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:

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

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

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

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

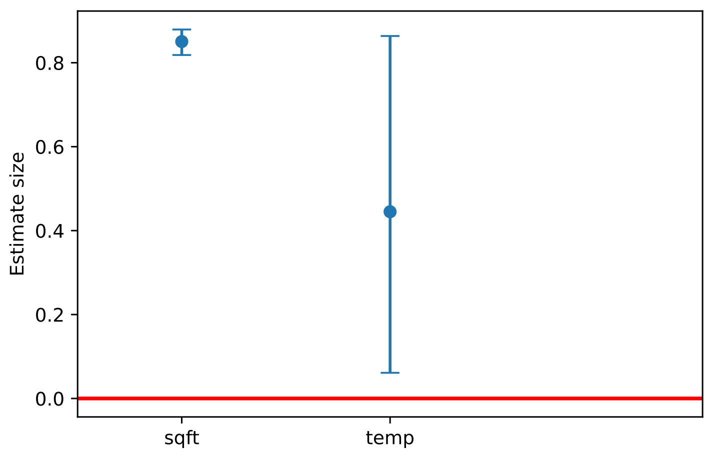

Figure 1: Average marginal effects estimates with 95% confidence intervals bootstrapped using 1,000 replications.