Empirical problem set: Behavioral welfare analysis and estimating optimal sin taxes

Behavioral Public Economics Mini-Course

September 30, 2019

Overview

This problem set is a replication, extension, and discussion of Allcott and Taubinsky (2015), "Evaluating Behaviorally Motivated Policy," hereafter "AT." The paper and online appendix are available here.

For this problem set and all of your empirical work, we strongly recommend that you use GitHub for version control and task management. A good reference is the Gentzkow-Shapiro RA guide, available here.

We have set up a start-up folder (including folder structure, input data, and starter code) on a GitHub repository, available here. To use this, set up a GitHub account here and clone the problem set repository. The data files necessary for the analysis are available here. You can then do the analysis beginning with the Stata starter do file or any other data analysis software, compile your results into the starter lyx file, and replace the starter results pdf with your completed work.

If you do not want to use GitHub, you can simply download the files directly from the web links.

1 Replication and critique of AT

1.1 To make sure you understand the data, first replicate Table 1, Figure 3, and Figure 4 from AT.

1.2 Review Assumption 1 on page 2524 of the published paper. To what extent do you find Assumption 1 plausible in this context?

1.3 Using the results of Figure 4, what is the optimal CFL subsidy under Assumption 1?

1.4 Estimate average marginal bias using the Equivalent Price Metric, as described in Online Appendix B.B.

1.5 Using your results from question 1.4, what is the optimal CFL subsidy under Assumption 1?

1.6 Using the discussion on page 2511, describe in your own words the assumption required for the Equivalent Price Metric to equal money-metric bias. Give an intuitive example of why this might fail.

1.7 Calculate the welfare effect of a ban on incandescent lightbulbs under Assumption 1, in units of \$/package. This should match row 1 of Table 3 from AT. What are the total "internality reduction" gain and the total "Harberger distortion" loss (as illustrated in Figure 6 from AT), in units of \$/package?

1.8 What additional considerations would you take into account before using these results to advise policy makers?

2 Comparing demand responses

In addition to a debiasing intervention as carried out by AT, another approach to measuring bias from inattention or imperfect information is what we have called "comparing demand responses."

Imagine that consumer type θ's normative valuation for the CFL relative to the incandescent lightbulb is

$$V_\theta = v_\theta - p + e, \tag{1}$$

where v reflects heterogeneous preferences for the non-price characteristics of the two bulbs, p is the relative price of the CFL, and e is the present discounted value of the lifetime relative electricity savings from the CFL. More precisely, if the average lightbulb will be used 1000 hours per year over four years (a rough approximation), the annual discount factor is $\delta = 0.95$, p_e is the marginal electricity price in dollars per kilowatt-hour (kWh), w is electricity use ($w_{inc} = 0.06$ kWh per hour and $w_{CFL} = 0.015$ kWh per hour), and we assume zero discounting, then

$$e = e(p_e) = \sum_{t=1}^{4} \delta^t \cdot 1000 \cdot p_e \cdot (w_{inc} - w_{CFL}) \tag{2}$$

dollars.

If consumers do not pay full attention to the electricity savings e, then type θ's actual valuation would be

$$U = v - p + (1 - \tilde{\gamma}_\theta)e, \tag{3}$$

where $\tilde{\gamma}_\theta$ reflects the share of e that is misperceived. In the standard model, $\tilde{\gamma}_\theta = 0$. If electricity prices are not fully salient or consumers underestimate the electricity savings $(w_{inc} - w_{CFL})$, then $\tilde{\gamma}_\theta > 0$.

Electricity prices p_e vary across utilities and states. A testable hypothesis of $\tilde{\gamma}_\theta = 0$ is that their valuations will reflect this cross-sectional variation. Let's test this hypothesis.

2.1 The file MarginalElectricityPrice.dta contains average marginal residential electricity prices by state for 2014. (The original data on marginal price are at the utility level, from Borenstein and Bushnell (2019). We collapsed this to the state level, weighting by each utility's number of customers, so this is the average of marginal prices across utilities.) Add an additional variable to MarginalElectricityPrice.dta that contains the CFL lifetime electricity savings e from Equation (2). Report the unweighted average across states.

2.2 Merge the e variable into the AT TESS microdata. Construct a scatterplot with one observation per state, showing the average of baseline relative CFL valuation (the WTP1 variable) on the y-axis and the average of relative CFL savings (your new e variable) on the x-axis. Plot a best fit line, weighting each state by the number of observations in that state. What is the slope of this best-fit line?

2.3 Construct a regression table that presents the results of an regression of WTP1 on e. Cluster your standard errors by state. The slope should be the same as the best-fit line from question 2.2.

2.4 What are the assumptions required for this regression to be an unbiased estimator of $\tilde{\gamma}$? (Hint: there are two. The first is discussed on page 2512 of AT. The second is that v is exogenous.)

2.5 Can you think of any reasons why v might not be exogenous? Put differently, are there any reasons why preferences for CFLs might be correlated with electricity prices?

2.6 Look in the AT TESS microdata for variables that might help control for confounding factors you discussed in question 2.5. Add another column to your regression table that includes these control variables. How much does this change the results?

2.7 Calculate the average marginal bias (in units of dollars) based on your regression estimate of $\tilde{\gamma}$. (The estimated average marginal bias should be $\hat{\gamma} = \hat{\tilde{\gamma}}e$.) Compare and contrast this estimate to the estimates from the informational intervention in AT's Figure 4. What might explain any differences?