegetown.inp*