PUBPOL 639: ASSIGNMENT 6 - Solutions
Winter 2011

Due: Monday, April 18th at the start of class

Below is a sketch of a response to assignment 6.

Callan, Scott and Janet Thomas. 1997. "The Impact of State and Local Policies on the Recycling Effort." *Eastern Economic Journal* 23(Fall), 411- 24.	**Fullerton, Don and Thomas C. Kinnaman**. 1996. "Household Responses to Pricing Garbage by the Bag." *American Economic Review* 86, 971–83
1a) Causal question of interest	
What is the effect of having curbside recycling, garbage unit-pricing, and these two policies together on the fraction of waste that is recycled? Note: These papers could also be used to answer a ton of other questions such as "what is the effect of proximity to a state material recycling center on community recycling rates?" or "how does population density relate to recycling rates?" I focus here (as should you) on the most important one as it relates to the question posed in the assignment and by the Mayor in the final project.	What is the effect of garbage unit-pricing on the amount of garbage and recycling produced by households (weight and/or volume)? Note: the policy they look at was implemented when curbside recycling was already available, so they are measuring the incremental effect of unit-pricing.
1b) Ideal experiment	
Randomly assign these three policies (plus no policy change) across households. Compare to control group before and after. Households in different groups would need to be far enough away to avoid spillovers. Check that control and treatment groups are comparable in their recycling/trash behavior before random assignment.	Same
1c) Identification strategy	
Use variation in policies across towns/cities, after controlling for town/city characteristics.	Before/after comparison and difference in difference. Compare same households before/after policy change. Contrast outcome change over time to that seen in comparable cities that did not experience a policy change.
2a) Estimated effect of X on Y?	
In isolation, unit pricing and curbside recycling are associated with a 6.6 [$p<0.01$] and 4.2 [$p<0.05$] percentage point increase in the recycling rate, respectively. When	Unit pricing (when curbside recycling is already available) is associated with a 14% [$p<0.05$] decrease in garbage weight, 37% [$p<0.01$] decrease in number of garbage cans,

implemented together, these policies are associated with an additional gain of 5.5 percentage points [p<0.10] in the recycling rate beyond the contribution of these policies individually. Together, these imply that the recycling rate of a community that already has curbside recycling would be expected to increase its recycling rate by 12.1 percentage points when unit pricing was implemented. These effects are pretty large relative to the mean recycling rate of 26%. [Note: I haven't said "holding constant…." but you could.]	and a 16% [p<.10] increase in recycling weight. Another way of doing this would be to calculate that the recycling rate (by volume) [1] increased from 25% to 31% with the introduction of unit pricing. This 6 percentage point increase is pretty large relative to the baseline rate of 25%. [Note: I haven't said "holding all fixed characteristics of households constant" but you could.]

2b) Data

Unit of observation is the city/town. All towns/cities in Massachusetts in 1995 (excluding 27 with missing data, final n = 324). Data is probably reflective of MA overall, but MA may or may not be representative of the US overall. Includes both rural towns and urban areas.	Unit of observation is the household. Data come from a (initially) random sample of households in Charlottesville, VA in 1992, excluding households near UVA. Of the 400 sampled households, 97 agreed to participate. And final sample was 75 households, after adjusting for missing data and movers. Sample is higher than average income, education, oversamples homeowners, married couples, and FT workers.

3a) Why treatment status varies

There is not a very detailed discussion of this. There was an overall push by the state to get communities to recycle more, but we don't really know why some towns enacted recycling programs while others did not. Policies are implemented at the local level, so we might worry that the communities that had implemented recycling/garbage policies at the time of the study may be different than the communities that implemented them later or not at all.	Treatment status varies because of a policy change that was implemented city-wide. A strength of the study is that individual households did not choose to experience the policy change.

3b) Indentifying variation

The identifying variation is the variation in policies across towns that cannot be explained by the socioeconomic characteristics included in the regression. That is, even after controlling for income, education, density, population, socioeconomic classification, etc, there is still variation in the policies that towns	The identifying variation is the variation in treatment status within households (over time). So this controls for any fixed differences between households in their recycling behavior.

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[1] Recycling rate in May is 3.69/(3.69+10.9) = 25.3%. Same method to calculate recycling rate in Sept.

enact. This is our identifying variation.	
3b) Threats to internal validity	
The biggest concern is that the policies may be correlated with other (unobserved) determinants of recycling behavior. For instance, communities that care more about the environment may have more enviro-friendly policies and be more likely to recycle even in the absence of these policies. Or there could be reverse causality: towns with higher recycling rates may decide to implement curb-side recycling to reduce the recycling burden. Both of these would cause the OLS estimates to overstate the true causal effect (i.e. positive bias). There are other possible mechanisms that could generate negative omitted variable bias, positive bias seems more likely. Measurement error is unlikely to be a problem here since the data comes from the agency that oversees and regulates this. Sample selection is probably not a problem here because inclusion in the sample was not voluntary: all cities/towns (without missing data) are included.	Sample selection. People that participated in the study may have been particularly enthusiastic about the policy change (positive bias if they expected to increase recycling a lot; negative bias if they were already recycling as much as they could).

Changes in consumption over time. You can think of the time trend as generating an omitted variable bias – it is possible that garbage/recycling would have changed anyways over the time period, even if the policy had not changed. "Time" is an omitted variable that is correlated with the treatment and could be correlated with the outcome. To address this, they make comparisons to the aggregate (residential +commercial) seasonal trend in other cities and in Charlottesville in other years (a difference-in-difference approach). It is reassuring that the May to September change is similar for all these other "control groups," but it is not clear that this is a good comparison group for household behavior since aggregated waste may have a different trend then household only. Also, they do not present seasonal recycling trends for these control cities. For these reasons, the authors actually prefer to use the estimates that do not control explicitly for a possible time trend. |
| **4) External validity** | |
| The external validity depends on what you are trying to compare to. Compared to New England overall (or New England states with similar characteristics) this might provide a useful comparison.

Since this study combines many types of communities and estimates an average for all of them, you may be cautious about applying results to one specific community, unless that community is similar to the MA average. For instance, results may not generalize to rural areas specifically or urban areas specifically since this study | This study looks at a very specific population (well-off households in a medium sized college town). Would worry about extrapolating more broadly. However, to the extent that the population is similar to that in other small cities, especially those with colleges (e.g., East Lansing), it might be OK to extrapolate, at least for the early 1990s.

One thing that is useful about this study is that since they have also estimated how the response differed with household characteristics [Table 4], you could use their estimates to predict the overall response in an |

estimates an average of these. A lot has changed since 1995. Would need to explore how this might affect applying these findings to today.	area that had different characteristics.

5a) Differ in findings and conclusions?

The studies do have findings that are <u>broadly consistent</u>: <u>unit pricing increases the fraction of household waste that is recycled</u>. Fullerton and Kinnaman are also able to decompose this into the change due to decreased garbage, increased recycling, and increased dumping. The studies do differ somewhat in the estimated magnitude: C&T find that the recycling rate increase associated with unit pricing (when curbside recycling is already present) is about twice that found by F&K (12 vs. 6 percentage points). This could just reflect statistical chance. I have not calculated the standard errors on these estimates, but I doubt that we would be able to reject that the two studies have the same estimated effect. There is also reason to believe that C&T may suffer from positive OVB while the bias in F&K could be positive or negative. Lastly, it is possible that differences in the population studied could partially explain the results. While C&T examine a very broad population (all cities/towns in MA), Charlottesville residents are particularly well educated. If more educated households tend to recycle more even in the absence of unit pricing for garbage, the effect of the policy change will be smaller than we might see in a broader population.

5b) Overall conclusions

Collectively, the studies do suggest that unit pricing increases the recycling rate, either by reducing garbage, increasing the use of the recyclables, or causing people to be more diligent about separating recyclables from non-recyclables. The studies use very different methods, identification strategies, and data to reach, essentially, the same conclusion. Uncertainty about the precise magnitude of the effect is the weakest aspect of the studies.

General Advice on Reading Empirical Studies

Expect jargon and poor writing (enjoy the rare exceptions!). Plowing through nonsense in order to grasp the gist of a study is a critical task for policy analysts. You have an excellent grounding in empirical methods and are quickly gaining the skills needed to assess just about any empirical evaluation. You may not be able to interpret every equation or sentence, but if the authors have done their job then you will be able to evaluate their results and judge the quality of their analysis.

Questions to Answer

1) FAQs
   a) What is the causal question of interest?
   b) Ideal experiment: How could you use an RCT to answer this causal question?
   c) Identification strategy: How does the study use observational data to approximate an ideal experiment?

2) Important Details
   a) What is the estimated effect of X on Y?
      i) What is its statistical significance?
      ii) What is its practical significance (magnitude)?
   b) Data
      i) What is the unit of observation?
      ii) What is the size of sample
      iii) What are some key characteristics of the sample (you could say a lot here – try to focus on what is relevant for assessing internal and external validity)

3) Assess internal validity: is the identification strategy a good one?
   a) To answer this, first think about (and discuss) *why* treatment status varies in general. Do people choose treatment? Is it chosen for them? By what process?
   b) Then describe the *identifying variation* in this study. This is the variation left after we control for the other variables.
   c) What are the key threats to the internal validity of the study? As you list them, make sure you tell us how these threats could affect the results (e.g., sign the bias).

4) Assess external validity: to what populations, programs and places can the results be safely extrapolated?

5) Reconciling the two studies
   a) Do the studies differ in their findings and conclusions? If so, why?
      i) Bias differs across the studies (issues of internal validity)?
      ii) Differences in treatment, outcome, population (issues of external validity)?
   b) Based on the weight of this evidence, what is your answer to the causal question of interest? What are you most and least confident about in your conclusions?