Written Exercise
ARE 264: Empirical Energy and Environmental Economics

Revising a theoretical treatment

The empirical results in West, Hoekstra, Meer and Puller (*Journal of Public Economics* 2017) suggest that consumers, who were pushed to purchase a more efficient vehicle by the cash-for-clunkers program, did not increase their mileage in response to the improved fuel economy of their cars. They argue that this makes sense, as the more efficient cars were lower quality on other dimensions, which makes them less desirable to drive. The treatment that they provide, however, allows for an endogenous choice in mileage, but not in fuel economy or quality.

Your task is to rewrite the theoretical material, <u>as if you were going to place this into the paper</u> (basically, start in the first full paragraph on page 5), taking into account the endogenous choice of vehicle attributes, including fuel economy and "quality". Your material should be 3 or 4 pages of text (plus figures, as needed), and it should introduce the model and explain the key result. You should have two goals in mind. First, your model should deliver whatever result is relevant for the empirical portion of the paper. Second, the current paper comments briefly on how the quality-mileage interaction affects what response you'd expect from a fuel-economy policy. Modify these thoughts, as appropriate, in your setup. Again, you are to write this as if it part of the full paper.

If you believe that any additional insights from making fuel economy and quality endogenous are truly tertiary, feel free to write this up as an appendix section that shows that the model they have is robust to this generalization.

I suggest (but do not require) that you use the following pieces in your model:

- Let mileage m, quality x and fuel consumption rate g (for gallons-per-mile) be choice variables. I recommend working with fuel consumption rather than fuel economy, because driving cost is linearly related to fuel consumption. This just makes the algebra a little less cumbersome.

- You might want to just model the interaction between quality and mileage by having a transparent product of functions yield utility: e.g., utility from driving is $\phi(m) \times \theta(x)$. This might make notation and intuition easier than a more general $f(m, x)$.

- Let prices of the car be some smooth function of quality and fuel consumption $p(x, g)$. Assume the consumer can choose any bundle x and g, rather than modeling a finite set of products.

- You can let utility be quasilinear in the numeraire consumption good (no income effects). (Feel free to consider income effects, but they seem to me second-order, though I might be wrong.)

- You can ignore externalities; the government cares about externalities, but the paper is about understanding consumer choices, not optimal policy design. (Note, however, that the welfare implications of the rebound will depend on how it affects the externality. So, you can go into this if you want, but the main objective here is to make predictions about what will happen in the empirical part of the paper, which is non-normative.)