Estimating the Crime-Prevention Effects of License Plate Readers

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Note: I'm addressing the third prompt for the second scenario.

I. Introduction

The use of technology in policing is increasing dramatically – jurisdictions are investing in a host of new technologies with the intention of making officers more efficient, fair and productive. A number of these technologies have been adopted because they essentially automate a task that police previously did manually, increasing the speed and volume of the activity.

License Plate Readers allow jurisdictions to scan a massive number of vehicles without having to expend additional labor resources. The scans are checked against law enforcement databases to determine whether the vehicle or plates have been reported stolen and whether the driver to whom the car is registered has an outstanding warrant or unpaid fines. The readers are often mounted on patrol cars and set to notify the officers in the car when a "hit" is found, indicating that it turned up a match in one of the databases. The scans can also be stored for use in other types of investigations.

One of the objectives of installing a license plate reading system is to assist in solving auto theft crimes. Solving these existing crimes may have the effect of deterring additional crimes through a number of channels.

First, as cases are cleared and adjudicated, the offenders responsible for them are likely to face incarceration, which prevents them from committing crimes at least in the short run. For younger offenders in particular, incapacitating them may have a large effect on the total crimes they may commit in their lives. Estimates from Owens (2009), suggest that incapacitation effects are substantial, and that this effect could have a real impact on local crime.

Second, if potential criminals perceive an increase in the probability of detection, they may be deterred from committing crimes. Seminal work in the economics of crime, Becker (1968), suggests that in addition to the costs and benefits considered by all economic actors, potential criminals also consider the likelihood of detection and the punishment that will be conferred if they are found guilty. This perceived increase in likelihood of detection would alter this basic calculus directly. Importantly, this deterrence depends on the salience of the policy. If the policing does not appear to be more substantial, potential offenders may never consider this additional likelihood that they are caught.

Neither of these potential effects are necessarily limited to auto theft. Some jurisdictions have reported using license plate readers to solve other crimes. Although it is not necessarily the intention of adopting the technology, this added investigative benefit can have the same effects (in terms of incapacitating individual criminals and deterring crimes in general) on other types of crime. Even if individuals connected to criminal networks are not cognizant of the technology causing the increase in detection, they may attribute a perceived increase in clearance rates to an overall increase in police efficacy.

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Determining whether any of these mechanisms have an effect on crime is an empirical challenge, and attempting to disentangle them from one another is even yet more challenging. In this piece, I intend to offer some suggestions for methodological approaches to studying this. In the next section, I detail the current research on license plate readers, giving special attention to some of the drawbacks to using a randomized control trial. In the third section, I make some specific suggestions for using natural experimental methodology to overcome the limitations of randomized control trials in this setting. In the last section, I conclude.

II. Current Literature

Researchers have studied the effects on auto theft clearance rates and these deterrent effects in a number of jurisdictions using randomized control trials. Lum et al. (2011) study two adjacent jurisdictions in suburban Washington D.C.: Alexandria City and Fairfax County. After identifying a set of auto theft hot spots they randomly select half of them for a treatment. In this study, the treatment is composed of sending officers into the treated hotspots for up to 30 minutes during which they were instructed to do a "sweep and sit" scheme, in which they use the technology in both mobile and stationary applications.

Lum et al. (2011) find no evidence in support of any deterrent effects. Although the randomization used in the experiment allows for causal interpretation of their results, the scope of the treatment may have been too small to have any effect on the public knowledge of the technology. In fact, there are only 19 "hits" in Fairfax and 14 in Alexandria in which the scanning technology identified a car in need of additional attention. Of these, only 10 were related to auto or plate theft. If the deterrence is created by the perception that the likelihood of apprehension has increased, these 10 hits may not be substantial enough to change perceptions.

Taylor et al. (2012) use a similar methodology to select "hot routes" frequently travelled post-auto theft, then randomize the deployment of a special auto theft task force which (again randomly) used either the license plate detection technology or manual license plate searches to look up plates. Their experiment was conducted in Mesa, Arizona, which has a particularly high rate of auto theft. In this study, the intervention was similar to Lum et al. (2011) in that the officers were instructed to do a "sweep" and then do surveillance from a fixed location.

Also like the Lum et al. (2011) study, this paper finds no deterrent effects, but it does provide evidence that the readers lead to more "hits" than officers looking up plates manually. They also find that there is less auto theft two weeks after the intervention in the areas that received the manual lookup treatment, but not the license plate reader treatment. Each hotspot received 8 hours of treatment over the course of the study, so again, I speculate that effects may be limited due to the saliency of the technology. To the extent that manual lookups appear to be more active, the manual treatment may have been more visible to residents, explaining this surprising effect.

In a follow-up study of the same Mesa, Arizona, experiment, Koper et al. (2013) are able to detect reductions for calls for service related to drug offenses in the license plate reader treatment areas that persist for several weeks. They also show that there is a reduction in calls regarding person offenses and auto theft in the manual treatment areas, but that these effects are shorter-lived.

These studies imply that there is scope for substantial responses to such policies. The results in all of these papers exhibit strong internal validity and thorough experimental design. The size of police department interventions based on such technology could be much larger than that explored in the above studies. Natural experiments mirror full-scale interventions because they often grow out of the implementation.

III. Suggested Methodologies

Randomized control trials are the gold standard in policy analysis. They allow for the strictest interpretation of results in a causal light, and allow the experimenter to design an intervention that can isolate the mechanisms behind any observed effects. For example, in the studies I discuss in the previous section, the researchers made intentional choices about how and where police would use the license plate reader technology.

Unfortunately, randomized control trials are not always feasible, and at times their scale is limited by resources and stakeholder buy-in. Small-scale randomized control trials have a number of drawbacks. First, they may not mirror "real world" applications in their scope. In the context of license plate readers, the lengths of RCT interventions have been unrealistically short. The presence of potential deterrent effects due to license plate readers depends on the community's knowledge of the intervention.

A difference-in-differences empirical strategy could be appropriate for analyzing a number of implementation scenarios that could give rise to naturally-occurring variation. This strategy compares the difference in trends in outcomes of treated and untreated geographic units over time. Importantly, the validity of such an approach does not depend on the assumption that the treated and untreated units are ideal counterfactuals in absolute terms, but only that the untreated units provide an appropriate counterfactual for what would have happened to the trends in crime outcomes in the treated units, absent treatment.

For example, a jurisdiction that adopts license plate readers likely has a higher rate of auto theft than a jurisdiction that does not, but both are subject to the same overarching social trends and any other large-scale shocks that could affect crime. The use of a control group in this setting allows the experimenter to exploit the time series variation in the treatment, while controlling for the fact that external factors could cause changes in crime that could (otherwise) wrongly be attributed to the policy. Similarly, within a jurisdiction, a savvy police department would choose to use the technology in areas with high rates of auto theft using a strategy like hot spot analysis (as in Lum et al. 2011 and Taylor et al. 2012). These areas will be substantially different from those not selected, but they would be subject to all of the same local phenomena like local elections, periods of good or bad weather, or economic influences like manufacturing plant closures. For this reason, the crime trends in the untreated places will likely provide an appropriate counterfactual for the trends in treated places absent treatment.

One scenario that could lend itself to such analysis is one where the rollout of the license plate readers within the jurisdiction is staggered, likely due to resource or staffing constraints. For example, if a police department only has the ability to train half of the officers needed for an auto theft prevention task force, they may do so by training only the officers from some districts. This would allow those districts to start the program earlier than others. The areas yet to be treated

would serve as a control group. Any scenario in which some parts of the city are not treated or treated at different times could provide such an opportunity.

Again, citizen awareness of the use of this new technology (or at least the awareness of rising clearance rates) is a necessary condition for deterrence to occur. Absent official announcements and media coverage, this awareness is tied to the observation of the technology's use or the knowledge that it has increased auto theft clearance rates. The intensity of treatment across communities within a jurisdiction is therefore related to the outcomes measuring the technology's successes. Rather than just using a binary indicator of treatment, an alternative measure would be to use the number of plates scanned, the number of "hits" and the number of cases cleared using the technology.

Another option is to use jurisdictions that never adopted such policies as a control group for those that did. Again, using this empirical specification, the important assumption is not that the control and treatment groups are the same, but that the control group provides a reasonable counterfactual for the trends that would have occurred in the treated states absent treatment.

In Lum et al. (2011) the authors collected information from a survey of jurisdictions about their use of this technology. Using this as a measure of "treatment" would allow for the identification of the causal effects of treatment in the set of adopting jurisdictions, relative to the effects of general societal influences in those that did not adopt. In order to get a more recent measure of "treatment," a follow-up study could be performed, or the manufacturers of such products could be contacted to obtain a list of the jurisdictions using the technology currently and when they began to use it. The original survey included questions about the ways that departments use the technology (e.g. fixed vs. mobile use), and these measures would be useful in the study I detail here to explore heterogeneous effects by implementation style.

In order to test the hypothesis that deterrent effects are driven by the knowledge of license plate reader use, it would also be useful to find the first mention of the technology in local media outlets or police department press releases. I would consider the original use and the public announcement of it to be different treatments.

After details on the use of the technology by jurisdictions are obtained, the data contained in the National Incident-Based Reporting System (NIBRS) could provide an appropriate jurisdiction-level dataset for the outcome analysis. The NIBRS data contain detailed information on the offenses and the offenders that could be used to examine competing hypotheses about the underlying mechanisms.

Alternatively, geocoded crime data could be obtained from a set of jurisdictions in order to look at more localized effects. These detailed data would be of particular interest if the researcher were also able to obtain information on the location of "hits" and their outcomes. Although there will be no such measure for the control jurisdictions, a within-jurisdiction study on the intensity of treatment (for even a few jurisdictions) would be a good complement to an across-jurisdiction difference-in-differences study as I have described.

IV. Conclusion:

Natural experiments, while sometimes difficult to identify, are useful in scenarios such as these when the cost of a large-scale implementation is prohibitively expensive. In this piece, I have described two related ways in which a naturally-occurring variation in the policy environment could be used to study the effects of license plate reader use on crime. Specifically, I suggest two ways to use a difference-in- differences methodology to exploit the variation in the timing and intensity of the use of the readers to obtain plausibly exogenous estimates of the deterrent effects.

These difference-in-differences strategies can be used in a way that explores an important part of the puzzle that I believe is understudied in the literature - the role of public knowledge of the use and effects of license plate readers. This caveat could explain the lack of detected effects found in much of the existing literature. License plate readers can only deter crime if the populous is aware of their use and the effect that they have on the clearance rate of crimes.

Like many new technologies in policing, further study into the efficacy of license plate readers at deterring crime and their other costs and benefits is critical. I look forward to future studies on this and related topics in the arena of policing strategy.

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