

Homework 3

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Spring semester 2021

1.(a) Since $y_i = e^\alpha \delta^{d_i} z_i^\gamma e^{\eta_i}$, if we take \ln on this relationship we get:

$$\ln(y_i) = \ln(e^\alpha \delta^{d_i} z_i^\gamma e^{\eta_i}) = \ln(e^\alpha + \ln \delta^{d_i} + \ln z_i^\gamma + \ln e^{\eta_i}) = \alpha + \ln(\delta) d_i + \gamma \ln(z_i) + \eta_i$$

(b) In the model, we take the exponential of $\ln \delta$ since we have $\ln(y_i)$ which is δ . So a unit increase in d_i which means receiving the retrofit program cause a change in average y, equal to $|1 - \delta|$ percentage points, if all other variables are held constant. The change could be increase when sign is positive and decrease when sign is negative.

$$(c) \text{ For } d_i = 0, \frac{\Delta y_i}{\Delta d_i} = \frac{(e^{\alpha \delta^{d_i + \Delta d_i}} z_i^\gamma e^{\eta_i} - e^{\alpha \delta^{d_i}} z_i^\gamma e^{\eta_i})}{\Delta d_i} = \frac{(e^{\alpha \delta^{0 + \Delta d_i}} z_i^\gamma e^{\eta_i} - e^{\alpha \delta^0} z_i^\gamma e^{\eta_i})}{\Delta d_i} = \frac{e^{\alpha} z_i^\gamma e^{\eta_i} (\delta^{\Delta d_i} - 1)}{\Delta d_i}$$

$$\text{but } \Delta d_i = 1, \text{ so } \frac{\Delta y_i}{\Delta d_i} = e^{\alpha} z_i^\gamma e^{\eta_i} (\delta - 1) = \frac{y_i (\delta - 1)}{\delta^{d_i}}.$$

It shows the change in electricity use when a home receives the retrofit program.

$$(d) \frac{\partial y_i}{\partial z_i} = e^{\alpha} \delta^{d_i} \gamma z_i^{\gamma-1} e^{\eta_i} = \frac{\gamma e^{\alpha} \delta^{d_i} z_i^\gamma e^{\eta_i}}{z_i} = \gamma \frac{y_i}{z_i}.$$

It shows the change in electricity use when there is a change in square feet of the house.

(e) See table 1:

	Coefficient estimates	Marginal Effect Estimates
ln(sqft)	0.89 (0.88, 0.91)	0.85 (0.82, 0.88)
retrofit	-0.1 (-0.11, -0.09)	-0.71 (0.06, 0.86)
ln(temp)	0.28 (0.04, 0.53)	0.44 (-0.85, -0.58)
constant	-0.76 (-1.88, 0.33)	NaN NaN

Table 1: Sample regression output table with confidence intervals! Confidence intervals bootstrapped with 1000 replications.

(f) The confidence interval of temp is wider compared to sqft, which means higher variability. See figure 1:

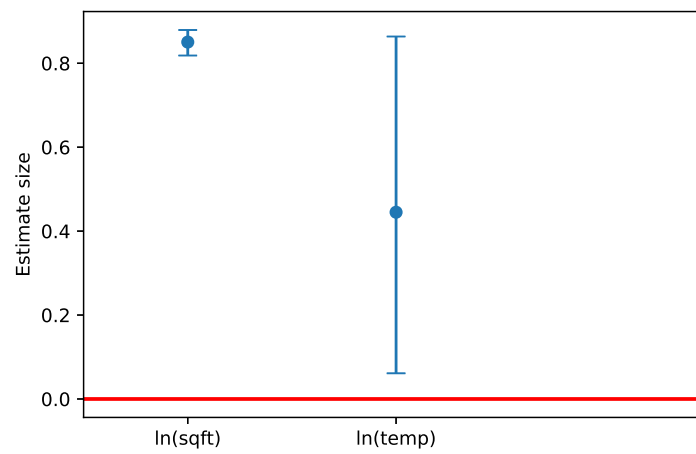


Figure 1: Average marginal effects estimates with 95% confidence intervals bootstrapped using 1,000 replications.