ALPRs and Vehicle Theft:

An Explainer of "Working Paper: Automated License Plate Readers, Vehicle Theft, and Clearance"

Matthew West, Ph.D.
Institute for Justice
September 17, 2026

A recent study, currently published as a working paper, examined the effect of Flock automated license plate reader systems on crime.[1] To my knowledge, it is the first study to test the effects of fixed ALPR systems with a nationwide sample of law enforcement agencies. Prior research on ALPRs is limited, often focused on potential effects in specific localities.[2]

The recent study purports to offer evidence that ALPR systems can reduce motor vehicle theft and increase police effectiveness. However, the topline findings are more limited than they might initially appear, and other findings in the study cast doubt on the effectiveness of Flock ALPRs. This explainer summarizes the study, identifies key limitations, and explains why the topline findings should be interpreted with caution and may not represent causal effects of Flock ALPR systems.

Study Overview

The study tested the effects of deploying Flock ALPR systems on monthly motor vehicle thefts, arrest rates for motor vehicle theft ("clearances"),[3] and recovery time of stolen vehicles. The study sample included 216 agencies that deployed Flock ALPR systems sometime from 2017 to 2023—though only 168 of the 216 were observed both before and after Flock deployment—and 3,108 agencies that did not deploy Flock ALPR systems in that period. The agencies that deployed Flock ALPR systems tended to have bigger populations, more motor vehicle theft, more property crime, and lower motor vehicle theft arrest rates than agencies that did not deploy Flock ALPRs, as shown in Table 1 (pages 7–8). Agencies typically rolled out deployment over several months. The median number of

[1] Mourtgos, S. M., & Adams, I. T. (2026). *Automated license plate readers, vehicle theft, and clearance*. *CrimRxiv* (Working Paper). https://doi.org/10.21428/cb6ab371.0dc24006
[2] E.g., see Lum, C., Hibdon, J., Cave, B., Koper, C. S., & Merola, L. (2011). License plate reader (LPR) police patrols in crime hot spots: An experimental evaluation in two adjacent jurisdictions. *Journal of Experimental Criminology*, *7*(4), 321–345. https://doi.org/10.1007/s11292-011-9133-9
[3] I describe "clearances" as an arrest rate because that is what was measured in the study. Arrest rate can be considered a proxy for clearance rate, which is why the authors use the term "clearance." Clearance rate essentially is the rate of "solved" cases. An arrest is the typical, but not the only, way a case is cleared.

cameras deployed in the first month was 6 and after the first year it was 23. (See Figure S1 and accompanying text, pages 35–36.) The study estimates effects over 12 months.

In the authors' words, their study shows that "fixed ALPR deployment is associated with lower theft and higher clearance [by arrest], alongside a modest reduction in recovery lag among recorded recoveries that does not extend to all stolen vehicles" (abstract, page 2). After Flock ALPR deployment, the study estimates:

- An 11% decline in vehicle theft (Table 2, first row, page 12).
- A 5.2% decline in the ratio of vehicle theft to other property crime (Table 2, second row).
- A 15.9% increase in the rate of vehicle theft arrests (Table 2, fourth row), though "the increase began during the final three pre-deployment months, weakening causal attribution to the cameras" (abstract).
- Among recovered vehicles, a median reduction in recovery time of 0.28 days (Table 2, fifth row). However, "measures covering all stolen vehicles show no aggregate improvement" (abstract).

Key Limitations

1. **Arrest rates for motor vehicle theft were rising immediately before Flock ALPR systems were deployed, making it difficult to attribute increased arrest rates after deployment to the systems.**

As reported in Table S1 under the heading "MVT arrest clearance" (pages 29–30) and displayed in Figure 2 (page 17), for agencies that deployed Flock ALPRs, arrest rates began rising significantly three months *before* deployment compared to agencies that did not deploy Flock ALPRs. As the authors acknowledge, the difference before deployment "prevents precise attribution to the cameras" (page 17). Since there was already a difference before ALPRs were deployed, the difference afterward could be due to ALPRs, one or more other factors, or some combination of ALPRs and one or more other factors.[4] In other words, the difference in the arrest rate after Flock ALPR deployment might not represent a causal effect of Flock ALPRs.

The best way to test whether one thing affects another thing is to do a randomized controlled trial. For example, to test whether a new medication works, one group of people is randomly assigned to take the new medication and another group is assigned to take a

[4] Such factors, according to the authors, could include "preparatory work, date error, pilot cameras, or a broader anti-theft initiative that included camera purchase. Under the first three accounts, the effect is mistimed; under the last, it is partly confounded by selection. The data cannot distinguish these accounts" (page 16).

placebo. Because taking the medication or a placebo is random, researchers can compare the two groups, and any difference can be attributed to the medication and not some other factor. If people were not randomly assigned to groups, any difference between the groups could be due to something besides the medication.

Unsurprisingly, it is not realistic to randomly assign some policing agencies to deploy ALPRs and others to not deploy ALPRs. The study authors therefore use a design that approximates a randomized controlled trial and can support causal conclusions, but only when certain conditions are met. One important condition is that places that do and do not adopt ALPR systems must be on similar trajectories. This is because places that do not adopt ALPR systems are used to represent something that cannot be directly observed: what would have happened in places that did adopt ALPR systems had they not done so. The problem is that we can never truly know whether the condition is met.

As the study's authors note, adopting ALPRs is not random.[5] Most notably, it is possible agencies that adopted ALPRs did so because of motor vehicle theft problems. And indeed, Table 1 (pages 7–8) shows that agencies that adopted ALPRs had more motor vehicle thefts compared to agencies that did not adopt them, among other differences. It is plausible the police identified a crime problem and implemented strategies to reduce the problem—one of which was adopting an ALPR system. In turn, the effect could be an outcome of changing enforcement, not necessarily ALPRs in particular.

2. **Motor vehicle theft declined immediately before Flock ALPR systems were deployed, making it difficult to attribute fewer motor vehicle thefts after deployment to ALPRs.**

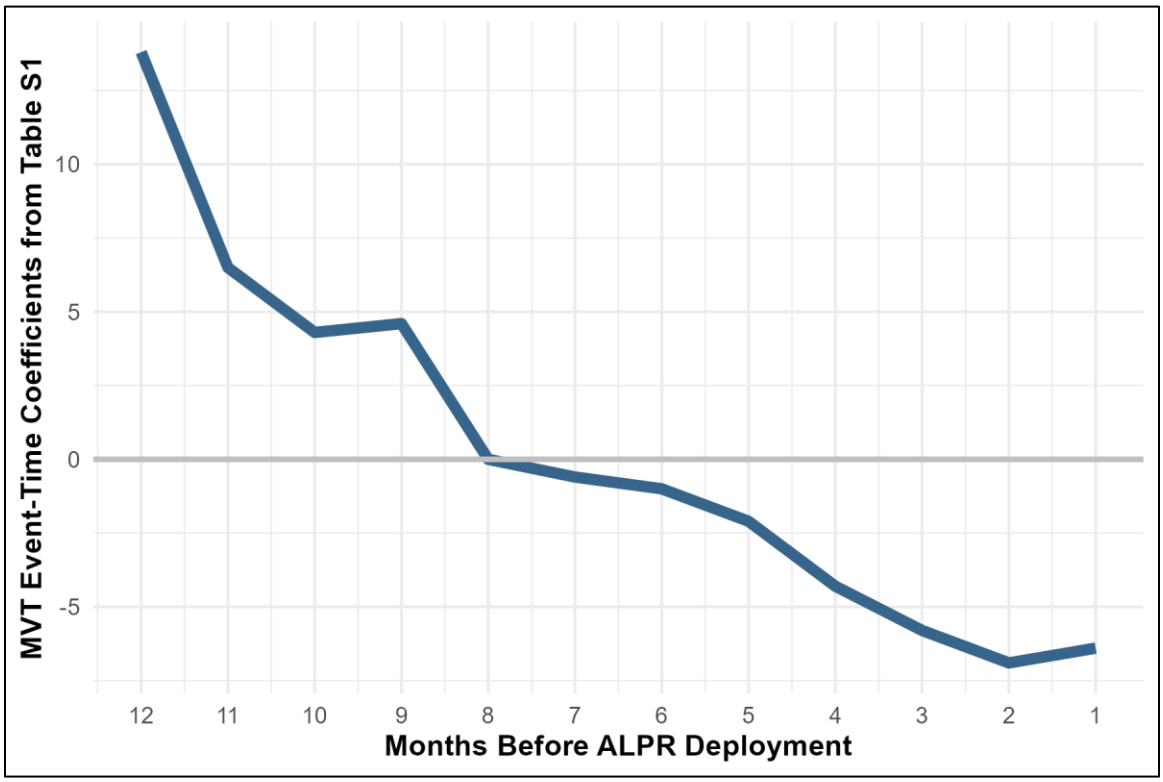
As reported in Table S1 under the heading "Motor vehicle theft," vehicle thefts in agencies that deployed ALPRs were already declining in the four months before deployment compared to agencies that did not deploy ALPRs, and the estimated differences in those months were statistically significant. The authors do not include a visual like they do for arrest rates, but the chart below uses information they report in Table S1 to show the differing trends in the number of vehicle thefts between agencies that did and did not adopt ALPRs each month before the systems were deployed. As with the arrest rate, because trends differed before ALPR deployment, the difference after ALPR deployment might not be attributable to Flock ALPRs.[6]

---

[5] In the study's limitations section, the authors write: "Identification relies on within-agency comparisons with never-treated and not-yet-treated agencies in the same population range. Adoption is not random; agencies may purchase cameras in response to the outcomes being studied" (page 20).

[6] The study does not present monthly estimates for motor vehicle theft after Flock deployment, as it does for the ratio of motor vehicle theft to other property crime (Figure 1, page 15) and for the arrest rate (Figure 2,

Pre-deployment trend in motor vehicle thefts (MVTs)*



*Estimates for months 12, 4, 3, 2, and 1 are statistically significant.

Another concern with attributing the difference in motor vehicle theft after deployment to Flock ALPRs is the possibility that higher arrest rates before deployment were due to increased enforcement or a broader antitheft initiative, one of the explanations the authors acknowledge is plausible. In theory, ALPRs would reduce vehicle theft by increasing the probability that vehicle thieves are arrested. This is a basic principle of deterrence—would-be offenders are less likely to offend if there is a high risk they will be caught.[7] If increased enforcement in part drove the rise in arrest rate, it would not be surprising for the study to show fewer thefts regardless of Flock deployment.

The authors also use an alternative measure of crime, the ratio of motor vehicle theft to other property crime. Unlike with the count of vehicle thefts, trends on this measure for agencies that adopted Flock ALPR systems and those that did not were relatively similar before Flock deployment. As such, it could be viewed as credible evidence of a Flock effect, though, at 5.2%, a smaller and different one that finds motor vehicle thefts declining

page 17). Similarly, Tables S2 and S3 (pages 30 and 31) provide sensitivity and robustness checks, but only for the ratio and the arrest rate, not for motor vehicle thefts.

[7] See, e.g., Nagin, D. S. (2013). Deterrence in the twenty-first century. *Crime and Justice*, *42*, 199–263. https://doi.org/10.1086/670398

compared to property crimes more generally. However, the rise in the pre-deployment arrest rate still makes attributing the estimated effect to Flock ALPRs a problem. If motor vehicle theft enforcement intensified before deployment, this could still plausibly explain at least some differences in the ratio after deployment.[8] Regardless, even if causal, a decline in the ratio does not resolve concerns with the study's topline finding of a reduction in vehicle thefts of 11%.

3. **The 11% reduction in vehicle thefts, even if attributable to Flock ALPRs, does not apply uniformly to all agencies.**

The authors' topline finding of an 11% reduction in vehicle thefts is statistically significant only when the data are weighted to favor agencies that had a bigger problem to begin with. If, instead, the data are not weighted or are weighted by population, the study finds no statistically significant change, as shown in the last two rows of Table S7 (page 34). This indicates that any reductions in theft are not broadly shared across all agencies that deployed Flock ALPR systems. As the authors put it, "the decline is concentrated in the jurisdictions carrying more of the MVT [motor vehicle theft] burden rather than representing a uniform effect across adopting agencies" (page 15).

Weighting is a common procedure in social science. It is used to make some observations matter more in an analysis and some observations matter less; it changes how estimated effects are interpreted. For example, when the authors weight by population, agencies with bigger populations are more important in the analysis, and the estimated effect represents the effect primarily in agencies with bigger populations. In contrast, the estimated effect when no weighting is used represents the overall average across agencies. The authors note that there is no uniform effect because there was no significant effect when no weighting was used. The fact that the reduction in vehicle theft was significant only when weighting based on preexisting levels of vehicle theft suggests that effects could vary across agencies depending on the size of the vehicle theft problem before deployment.

The authors do a supplemental analysis to more fully unpack whether there was a difference in effects depending on levels of motor vehicle theft prior to deployment. This supplemental analysis, shown in Table S8 (pages 34–35), indicates that any reduction in vehicle thefts may be driven by agencies with the very biggest preexisting problems, while other agencies may have seen thefts *increase*.

[8] Table S2 (page 30) also suggests the ratio result might not hold had vehicle theft continued moving even slightly differently from other property crime after deployment for reasons unrelated to ALPRs.

Among the subset of agencies with the largest volume of vehicle thefts (and most agencies that adopted Flock ALPRs were in this subset),[9] the authors find a statistically significant reduction in thefts only when weighting based on volume, and the effect is cut in half to 5.4%. In other words, the reduction is not simply concentrated in agencies with more motor vehicle theft; it is concentrated in agencies with the most vehicle theft among agencies with already high levels of vehicle theft.

Moreover, without weighting, this subset of agencies with higher preexisting levels of motor vehicle theft actually sees a statistically significant *increase* in vehicle theft of 4.2%. Insofar as the study can be interpreted as showing a reduction in vehicle theft attributable to Flock ALPRs, it can also be interpreted as showing an increase in vehicle theft attributable to Flock ALPRs. The table below summarizes the key estimates of the effect of ALPRs on vehicle theft.

Analysis	Estimated Effect	Interpretation
Full Sample		
Vehicle Theft Weighted	-11.0%	A decline in theft primarily among agencies with a bigger vehicle theft problem.
Population Weighted	+4.1%	An increase in theft primarily among agencies with a bigger population. However, the effect is not statistically distinguishable from zero.
Unweighted	+4.4%	An increase in theft on average among all agencies. However, the effect is not statistically distinguishable from zero.
High-Theft Agencies		
Vehicle Theft Weighted	-5.4%	A decline in theft primarily among agencies with the most extreme vehicle theft problems.
Unweighted	+4.2%	An increase in vehicle theft on average among all agencies with a relatively

[9] Overall, 133 agencies that adopted Flock ALPRs fell into the high vehicle theft group. These agencies represent over 60% of all agencies that adopted Flock ALPRs (216 agencies) and nearly 80% of all agencies that adopted Flock ALPRs and were observed after ALPR deployment (168 agencies).

		large motor vehicle theft problem.

4. The study period included at least two notable events that could have affected results.

Another complication is that the study period included the COVID-19 pandemic, as well as the viral trend of Kia and Hyundai thefts. The pandemic had an impact on a lot of behavior, including crime and driving, and the impacts were not always the same across the country. For example, one study found decreases in motor vehicle theft in some cities and increases in others.[10] Possibly tied to the pandemic, the "Kia Challenge," where people would exploit a vulnerability of certain models of Kia and Hyundai vehicles, steal them, and often post it on social media, started around 2021.[11] Thefts surged, first in the Midwest where the trend started and then in other regions.[12]

The fact that these things happened in the study period does not automatically mean the results are wrong. The core of the problem is that the events may have contributed to motor vehicle theft rising and falling at different times in different places. And if places that adopted ALPRs had unique trajectories, it is harder to attribute any change to ALPR adoption specifically. If, for example, agencies that adopted ALPRs were more likely to do so at a time when motor vehicle theft was peaking in their jurisdictions, the estimated effect could at least in part represent motor vehicle theft returning to a typical level.[13]

5. The slightly shorter recovery time is not a causal effect and applies only to vehicles that were recovered.

As the authors note, the slightly shorter recovery time by 0.28 days (or about 7 hours), as shown in Table 5 (pages 17–18), cannot be interpreted as an effect of Flock deployment because it could be due to other factors (e.g., a change in composition of stolen

[10] Ashby, M. P. J. (2020). Initial evidence on the relationship between the coronavirus pandemic and crime in the United States. *Crime Science*, *9*(1), 1–16. https://doi.org/10.1186/s40163-020-00117-6

[11] Feldman, S. (2023, June 21). Who are the "Kia Boyz"? How TikTok fueled an epidemic of car thefts. *Ars Technica*. https://arstechnica.com/cars/2023/06/who-are-the-kia-boyz-how-tiktok-fueled-an-epidemic-of-car-thefts/

[12] Rollins, A. (2024). *Information spread through social media and engagement in crime: Evidence from a national wave of car thefts*. https://adrollins.github.io/JMP/RollinsJMP.pdf

[13] The authors account for persistent differences between agencies and national, regional, state, and agency-size-specific effects, but that approach controls only for common "shocks," changes that are shared by agencies (i.e., all agencies in the country, all agencies in a region, all agencies in a state, and all agencies of a similar size). For example, the authors note that their approach accounts for "national and regional monthly shocks, including the 2020-2022 MVT [motor vehicle theft] surge" (page 10). What their approach cannot fully account for are shocks affecting certain jurisdictions differently from other agencies in the same region, in the same state, or of a similar size.

vehicles).[14] As important, the faster recovery time describes only vehicles that were recovered. It does not speak to the effect of Flock ALPRs on the likelihood of recovering stolen vehicles. The authors separately examined the likelihood of vehicle recovery within 1 day, 1 week, 1 month, and 3 months, which could have potentially revealed an effect of Flock ALPRs. However, that analysis did not find any evidence of such an effect. (See Table S4, page 32.)

Interpretation of Key Findings

Motor vehicle theft

The authors report evidence of a modest decrease (11%) in the number of motor vehicle thefts in the 12 months after ALPR deployment. Although the authors find a difference between agencies that deployed Flock ALPRs and those that did not, we do not know whether this represents a reduction attributable to Flock ALPRs. This is because 1) vehicle thefts were already declining among agencies that deployed Flock ALPRs immediately before deployment and 2) there is evidence that agencies may have increased enforcement before deploying ALPRs, consistent with the significant increase in arrest rates before deployment. Moreover, intervening events like the COVID-19 pandemic and the viral trend of Kia and Hyundai thefts, which impacted vehicle theft in different ways and at different times in different places, may have biased the results.

With the alternative measure of vehicle theft, the ratio of vehicle theft to other property crime, there is less evidence of differing trends between agencies that deployed ALPRs and those that did not prior to deployment. However, the estimated effect with this measure might also not be attributable to Flock ALPRs. Like the estimated effect with the count of motor vehicle thefts, it is possible it is explained by increased enforcement that started before ALPRs were deployed. The effect is also smaller and relative to property crime more generally.

Finally, even if the estimated effect of a reduction in thefts by 11% is interpreted as attributable to ALPRs, it is not a uniform effect across all agencies, as the authors acknowledge. Rather, it is skewed toward agencies that had bigger problems to begin with. However, even among the group of agencies with a large volume of thefts, the effect is not uniform. In fact, on average, agencies in that group actually saw a statistically significant increase in thefts after Flock deployment. These results indicate that the topline 11%

[14] The authors write: "The measure conditions on recovery and therefore describes a selected subset. Because 56 percent of stolen vehicles are recorded as recovered, changes in the composition of that subset can shift the conditional median without a corresponding change in recovery time for comparable vehicles. We therefore interpret the estimate as a lower conditional median after deployment, not as a causal effect on recovery time among recovered vehicles" (page 18).

figure, even if causal, does not describe the experience of many if not most agencies that deployed Flock ALPRs.

Arrests for motor vehicle theft

The authors report evidence of a modest increase (16%) in motor vehicle theft arrests in the 12 months after ALPR deployment. This finding could be interpreted as ALPRs increasing law enforcement's ability to solve motor vehicle thefts—in general, arrests are often used as a measure of police effectiveness. As noted above and by the authors, the central problem is that arrest trends were already different between places that did and did not adopt ALPRs *before* deployment.[15] This means the estimated effect should *not* be interpreted as an effect of ALPRs.

Recovery time and likelihood of recovery

The authors report evidence of a reduction in the recovery time of stolen vehicles among agencies that adopted Flock ALPRs. Among stolen vehicles that were recovered, ALPR deployment was associated with a slightly shorter recovery time (7 hours faster). As the authors note, this should not be interpreted as an effect of ALPR deployment. The authors looked at recovery in two ways. The first way, which resulted in a statistically significant finding, looked at recovery time specifically among the subset of vehicles that were recovered. The authors point out that the finding among this subset could be due to a change in the composition of stolen vehicles recovered after ALPR deployment, not necessarily due to ALPR deployment. The second way looked at the odds of recovery within certain timeframes (e.g., 1 day, 1 week) among all stolen vehicles and found no meaningful effect. The second approach, but not the first approach, answers the key policy question—if a person's vehicle is stolen, do ALPRs increase the chance that the vehicle is quickly recovered? The answer according to the study is no.

[15] The authors note that the different trends in arrests prior to ALPR deployment "prevent[] precise attribution to the cameras" (page 17). Or, as they put it later in the study, the "pre-deployment rise [in arrests] weakens causal attribution" (page 19).