

# Consequences of Body-worn Cameras on the Court System: Evidence from State District and Circuit Court Data

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**Abstract:** In less than a decade, body-worn cameras rose from rarity to standard amongst local law enforcement in the U.S. In addition to monitoring policing, this tool generates large quantities of new data for criminal courts: footage of criminal defendants. These data can provide evidence pertinent to criminal cases, but do so at a cost of attorney time. To investigate whether body-worn camera adoption changes policing and court outcomes, I use rich criminal charge data from Virginia state courts from 2006-2020 and a new, self-collected body-worn camera data set. Leveraging the staggered adoption of body-worn cameras by local law enforcement through a difference-in-differences estimation strategy, I find evidence that body-worn cameras affect a subset of police interactions for which body-worn cameras may be most salient. In this subset of cases I find an approximately ten percent reduction in new case filings after police begin using body-worn cameras. Although this subset of cases may be particularly likely to show behavioral effects of body-worn cameras, the cameras generate evidence toward a broader base of cases. Using a set of case disposition, sentencing, and timing outcomes to test for evidentiary and attorney time use effects, I find that this influx of data generated by body-worn camera footage does not generate changes in case outcomes or court processes on average.

# 1 Introduction

Defining and implementing effective policing remains one of the most salient political issues of the past decade. In the midst of sometimes contentious debate over policing policies, one policy with broad public support is expanding or mandating the use of body-worn cameras (BWCs) by law enforcement.<sup>1</sup>

Although now commonplace, body-worn cameras are a recent technological advancement for law enforcement in the United States. Only a decade ago, in 2010, less than 5 percent of law enforcement agencies used body-worn cameras (LEMAS-BWCS, 2016). This changed when a police officer shot and killed eighteen-year-old Michael Brown in Ferguson, Missouri in August 2014. In the aftermath of the shooting, witnesses provided substantively conflicting reports of the event (Buchanan et al., 2015), and a grand jury decided not to indict the officer involved. This case spurred nationwide protests and highlighted tensions and distrust between the public and police in Ferguson and elsewhere. Under pressure to increase transparency, accountability, and public trust, Ferguson police soon outfitted officers with body-worn cameras (BBC News 2014).

In the following months and years, body-worn cameras swept across the country. To facilitate their expansion, in 2015 the Department of Justice announced a \$75 million national grant program intended to fund 50,000 cameras over a three-year period (Department of Justice, 2015). Between 2013 and late 2016 the share of departments using body-worn cameras rose from approximately 12 percent to nearly half of general-purpose law enforcement agencies in the U.S. (LEMAS-BWCS, 2016). Pressure to increase body-worn camera use continues, and between 2020 and mid-2021 six states mandated body-worn cameras for law enforcement (NCSL, 2021).

While advocates for body-worn cameras intend the technology to increase transparency and improve safety in police interactions, criminal justice practitioners warn of broader effects of body-worn cameras on policing and the courts. First, body-worn camera footage may increase the probability or consequences of a criminal conviction, leading to behavioral changes amongst police and members of the public. More specifically, body-worn cameras

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<sup>1</sup>One recent poll shows 85 percent of Republicans and 94 percent of Democrats favor body-worn camera mandates (Kull, 2020).

may serve as a deterrent for police misconduct and certain visible criminal activities, changing the set of cases that enter the courts. Next, for those cases that are not deterred (i.e. that enter the courts), other court actors report unintended consequences of body-worn camera footage on their operations. Perhaps the most vocal of these actors are the attorneys representing low-income defendants in criminal courts. These lawyer-advocates point out that when law enforcement adopts body-worn cameras other actors in the criminal justice system receive an influx of recorded data that may be relevant to criminal cases. While, alone, these data may be beneficial, accessing the evidentiary value of the data comes at a cost of already scarce attorney time. It is this tension between the additional labor demands of cases with body-worn camera footage and attorney time constraints that led the Executive Director of the Virginia Indigent Defense Commission to write of public defenders: "... we have significant concerns that our attorneys will not be able to continue to meet their ethical and professional responsibilities" (Compensation Board, 2018).

Despite extensive anecdotal evidence on the influence of body-worn camera footage on the courts and court actors, there is minimal empirical research on these downstream effects. In this paper I extend the base of research on body-worn cameras as a *policing tool* to incorporate their aggregate effects on courts and defendant outcomes. Specifically, I use the timing of body-worn camera adoption by local law enforcement agencies across the Commonwealth of Virginia to study changes in criminal case outcomes and court processes after local law enforcement begin using body-worn cameras. I enumerate three primary avenues through which body-worn cameras can affect criminal courts, court actors, and cases, which include: civilization (behavioral) effects, evidentiary effects, and attorney time use effects.

The first of these – civilization effects – refers to the first order policing responses to body-worn camera adoption. My contributions build upon the existing work by criminologists including Ariel et al. (2015) and Yokum et al. (2017), as well as recent work in economics by Kim (2020). More broadly, by exploring civilization effects I contribute to literatures on police responses to oversight (Ba and Rivera, 2019), criminal responses to surveillance (Gómez, 2021; Piza et al., 2019; Gonzalez-Navarro, 2013), and criminal deterrence more broadly (Chalfin & McCrary, 2017). While previous body-worn camera studies often focus on

changes in police use-of-force – an important but uncommon outcome – I check for civilization effects in more common events by measuring changes in the frequency and composition of charges that are filed in criminal courts.

Much less is known about if and how body-worn cameras affect court outcomes and processes once charges are filed. Two local impact evaluations – one in Washington D.C. and one in Phoenix– provide the best, but contradicting, evidence at this point. Yokum et al. (2017) do not find effects of body-worn cameras on case outcomes in Washington D.C., whereas Katz et al. (2014) highlighted prosecutorial changes that coincided with body-worn camera adoption. Outside of criminal courts, Çubukçu et al. (2021) find evidence that body-worn camera footage provides influential evidentiary benefits for citizen complaints against police.

Although existing survey data, like that from the Law Enforcement Management and Administrative Statistics- Body-worn Camera Supplement (LEMAS-BWCS, 2016) can provide insights into body-worn camera adoption trends, these data are not comprehensive. Because multiple law enforcement agencies can operate within a single court jurisdiction, the sampling structure for these data encourage law enforcement agency-level analyses rather than court-level analyses. Further, the typical body-worn camera evaluation is based on a single adopting agency. Together, these lead to a high representation of cities in body-worn camera evaluations and less evidence from small and mid-sized localities. To analyze effects of body-worn cameras on a range of courts, I collected a new body-worn camera adoption data set with the broadest coverage of Virginia law enforcement agencies to date, containing adoption and adoption timing information for all of the major law enforcement agencies in 90 percent of Virginia court jurisdictions. I also make use of a second data set containing the near-universe of criminal court cases in Virginia from 2008-2020.<sup>2</sup> I use these charge-level data to create a court-level panel, covering 102 Virginia circuit courts and 107 Virginia district courts. To my knowledge I am the first to use these case data in an academic research paper.

When analyzing these data I am conscious of the emerging econometric literature which

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<sup>2</sup>These years reflect those for which I have both district court and circuit court data. I additionally use circuit court-only data dating back to 2006.

demonstrates some shortcomings of the traditional difference-in-differences estimator under staggered treatment and in the presence of heterogeneous treatment effects over time. To test for the effects of BWCs on case filings, processes, and outcomes I discuss and implement both the traditional two-way fixed effects estimator and an alternative imputation estimator proposed by Borusyak, Jaravel, and Spiess (2021). In the case of body-worn cameras in Virginia, I find that the traditional two-way fixed effects estimator performs well, providing results congruous to those of the new imputation estimator.

Across two court levels and a variety of outcomes designed to measure changes in the number and composition of case filings, processes, and outcomes, I find a strong pattern of results. While body-worn cameras civilized a small subset of police interactions, reducing the prevalence of a set of charges encompassing assault on police, resisting arrest, and similar offenses, they do not appear to have altered police behaviors as a whole. The number of cases filed and the share of those cases involving multiple charges did not change after police began using body-worn cameras. Further, there was no evidence that body-worn camera-induced civilization effects systematically reduced the severity of the charges filed. Although body-worn cameras generate substantial data, and despite practitioner reports of an indigent defense system buckling under the weight of this data, I do not find evidence that cases systematically proceeded through the courts differently or resolved differently after police began using body-worn cameras. One potential explanation for this result could be that evidentiary benefits of footage offset the attorney time use effects for a net zero effect. However, I show that this explanation does not hold if attorneys substitute time across the cases they represent.

The paper proceeds as follows. In Section 2 I provide context for this paper— context around both the institutional details pertinent to Virginia courts and body-worn camera adoption, and an economic context for understanding the consequences of court outcomes. In Section 3 I present a conceptual framework for the three primary channels through which body-worn cameras may affect court cases: behavioral effects, evidentiary effects, and attorney time use effects. Section 4 contains a description of the court and body-worn camera adoption data that I use for my court-level analyses; Section 5 outlines the empirical strategies that I use to analyze these data. Here I include estimates of the effects of body-worn

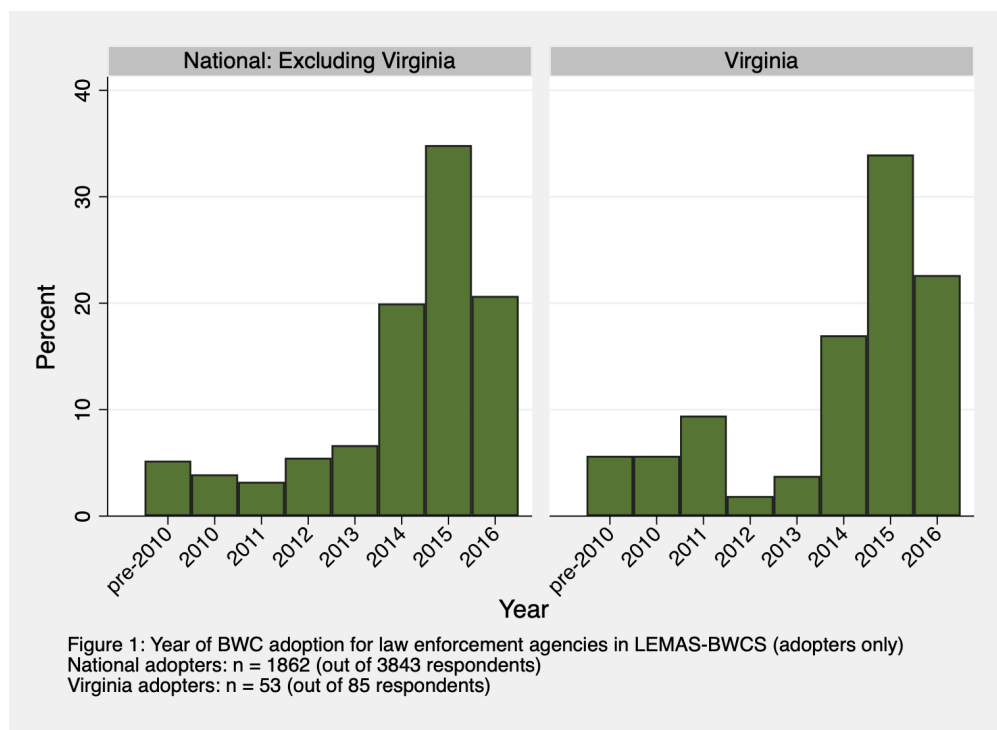
cameras on policing as measured through case filings, and estimates of the overall effects of locality body-worn camera adoption on defendant outcomes. Despite extensive practitioner reports of widespread effects of body-worn cameras on criminal cases, I find no systematic effects of body-worn cameras on case processes or resolutions. Within Section 6 I dissect this null result further and test for heterogeneity in treatment effects for cases more and less likely to have body-worn camera footage. Because a common pool of attorneys litigates cases with and without footage within a court, time use effects are expected to spill over into a broad base of cases, whereas evidentiary effects are restricted to only cases expected to have footage. Finding no significant differences across the two classifications of cases, I dismiss an "offsetting effects" hypothesis in which the three channels for body-worn camera effects cancel in the aggregate. The national push for body-worn camera programs was motivated by observed racial disparities in policing. For this reason, in this section I also test for evidence of differential effects of body-worn cameras for black and non-black defendants, finding no aggregate effects on case filings or outcomes. Section 7 concludes.

## 2 Background

### 2.1 Body-worn cameras

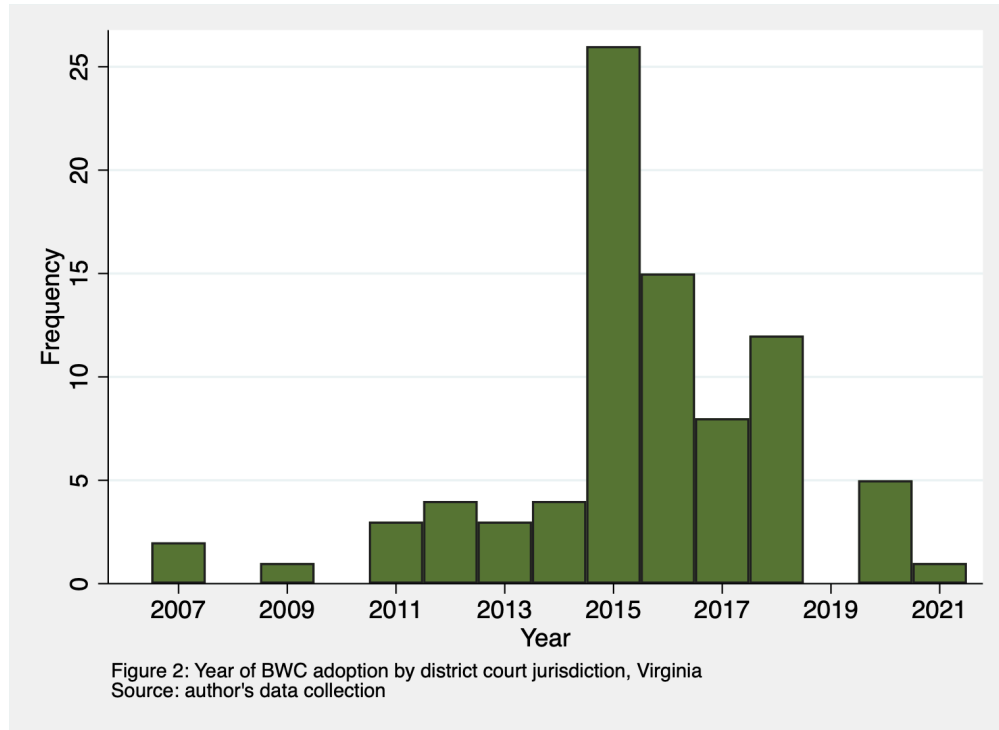
Nationally, body-worn cameras became a commonplace tool for U.S. law enforcement agencies in the latter half of the 2010s. A 2016 national survey of U.S. law enforcement agencies, the LEMAS-BWCS, documented the rapid rise of this technology. This survey generated responses from nearly 4,000 law enforcement agencies and included comprehensive questions about body-worn camera adoption status, expectations for the technology, and policies concerning body-worn camera use. The LEMAS-BWCS data shows broad adoption of body-worn cameras by 2016, but also high intentions amongst non-adopters to use the technology in the future. Thirty-one percent of non-adopting agencies reported that they were likely or very likely to consider acquiring body-worn cameras in the next year. Even agencies that did not imminently intend to adopt nonetheless reported high rates of officer and community support for body-worn cameras.

Within Virginia, respondents to the LEMAS-BWCS demonstrated similar adoption trends to the U.S. overall. Figure 1 shows 62% of the 85 responding Virginia law enforcement agencies adopted body-worn cameras by the time of the survey and adoptions in both Virginia and the U.S. peaked in 2015.<sup>3</sup> Because the LEMAS-BWCS samples law enforcement agencies and does not include adoptions that took place after 2016, I collected an updated and expanded body-worn camera adoption data set for Virginia agencies. I describe these data in detail in section 4.1, and Figure 2 shows these new data confirm the adoption trends evident in the LEMAS-BWCS. The pace of adoptions tapered after the 2015 peak but Virginia departments continued to routinely adopt body-worn cameras through 2018. Not only did the number of jurisdictions using body-worn cameras increase rapidly between 2014 and 2018, but the population exposed to body-worn cameras also increased rapidly. Figure 3 shows the size of the population in Virginia living in a court jurisdiction where a major law enforcement agency used body-worn cameras for each year from the earliest adoption in 2007 through 2020.



Respondents to the LEMAS-BWCS also clarified why and how they implemented body-

<sup>3</sup>Respondents for LEMAS surveys are drawn from the Department of Justice’s Law Enforcement Agency Roster (2016) which shows 293 agencies within Virginia.

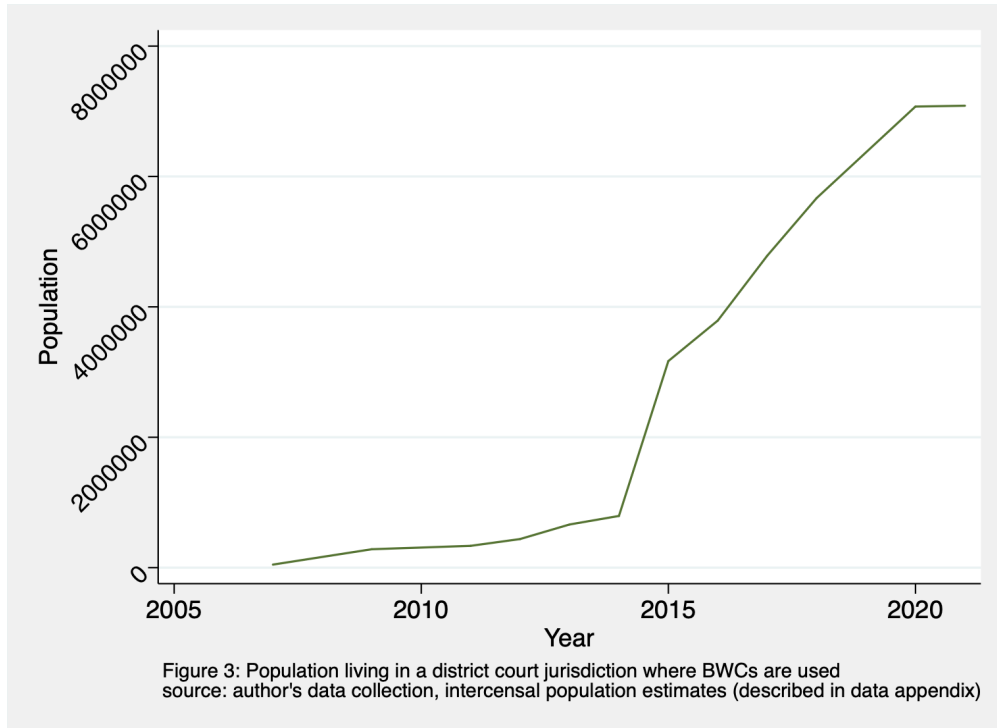


worn cameras. Although body-worn camera footage can be used in criminal courts, agencies rarely based adoption decisions on expected effects on the courts. Instead, agencies cited expected benefits to policing including improvements in officer safety (21 percent), accountability (19 percent), and a reduction in/faster resolution of citizen complaints (15 percent)<sup>4</sup> as the primary reasons they adopted body-worn cameras. Yet while expected effects in the courts rarely drove adoption decisions, agencies reported that they *did* anticipate that body-worn cameras would affect court cases; less than 10 percent of agencies cited improvements to evidence quality (9.5 percent) or making cases more prosecutable (7.6 percent) as the primary reason they adopted body-worn cameras but most (78.8 and 69.8 percent, respectively) cited these as contributing factors. Agencies that did not obtain body-worn cameras by the time of the survey cited the high costs to obtain and maintain the cameras, their footage, and related tasks – such costs were cited by many adopting agencies as an obstacle as well.

Once agencies adopt body-worn cameras they also must decide how to use the technology. This point is of particular importance as we consider the effects of body-worn camera footage on the courts; if officers wear body-worn cameras but rarely record or preserve the videos

<sup>4</sup>Percentages exclude respondents whose agency's primary purpose was to conduct a pilot program.





then the cameras would be unlikely to affect criminal cases on a large scale. In practice, because officers typically must manually activate the cameras at the start of an interaction, the LEMAS-BWCS shows that adopting agencies almost always have some form of formal policy that outlines expectations for when body-worn cameras must be turned on. Of those agencies that set requirements, almost all (93 percent) required that the cameras be used during traffic stops and nearly 85 percent required officers to turn on body-worn cameras when executing arrest or search warrants, deploying firearms, and initiating contact with members of the public. Recordings typically must be preserved for between 1 month and 1 year, but in the event the footage is pertinent to an ongoing matter – such as a use of force incident, citizen complaint, or if used as evidence in a legal proceeding– may be retained longer.

## 2.2 Virginia Courts and Court Actors

For a member of the public, an interaction with a police officer carries the risk– small or large– of arrest or citation, and police interactions are common. The Bureau of Justice Statistics estimates that in 2018 over 60 million people, or about 24 percent of the U.S. population, had

some contact with the police (Harrell and Davis, 2020). Typically these contacts do not result in criminal charges and, more often than not, are initiated by residents rather than officers. Nonetheless, in 2013 there were nearly 700,000 felony or misdemeanor filings in Virginia State General District Courts (Office of the Executive Secretary, 2014a), and 190,000 in Virginia State Circuit Courts (Office of the Executive Secretary, 2014b), the two primary venues for criminal litigation in Virginia. These courts largely share geographic jurisdictions, with approximately one circuit court and one district court in each county or independent city across the state.<sup>5</sup> However, they differ in the scope of the cases they hear: district courts hold jurisdiction over misdemeanor cases whereas the circuit courts hear felonies.<sup>6</sup> Oftentimes geographic court boundaries contain multiple law enforcement jurisdictions. For example, both a county sheriff and a town police department may operate within a single county. Thus, courts can receive cases from multiple law enforcement agencies.

Cases enter the courts through two primary mechanisms. Police officers can issue a Virginia Uniform Summons, which initiates a filing in the district court. These summonses are common in misdemeanors and do not require that a defendant be held in custody while awaiting court hearings. Alternatively, police can arrest defendants. When this happens a local magistrate serves as an intermediate step between law enforcement and the courts. Magistrates review sworn statements from a complainant (such as an arresting officer) to assess whether there is probable cause to proceed with a criminal charge. This standard of probable cause is much weaker than a standard to convict— the Virginia Magistrate Manual describes that the magistrate needs only to ascertain that “the charges are not capricious and are sufficiently supported to justify bringing into play the further steps of the criminal process” (Department of Magistrate Services, 2021).

After a summons is issued or the charges advance from the magistrate’s office, the outcomes of the charges can be influenced by three court actors: a judge, prosecutor, and defense attorney.<sup>7</sup> I provide a basic case road map outlining the entities involved in various states of

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<sup>5</sup>In a few places, multiple district courts operate within a single circuit court jurisdiction.

<sup>6</sup>Misdemeanors and felonies differ in the severity of the crime and the severity of the punishments if convicted: while a defendant can be sentenced to life in prison for a severe felony, the most severe misdemeanors carry a 12 month sentence.

<sup>7</sup>Statutorily, all three actors are involved in felony cases. Practically, all three actors are involved in many misdemeanor cases as well. However, for low-level misdemeanors and infractions a prosecutor and/or defense attorney may not be involved in the case.

<b>Table 1: Case Roadmap</b>			
Stage	Case Activity	Entities Involved	Activity Summary, <i>Body-worn camera role</i>
1	(Alleged) Offense	Defendant Police	Defendant allegedly commits offense; may or may not be seen by police. <i>Video may be captured</i>
2	Summons issued/ Arrest and booking	Defendant Police	Officer may release defendant with summons for later court date or arrest defendant. <i>Video captured</i>
3	Warrant/ Charge issued	Defendant Police Magistrate	If arrested, defendant appears before a judicial officer to determine whether charges proceed. <i>None</i>
4	Court hearings, preparation	Defendant Judge Attorneys	Court hears evidence, disposes charges, pronounces sentences. Attorneys negotiate plea agreements, argue for preferred dispositions and sentences. <i>Video reviewable</i>

criminal litigation in Table 1. Broadly, the court actors can influence outcomes for the defendant ranging from the final set of charges to be ruled on in court to the outcomes of those charges, their sentencing, and even the pace at which the case is resolved. More specifically, prosecutors can alter, drop, or add charges to the case against the defendant; judges dismiss or rule on charges and determine sentences<sup>8</sup>; and both prosecuting and defense attorneys lobby for preferred dispositions and sentencing.<sup>9</sup>

By design, both judges and prosecutors are always publicly funded government employees. In practice, defense attorneys often are too. A system of publicly funded attorneys (“indigent defenders”) represent low-income defendants in order to fulfill the Constitutional right to counsel.<sup>10</sup> In Virginia, these attorneys are either a) public defenders—salaried attorneys working in a state-funded law firm that represents indigent clients or b) assigned counsel—private attorneys compensated to represent indigent clients on a case-by-case basis.

<sup>8</sup>This is a simplification of the full role of judges: judges also rule on a variety of motions presented to the court and in some cases oversee jury trials wherein a jury rules on a case.

<sup>9</sup>“Dispositions” are the rulings or resolutions to cases, for example “guilty”.

<sup>10</sup>Data on the precise share of defendants using indigent defenders vs. private counsel are hard to come by and indigency thresholds vary across states. However, estimates routinely place the share of indigent defendants in excess of 70% of state-court defendants (Harlowe, 2000; Butcher et al., 2017).

A key motivation for this paper is the reports from indigent defenders warning that the marginal time required to review body-worn camera footage exceeds attorney time constraints. With this in mind it is valuable to note that prior to body-worn camera adoption, full-time indigent defenders in Virginia *were* likely to face binding time constraints for their caseloads. In FY 07/08, before body-worn cameras became widespread, public defenders in Virginia managed on average 320 cases per attorney per year (Kleiman and Lee, 2010). I provide evidence in Appendix D that these caseloads exceed the American Bar Association’s recommendation of a maximum of 150 felonies *or* 400 misdemeanors (American Bar Association, 2009) annually. While assigned counsel are employed on a case-by-case basis, they too face time constraints in the form of compensation caps. An assigned counsel attorney would need to represent clients against 138 felony charges in Virginian circuit courts or over 500 misdemeanor charges in district courts to reach merely the 10th percentile of national attorney earnings (Bureau of Labor Statistics 2021).<sup>11</sup>

### 3 Literature and Conceptual Framework

Criminal deterrence is a widely studied and politically salient topic because crime and the criminal justice system in the U.S. are both broad-reaching and multi-layered in their consequences. Criminal activity not only harms victims, but imposes costs on society as a whole. Victims of violent crimes experience lower levels of mental well-being, as do non-victims with higher levels of crime in their communities (Cornaglia et al., 2014). Local crime risks inhibit wealth accumulation by lowering housing prices (Linden & Rockoff, 2008) and exposure to crime reduces academic performance for youth (Schwartz et al., 2016).

Economic theory dating back at least to Becker’s influential crime model (1968) suggests that crime reduction may come about by increasing the expected costs or reducing the expected benefits to engaging in criminal activity. Empirically there is evidence that the determinants of criminal activities range from inequality and other socioeconomic factors (Kelly, 2000; İmrohoroglu et al. 2000; Fajnzylber et al., 2002(a); Fajnzylber et al., 2002(b);

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<sup>11</sup>There are some opportunities for fee waivers which would reduce this number. However in a companion paper (Bollman, 2021) I calculate fee waivers to be rarely granted, given for only about 3.3% of charges. I also find that attorneys rarely report working fewer than the maximum compensated hours per case.

Grogger, 1998; Buonanno & Montolio, 2008), to alcohol access (Heaton, 2012; Groönqvist & Niknami, 2014), social networks (Damm & Dustman, 2014; Billings et al. 2019), family background or adverse childhood experiences (Doyle, 2008; Currie & Tekin, 2012; Eriksson et al., 2016) and more. Even schooling and entertainment can affect crime by incapacitating would-be offenders (Dahl & DellaVigna, 2009; Jacob & Lefgren, 2003).

The most direct lever through which governments seek to reduce crime is through policing. Police can directly disrupt criminal activities and increase the costs of criminality by bringing defendants into the courts, where criminal convictions and punishments carry both short and long-term consequences. Studies repeatedly show that police are also effective in deterring criminal activity (Evans & Owens, 2007; Draca et al., 2011; Vollaard & Hamed, 2012; Chalfin & McCrary, 2018; Weisburd, 2021), and in 2018 states spent \$119 billion on police to do so (Urban Institute, 2021). Upon conviction, some offenders are incapacitated from criminal activities through incarceration (Barbarino & Mastrobuoni, 2014; Mastrobuoni, 2019), costing U.S. states an average of over \$30,000 per prison inmate each year (Mai and Subramanian, 2017).<sup>12</sup> While states incur financial costs for housing inmates, convicted defendants pay for their criminal activities in both time and future opportunities. Incarceration and criminal records diminish economic self-sufficiency by posing barriers to formal employment (Agan and Starr, 2017; Dobbie et al., 2018), with stronger effects for defendants sentenced to longer incarcerations (Mueller-Smith, 2015). Through these channels and the peer networks formed within jails and prisons convictions introduce future costs to society by spurring additional criminal activity upon release and increasing reliance on public assistance programs (Bayer et al., 2009; Mueller-Smith, 2015).

Because body-worn camera programs introduce change to both policing and court processes, they have the potential to change the prevalence of criminal activities, conviction rates, or the sentencing terms if convicted. Body-worn cameras may act as a deterrent for criminal activity through civilization effects, altering the set of charges that reach the courts. Through distinct channels, body-worn cameras may affect case outcomes and court processes after cases enter the courts. Body-worn camera footage changes the set of information available to attorneys, judges, and juries (evidentiary effects) and can alter the intensity

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<sup>12</sup>Calculated using data available from 45 states.

of attorney caseloads— in other words, change the amount of time required to litigate cases (attorney time use).

And, while police are tasked with reducing crime amongst the public, misconduct, criminality, and general levels of use-of-force amongst police themselves are also salient policy concerns. Public advocacy for body-worn cameras grew against the backdrop of a police shooting in Ferguson, Missouri that ignited large-scale protests (BBC News 2014) and a series of highly publicized incidents of police misconduct caught on camera. These incidents are costly to budgets, trust in criminal justice institutions, and social well-being. In 2019 the City of Chicago, on behalf of the Chicago Police Department, paid nearly \$47 million in settlements and court awards stemming from police misconduct (City of Chicago, 2020).<sup>13</sup> Indirect exposure to police violence has been shown to reduce academic attainment amongst high school students (Ang, 2021) with disparate effects across racial groups. There is also a correlation between perceptions of police use-of-force and trust in police across racial groups; a 2015 survey showed black individuals were both more likely to view police violence as a problem and less likely to trust the police than white or Hispanic individuals (AP-NORC, 2015). In light of this, body-worn cameras are intended to enhance accountability and trust of police officers and induce civilization effects for police as well as members of the public.

In the following subsections I detail all three prospective channels through which body-worn cameras can affect policing and the courts, present the existing evidence of their roles, and describe the sometimes conflicting effects we may anticipate they will have on criminal court cases.

### 3.1 Behavioral/Civilization Effects

*“That’s the beauty of these devices ... everybody gets politer when the cameras are on.”*  
-Norfolk Police Chief Michael Goldsmith

As Becker (1968) noted, the “supply” of crimes should be inversely related to the likelihood a criminal is discovered and convicted. As an evidence-generating technology, body-worn

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<sup>13</sup>For context, this is approximately equal to the City’s budget for senior service programs through the Department of Family and Support Services in the same year (City of Chicago, 2019).

cameras reduce some of the noise around allegations of criminal behavior or professional misconduct – thereby increasing the likelihood, *ceteris paribus*, of conviction for offenses caught on camera. The most publicized instances of this occur with excessive force cases for police. For example, in one highly publicized case a jury convicted an officer of murder after body-worn camera footage contradicted the officer’s allegation that he shot into a car because it moved “aggressive(ly)” toward law enforcement (McCullough, 2018). However, offenses committed by members of the public that are caught on camera should also be easier to prosecute.

Because of this, it is possible that the mere presence of a body-worn camera is enough to alter court outcomes if police and members of the public know they are being recorded and thus adhere more closely to legal and social standards.<sup>14</sup> At the most basic level, both police and members of the public should be less likely to engage in criminal behaviors in the presence of body-worn cameras. However, advocates and practitioners posit that these civilization effects are more comprehensive than simply disincentivizing *criminal* behavior and can foster milder interactions overall.

Established research into deterrence, criminal responses to surveillance, and police responses to oversight can be informative for predicting and understanding responses to body-worn cameras as evidence generators and accountability tools.

For defendants, numerous papers assess the effects of an alternate surveillance technology, stationary surveillance cameras called closed-circuit television (CCTV), on criminal behavior. Unlike body-worn cameras, CCTV cameras are affixed to a building or other fixed point from which they transmit video of whatever occurs within the camera’s frame. In contrast, body-worn cameras are mobile and record a constantly changing sight line intended to approximately reflect an officer’s field of vision. While CCTV cameras constantly transmit, often officers must activate their body-worn cameras. Like body-worn cameras, CCTV footage increases the likelihood that a criminal is caught and convicted if their offense is committed in view of a camera. Piza et al. (2019) conducted a meta-analysis of 76 CCTV studies within the criminology literature, finding an estimated 13 percent reduction

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<sup>14</sup>Body-worn cameras are worn on the outside of an officer’s uniform, typically affixed to clothing, equipment, or accessories. Because of this, they are observable to members of the public when interacting with police.

in crime in CCTV areas compared to controls. However, their heterogeneity analysis within this paper suggested that the success of CCTV in reducing crime is context specific: while evaluations set in parking facilities showed strong evidence of crime reductions, cameras in housing complexes did not appear to affect crime rates. Beyond location, effect sizes across evaluations also varied by whether the CCTV was actively monitored. The role of monitoring, which can enable a real-time response to criminal activity and is empirically shown to deter crime (Gonzalez & Komisarow, 2020), is a critical distinction between CCTV and body-worn cameras. Police, whether they use body-worn cameras or not, serve in the role of a monitor. If monitoring, rather than recording is the mechanism for CCTV crime reductions, then the crime reductions from CCTV are unlikely to be replicated with body-worn cameras. Gómez et al. (2021) provide new evidence on the role of monitoring using CCTV expansions in Medellín, Colombia that were not accompanied by expansions to monitoring capacities, finding that even without monitoring changes CCTV decreased the number of reported crimes and arrests.

Another technology, the Lojack car recovery device, lends empirical support to the theory of criminal deterrence in Becker’s model. Lojacks are easily concealed location transmitters placed in cars to aid in the recovery of stolen vehicles. Unlike CCTV or body-worn cameras, this technology has limited ability to link a particular defendant to an offense. However, it does increase the probability of discovery and, perhaps more importantly, reduces the expected value of the stolen goods by increasing the likelihood that the stolen vehicle is recovered. In practice, Lojack serves as an effective deterrent for car thefts among cars plausibly but not demonstrably equipped with the technology (Ayres & Levitt, 1998), and deterred an estimated 48 percent of car thefts among Lojack-equipped vehicles (Gonzalez-Navarro, 2013).

For police, body-worn cameras enable additional oversight. The desired effects of police oversight include improved conduct amongst officers and sorting out low-quality officers from the ranks. A less desired theoretical outcome of heightened oversight is *de-policing*, or reduced interactions between police and members of the public. There is precedent for this response given economic theory (Prat, 2004), however while Ba and Rivera (2019) do find evidence of de-policing following oversight generated by public outcry, they do not find



evidence for it when the oversight is generated within a policing organization.

Currently body-worn camera studies typically test for evidence of civilization effects in use of force and citizen complaint data. Within these studies, evidence for civilization effects is mixed. In an influential randomized controlled trial Ariel et al. (2015) found the rate of use-of-force incidents and officer complaints both declined for police assigned to use body-worn cameras, however an overlapping set of authors subsequently published a meta-analysis of 10 body-worn camera interventions that demonstrated no significant change in police use-of-force for adopters (Ariel et al., 2016). The following year Yokum et al. (2017) released results from a randomized controlled trial in Washington D.C. which showed no differences in either use of force or complaints between adopters and non-adopters. However, the interventions studied in these evaluations consisted of partial adoptions within single departments; it is possible that the estimates are attenuated due to spillovers into the interactions of non-BWC assigned police. For example, members of the public may be aware that police are using body-worn cameras but are unsure of whether the specific officers they interact with are using them. Additionally, officers may learn from their peer networks (Ouellett et al., 2019) – which do not necessarily directly coincide with their body-worn camera assignment groups. These concerns were also present in a non-randomized intervention which demonstrated a reduction in complaints against body-worn camera-wearing officers in Phoenix (Katz et al., 2014).

To bypass these limitations, Kim (2020) used a difference-in-differences strategy with a national sample of law enforcement agencies and found evidence that body-worn cameras *do* reduce police use-of-force. While this result suggests a civilizing effect on officers, he does not find any reductions in assaults where the victim was a police officer.<sup>15</sup> Together these findings suggest that officers– but not the public– are “civilized” by body-worn cameras and further may be indicative of null or limited changes in police use of discretion in charging.

While use of force is a salient and influential outcome to study, these events are relatively rare in policing. Complaints of excessive use of force are even more so: using data from Chicago police, Chalfin and Kaplan (2021) found that 84 percent of officers generated no

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<sup>15</sup>The global meta-analysis of local body-worn camera impact evaluations (Ariel et al. 2016) actually showed higher rates of assaults on police after adoption.

use-of-force complaints over a 5-year period. If we consider that the “better behavior” caused by civilization effects more broadly reduces the likelihood that an interaction escalates either physically or verbally, then we can expect to find broader changes in the charges that reach the courts. More deferential defendants and officers should reduce the frequency of charges of officer-oriented offenses such as resisting arrest. And officers, who have a degree of discretion in issuing citations and making arrests, may be less likely to overcharge criminal defendants – however, they also may be disincentivized from displaying leniency if they anticipate that their footage will be reviewed. These alterations could affect defendants on both the intensive and extensive margins – in other words, civilization effects may reduce the probability an individual is accused of a first offense or that they are charged with multiple offenses.

When Katz et al.(2014) conducted an impact evaluation for the Phoenix Police Department they tested aspects of this broader view of civilization effects. The authors first surveyed police about how they expected body-worn cameras to affect officers discretion and the frequency of contacts with the public. In both cases, before adoption respondents expected body-worn cameras to reduce discretion and contacts. However, these concerns lessened after body-worn camera adoption. While the authors acknowledge some shortcomings that limit the strength of causal claims within the study– including substantial officer turnover in the pre-adoption period – they find in practice adopting squads actually significantly increased their daily arrests and the frequency of resisting arrest charges was not significantly changed after body-worn camera adoption.<sup>16</sup> However, further study is needed to validate these findings outside of the Phoenix context.

### 3.2 Evidentiary Effects

Secondly, body-worn camera recordings can provide evidentiary value in court proceedings, affecting how judges and juries perceive the events that unfolded during a police interaction. Influentially, court actors resolve many cases outside of the courts through plea negotiations in which prosecutors and defendants (through their legal representation) agree upon a set of terms under which a defendant will admit culpability to the court– sometimes trading

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<sup>16</sup>Resisting arrest charges here were tested as a frequency instead of a share of arrests so this does not rule out evidence of a civilization effect in this outcome.

more lenient sentences or dropping charges in exchange for resolving the case without a time consuming trial. Guilty pleas are common and accounted for 88 percent of case resolutions in U.S. district courts in 2009 (Sourcebook, 2009).<sup>17</sup> Rational plea negotiations will take into account the probability of conviction and the expected severity of sentencing if convicted (Butcher et al., 2021). Additional evidence can influence these plea negotiations by improving the bargaining position of one side. In the case of body-worn cameras, footage may reveal law enforcement error or abuse or may corroborate/undermine defendant or law enforcement accounts of events.

While exposure of law enforcement error or abuse clearly benefits defendants, other evidentiary effects are theoretically ambiguous in direction. We may anticipate that they lean against defendants on average if the typical police stop is merited and/or the core components of a typical police report align with body-worn camera footage.<sup>18</sup> Ultimately, the balance of these elements determines whether additional evidence benefits or harms defendants on average— which is itself an empirical question.<sup>19</sup> Although adjudication of complaints against officers falls outside of the criminal justice system, in a recent working paper Çubukçu et al. (2021) found evidence that body-worn camera adoption in Chicago significantly reduced complaint dismissals for insufficient evidence while increasing disciplinary actions due to substantiated complaints.

Just how often body-worn camera footage provides evidentiary value for a case is unclear due to scarce data. Katz et al. (2014) show survey results, qualitatively consistent with the LEMAS-BWCS results, that officers *believe* body-worn cameras provide evidentiary value and make cases more prosecutable. However, a concurrent staffing intervention within the

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<sup>17</sup>I too find a preponderance of cases that end with a guilty plea: within my sample, which I detail in section 4, 65 percent of cases at the circuit court level conclude with at least one guilty plea

<sup>18</sup>We can consider this in a signaling framework: when footage confirms some details of a party's account of events this may strengthen the signal of the party's reliability and thus lends credence to the elements of the party's account that are not visible in the footage. Anecdotally attorneys report experiences consistent with this signaling. This signal may disproportionately advantage police accounts, particularly in those jurisdictions where law enforcement can review body-worn camera footage prior to writing an arrest report (NACDL, 2018). In the Katz et al.(2014) evaluation, the authors report that Phoenix police specifically required that their cameras have the capacity for in-field footage review

<sup>19</sup>An additional evidentiary consideration for body-worn cameras is the effect of not having body-worn camera footage of an incident when body-worn cameras are ubiquitous in an area and an officer is present. An officer may intentionally neglect to record an interaction for their own expected benefit or to preserve the privacy of a member of the public or may unintentionally neglect to record due to equipment malfunction or surprise.

department contaminated tests of the accuracy of this perception. Nonetheless, multiple sources show that a nontrivial share of cases in body-worn camera-using localities have related body-worn camera footage. The Katz et al. (2014) study comments on low compliance amongst officers, but also reports that footage was available for as high as 42 percent of calls in a month.

### 3.3 Time Use

*“It’s a razor thin wire, because you’re looking to be sure your client’s due process rights are preserved. On the other hand, I have 120 other clients. I have to preserve their due process rights too.”*  
-Newport News Public Defender Robert Moody (Albiges, 2019)

Another suggestive indicator of the evidentiary value of body-worn camera footage is the extent to which prosecutors and defense attorneys review the footage. Between 2016 and 2018 the Henrico County, Virginia Commonwealth’s Attorney’s office reportedly viewed footage for an average of over 2,000 cases each year with an average of just under an hour of footage viewed per case (Compensation Board, 2018), roughly the workload of a full-time employee. Although the Henrico County Commonwealth’s Attorneys’s (CA) office was the most detailed in its reporting, an October 2018 Commonwealth’s Attorney survey (Compensation Board, 2018) showed that 51 prosecutor offices reported receiving an estimated 180,000 hours of body-worn camera footage over a 12 month period (or an average of about 300 hours per month per office.)

Lesser-paid indigent defenders also experience body-worn camera-induced workload increases. For assigned counsel, who operate under a capped pay schedule, an hour of work reviewing body-worn camera footage (the average per case in the Henrico County prosecutor’s office) comprises over 75 percent of the total compensated time on a misdemeanor case, or 20 percent on a typical felony. And, in a time use study, three Virginia public defender offices reported spending between 160 and nearly 3000 hours per month on body-worn camera related tasks, the workload of between 1 and 16 additional full-time employees, over baselines of six to nine attorneys (Gaub et al., 2019).<sup>20</sup>

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<sup>20</sup>The offices employ non-attorney personnel as well.

At this point the extent to which these body-worn camera hours crowd out non-BWC activities remains ambiguous and anecdotal evidence of enhanced workloads due to body-worn camera footage remains more prevalent than detailed data on time spent on tasks related to body-worn cameras. But, this anecdotal evidence is powerful and already influenced policymakers in Virginia (VACO, 2019). As more law enforcement agencies adopted body-worn cameras the Virginia Indigent Defense Commission raised an alarm about the expected workload impacts of this technology expansion. Regarding court-appointed attorneys, the Executive Director of the Commission wrote, “it is not hard to imagine that court-appointed attorneys will be faced with terrible choices, which will hurt their clients, hurt their practice, or potentially undermine both. Court-appointed attorneys will likely have to stop taking court-appointed cases; not watch all the body-worn camera footage, in violation of their ethical duties; or basically be forced to work for free” (Compensation Board, 2018). The Ethics Counsel for the Virginia State Bar echoed this sentiment on the prosecutorial side, stating “Existing prosecutors’ workloads will be significantly increased by the time taken to review footage derived from body-worn cameras. To comply with legal and ethical standards, Commonwealth’s Attorneys must staff more lawyers or decline handling cases. Breaching the legal and ethical standards is obviously not an option” (Compensation Board, 2018).

## 4 Data

To study the effects of body-worn cameras on court outcomes, ideally, we would be able to link body-worn camera footage records to each court case throughout Virginia. Unfortunately body-worn camera data, especially at a case-level, are scarce. Even at agency or locality levels, existing data sets have limited coverage. Within Virginia the LEMAS-BWCS data included sample of 85 local law enforcement agencies and a survey of Virginia Commonwealth’s Attorneys often generated missing or incomplete responses on questions pertaining to the timing of body-worn camera adoption.

I fill this data gap by collecting a more comprehensive set of data on body-worn camera adoption by local law enforcement agencies in Virginia. I then use this data to develop body-worn camera adoption indicators within geographic court jurisdictions, which may include

multiple law enforcement agencies. Observing body-worn camera adoption at the court-level rather than the case level allows me to take a broad view of the effects of body-worn camera footage on cases in the court as a whole, encompassing direct effects of body-worn cameras on cases with footage and spillover effects on cases without footage. I combine this court-level data on body-worn camera proliferation with charge-level data from Virginia courts aggregated to form a quarterly court-level panel that I use to explore any changes in charging, case processes, and case outcomes after local law enforcement agencies begin using body-worn cameras.

## 4.1 BWC Data

To construct the court-level body-worn camera implementation data set, I used the 2016 Law Enforcement Agency Roster (United States Department of Justice, 2017) to identify the major law enforcement agencies within each geographic court jurisdiction in Virginia. I consider a court “treated” when the first major law enforcement agency based in its jurisdiction implements a body-worn camera program, excluding small-scale adoptions/pilot programs. I designate agencies as “major” if they employed at least 25 percent of the total officers in the court jurisdiction or if their policing jurisdiction included at least 25 percent of the court jurisdiction’s population.<sup>21</sup> I detail this designation more thoroughly in appendix A.1 and describe an alternative 50 percent threshold and the robustness of my results to this threshold in appendix B.2.

To obtain body-worn camera implementation data from qualifying law enforcement agencies in Virginia I extended Freedom of Information Act (FOIA) requests to 157 agencies.<sup>22,23</sup> In the exploratory stages of this project I also obtained information from an additional 32

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<sup>21</sup>Only agencies with policing duties were included and I omitted some sheriff’s offices that primarily handled jail and court security.

<sup>22</sup>Within the FOIA requests I specifically asked for separate information for pilot programs, if applicable. It is common for departments to use a testing or pilot phase in which a limited number of officers are given body-worn camera to use for a short time period to provide feedback to a department considering or planning to adopt body-worn camera on a larger scale. For example, one large department of over 200 officers piloted the technology with eight officers who had temporary use of the cameras. Other departments do not formalize this as a “pilot program” but begin by outfitting very few officers with cameras before establishing a department program. I do not treat these preliminary programs as adoptions.

<sup>23</sup>I am grateful to Nathan Fedorchak for his invaluable assistance navigating the Virginia FOIA process and to the numerous members of law enforcement agencies throughout Virginia and Michigan who shared their body-worn camera experiences with me.

Virginia agencies which either directly provided me with information about their body-worn camera programs or had highly publicized programs with information available on department websites and local media. Ultimately I obtained complete data for 111 district court jurisdictions including 78 that adopted body-worn cameras by 2019 and 106 circuit court jurisdictions, 76 of which adopted by 2019. These comprise nearly 90 percent of state district and circuit courts in Virginia.<sup>24</sup>

## 4.2 Criminal Case Data

I use charge-level data for criminal cases filed in Virginia district courts between January 2009 and March 2019 and Virginia circuit courts between January 2005 and March 2019 obtained from Virginia Court Data, a repository developed by scraping Virginia court websites and maintained by a private Virginian citizen (Virginia Court Data, 2021). The precise variables included in the data differ by court type, however all courts report defendant demographic information including race and sex, the date the charge was filed, the charge disposition, a series of sentencing outcomes, and text variables containing information about the charge itself and the section of the Virginia Code that encompasses the charge. Defendants most often receive dispositions of guilty, charge dropped by the prosecutor, or charge dismissed by a judge. Sentencing information can include the amount of time that someone is sentenced to serve in jail or prison as well as fines incurred. I also observe whether a charge is amended (superseded by an alternative charge) after filing. For example, I observe multiple instances in which an initial charge of assault on a police officer is replaced with the lesser offense of obstructing justice. Amendments can correct inaccurate initial charges or may reflect plea negotiations.

Each individual charge represents an allegation of a single offense, however it is common for defendants to be charged with multiple offenses at the same time. These charges can operate as alternatives – i.e. providing a jury the opportunity to convict a defendant of either manslaughter or second degree murder (or neither, but not both), or can come out of related

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<sup>24</sup>While some of the localities for which I do not include data did not respond to FOIA requests, there were also multiple localities where a major law enforcement agency had incomplete records and thus could not be included.

allegations, like multiple instances of embezzlement activities discovered jointly or a domestic violence incident that ended in an altercation with a responding police officer. When a defendant faces multiple charges at the same time it is likely that charge characteristics, court processes, and outcomes of the individual charges are related to one another. To address this, within each court type I aggregate charges up to a case-level using a grouping algorithm described in Appendix A.2. I use these case-level data to apply sample selection criteria, define outcome variables, and then subsequently aggregate up to a court-level quarterly panel.

Once charges are aggregated into cases, they may carry multiple dispositions and multiple sentences. For example, a three-charge case could end with one charge dismissed and two five-year prison sentences for the remaining two charges. I define disposition variables for cases by whether any of the charges in the case received a certain disposition. In this example, the case would be recorded as having both a "dismissed" and "guilty" disposition. Overall for analyses, I focus on the dispositions of "guilty", "dismissed", and "dropped" where charges are "dismissed" if a judge determines they should not proceed while charges are "dropped" if a prosecutor determines they should not proceed. I discuss the sentencing data in more detail and show results for additional sentencing outcomes in appendix B.4., but in the main results I show a simple binary measure of whether an individual was sentenced to serve a nonzero amount of time in a jail or prison.<sup>25</sup>

### 4.3 Sample and Outcome Variables

The three channels through which body-worn cameras can affect criminal defendants and the courts occur at two different stages in the criminal justice process. Civilization effects arise in police interactions, whereas evidentiary and attorney time use effects arise within the courts. Because of this distinction, I use different sample selection criteria for analyses of policing-based and court-based effects. Additionally, I use data from the two levels of courts separately. As a result, my main analyses will encompass five separate but related samples.

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<sup>25</sup>Some defendants who are sentenced to serve time according to this measure actually forgo incarceration by adhering to certain requirements set by the judge in their case. I ignore this in the definition of this variable, but include supplementary results showing the use of suspended sentences after body-worn camera introduction in appendix B.4



Table 3 shows baseline descriptive statistics for these samples.

#### 4.3.1 Case Filing Sample

I test for civilization effects in routine police interactions, expanding upon the existing literature that emphasizes the rare (but influential) outcomes of police use of force and complaints against officers. Oversight from body-worn cameras could change how police exercise discretion when issuing citations and making arrests, how likely it is for interactions to (even nonviolently) escalate, or the prevalence of certain charges. In this way, civilization effects could influence the number and composition of cases that enter the courts. Within my data this will be most clearly apparent in the district court filings; court actors typically influence these charges only after they are filed, meaning that changes in filing are attributable to changes at the policing stage. In contrast, since circuit court filings typically follow district court proceedings, changes in this set of filings will reflect all three channels of body-worn camera influence.

Because I am interested in policing stage changes, I include all recorded criminal court filings – including felonies, misdemeanors, and infractions – when creating the quarterly case filing panel data sets. In this way I will capture all police interactions that involve the courts without drawing distinctions across the levels of involvement. Civilization effects could change these case filings among multiple dimensions. If interactions are less likely to escalate after body-worn cameras are introduced, we expect to see a reduction in these filings both on the extensive and intensive margins.

On the extensive margin, this corresponds to a predicted reduction in the total number of cases entering the courts. This total count is the first outcome variable that I calculate for the case filing samples. However, it is unlikely that all cases are equally responsive to civilization effects. For this reason, I define a second extensive margin outcome to capture the prevalence of cases that include charges for which body-worn cameras are particularly salient. This set of charges, which I call “civilization effect charges”, originate or escalate in the presence of a police officer and include disorderly conduct, eluding police, resisting

arrest, and assault or other offenses specifically directed toward law enforcement.<sup>26 27</sup>

I measure intensive margin changes using two share variables: the share of cases consisting of multiple charges and the share of misdemeanor cases out of the set of felony and misdemeanor cases, since marginal felonies may instead be charged as misdemeanors and vice versa. Distributional assumptions about the effects of body worn cameras across case severities are necessary to predict the sign on these outcomes. For example, if the entire distribution of cases shifts downward (is civilized) under body-worn camera adoption then these intensive margin outcomes should show a smaller share of multicharge cases and a higher share of misdemeanors relative to felonies. If, however, body-worn cameras have the effect of truncating the distribution by removing the least severe cases from the courts without affecting more severe cases, then intensive margin outcomes could show increases in the share of multicharge cases and a higher share of felonies. On the policing side, existing literature suggests that body-worn cameras affect police behavior in severe situations (such as use of force), and so I anticipate that civilization effects in charging will reduce the share of multicharge cases and shift felonies toward misdemeanors on average but will interpret observed intensive margin results in the context of observed extensive margin results.

Although I can observe a longer panel of case filings, I restrict the sample frame for main analyses to only those cases filed by Q1, 2019. This is not necessary if my intention is simply to quantify the changes to case filings after body-worn camera introduction, but is chosen to mirror the time frame of the court process and resolutions sample so that these policing stage results will provide appropriate context for the court stage results. The outcome variables of interest in the court process and resolutions sample will not be realized or observable immediately upon filing, and so I shorten the sample to allow adequate time to observe case

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<sup>26</sup>I identify these charges using both the code section and charge fields within my data. These two pieces of information typically complement one another: the code section describes which specific provision of the Virginia legal code the defendant is accused of violating, while the charge field provides a textual, and sometimes finer, description of the offense. For example, assault and battery is listed under 18.2-57 in the Virginia code, but the corresponding charge field might contain something like "A/B - LEO", which designates that the defendant is specifically charged with assault and battery against a law enforcement officer.

<sup>27</sup>It is possible that there are times when an offense is directed at a law enforcement officer but this element of the charge is not indicated in either the code section or charge fields. If such misclassifications represent classical measurement error, my estimates will be less precise than they would be with perfect charge classifications but the measurement error does not introduce bias.

resolutions. I discuss my selection of the March, 2019 end date in the next section and also show results using a longer sample window for case filing effects in appendix 3.1.

Lastly, law enforcement began using body-worn cameras recently; 15 percent of adoptions before 2019 took place in 2018. Throughout these analyses, a trade-off for the timeliness of this paper is a shortened window of post-intervention periods to evaluate and the window of body-worn camera adoption does not neatly fit within my court data sample. I choose to require at least two years of pre-adoption case data and 1 year of post-adoption data in order for a locality to be included in my primary analyses. Because of this, I drop mid-late 2018 adopters from all samples. At the other end, the earliest adopters began using body-worn cameras in 2007. My district court data begins in 2009, so I omit from all district court analyses those localities that adopted before 2011. Such early adoptions are rare, comprising less than 4 percent of the localities that adopted body-worn cameras by 2019.

<i>Table 3: Comparison of treated and untreated localities at early-sample baseline</i>						
<i>Panel A: Case Filings</i>	<b>District</b>		<b>Circuit</b>			
	<i>Untreated</i>	<i>Treated</i>	<i>Untreated</i>	<i>Treated</i>		
Cases	4,424.8	4,090.7	80.2	189.3		
Civilization Effect Cases	27.6	44.2	3.6	9.4		
Multi-charge Cases	17.2%	18.9%	49.1%	46.3%		
Count Localities	33	76	28	76		
<i>Panel B: Case Processes &amp; Outcomes</i>	<b>Misdemeanors</b>		<b>Felonies</b>		<b>Felonies</b>	
	<i>Untreated</i>	<i>Treated</i>	<i>Untreated</i>	<i>Treated</i>	<i>Untreated</i>	<i>Treated</i>
Female	28	29	22	24	21	22
Black	21	33	26	43	27	45
Multi-charge	17	18	57	54	47	43
% Public Defender	33	43	33	43	25	46
% Cases with amended charge	9	9	4	4	2	2
Avg Sentence Time (days)	21.7	28.0	67.1	82.3	2404.2	2518.9
% Sentenced to time	18	22	27	28	66	71
% Received fine	65	65	13	13	11	12
% Cases with charge dismissed	19	17	10	10	7	4
% Cases with charge dropped	11	11	38	40	21	24
% Cases with guilty charge	73	75	34	33	72	72
Avg Num. Cases	999.7	1182.0	91.7	132.2	53.7	124.3
Count Localities	33	69	33	69	28	68
<i>Note: 2009 District court case characteristics, 2006 Circuit court case characteristics from unweighted locality-level panel. The treated group are localities that adopted by Q2, 2018 for the case processes and outcomes sample and localities adopting through Q4, 2018 for the case filing sample. Case filing panels are not case-type specific.</i>						

### 4.3.2 Court Process and Resolution Sample

After cases enter the courts, various court actors can influence their resolution and the process by which this resolution is realized. I introduce additional sample inclusion criteria to better capture the influence of these actors on cases. Additionally, cases will proceed and resolve differently based on characteristics of the case. Most notably, the set and likelihood of potential outcomes differ for misdemeanors and felonies. For this reason, I partition the district court sample based on these case types. I omit infraction cases from the court process and resolution samples since these rarely entail litigation, will not qualify for an indigent defender, and often are resolved by pre-paying a set fine without interacting with the court or court actors. Because misdemeanors only enter circuit courts an appeal from the district court or as an auxiliary charge to felony, I restrict circuit court sample cases to those that include at least one felony. In total, I use create three panels for the court process and resolution analyses: a circuit felonies , district felonies, and district misdemeanors. For all three samples I drop charges such as probation violations and bond violations that arise as a result of previous engagement with the criminal justice system.

I also restrict my sample to include only cases for which all charges were filed by March 12, 2019. This is to give all charges in my data set at least one year to resolve prior to the onset of the coronavirus pandemic.<sup>28</sup> Even so, some cases were not resolved by the end of the data collection period. This is particularly true for circuit court cases, which encompass more severe charges and often more intense litigation. Without correction, longer and more complex cases would systematically drop from the sample in later periods. To mitigate the effects of this attrition, I condition outcome variables for circuit court cases on having been observed within 1 year of the filing date. For example, rather than examining the share of cases for which at least one charge is amended, I use the share of cases for which at least one charges is amended *within 1 year of filing*.<sup>29</sup> District court cases tend to be simpler and faster-moving than circuit court cases, mitigating the end-of-sample attrition issue for district court cases without any intervention. In appendix B.1 I discuss the attrition issue

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<sup>28</sup>Because courts and attorneys suspended and/or substantially modified their operations after the onset of the 2020 coronavirus pandemic, cases after this time did not have a “normal” year to be resolved – the Governor of Virginia declared a state of emergency on March 12, 2020.

<sup>29</sup>In base year 2006, 83 percent of circuit court cases in my sample were disposed within 1 year of filing

in more depth.

When faced with a criminal charge, a natural sequence of questions to ask would be "will I be found guilty?" and "what happens if I am?" In line with this, the most basic outcomes of interest when studying the effects of body-worn cameras on criminal cases are the share of defendants who are convicted of an offense and the share that are sentenced to incarceration. Incarceration is a common but severe outcome, and is not the only possible sentence for a guilty verdict. Misdemeanors commonly carry a sentence of a fine rather than jail time and so I also include this outcome measure.

However, we are also interested in *how* these outcomes come to pass. While the ultimate effect on the defendant is the same, a verdict of "not guilty" after a case is presented to the court is different from a dropped charge or case dismissal, which may happen due to lack of evidence, plea negotiations, or demonstrated error. To capture changes in these case processes, I test for changes in the share of cases with dropped charges. Case dismissals and amended charges, while important aspects of the courts system, are rare case outcomes, particularly for felonies where they each occur less than 5 percent of the time on average in my court panels. In contrast, prosecutors drop charges routinely in both district and circuit court cases, particularly for felony cases.

Additionally, insofar as ongoing criminal litigation is disruptive for defendants, the amount of time a case is active within the courts is an outcome of interest. I leverage the timing data within the circuit court sample to see whether cases took longer to resolve after body-worn camera introduction using the share of cases that were disposed within 1 year of filing. Because my circuit court sample conditions on case outcomes being observed within 1 year of filing this will fulfill the dual purposes of describing changes to case duration and also alerting me to compositional changes in my sample stemming from this timing criteria. For district court cases, which resolve more quickly than circuit court cases, I also use the share of cases disposed within 3 months. The disposition date is unavailable in district court data, so here I substitute the date of the latest hearing for disposed cases.<sup>30</sup> This will cause an overestimate of the time to case resolution, particularly for cases for which a defendant was

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<sup>30</sup>I summarize each of these variables in table 2, along with their expected responses to body-worn camera adoption

sentenced to probation, but should serve as an effective proxy.

Overall, treated and untreated localities demonstrate many baseline similarities in case processes and resolutions, but vary in the court and defendant characteristics and some sentencing outcomes. Shown in table 3, case dispositions are similar across the treatment groups, including the share of cases with a guilty disposition, dropped or amended charges. One difference in case processes is evident at the circuit court level, where untreated localities on average take longer to reach case resolutions. However, at the district court level, cases across groups tend to resolve at similar rates. At the district court level, fines are levied across groups at similar rates, although they are slightly less common in untreated courts at the circuit court level. Across all three samples, incarceration outcomes are more common/more severe in treated courts. Treated localities are more likely to be in populous areas with more active courts, a higher share of black defendants, and are more likely to be served by a public defender’s office.

## 5 Methods and Results

### 5.1 Methods: Two-way Fixed Effects

I use the rollout of body-worn cameras across law enforcement agencies in Virginia to test for effects of body-worn cameras on the courts. To do so I will use a difference-in-differences strategy and first use OLS with two-way fixed effects to estimate the following model:

$$Y_{lt} = \alpha + \tau D_{lt} + \delta X_{lt} + \gamma_t + \lambda_l + \epsilon_{lt}$$

In this model,  $D_{lt} = 1[t \geq T_i]$  is an indicator that takes the value of 1 for adopting localities during or after the quarter of adoption. The vectors  $\gamma_t$  and  $\lambda_l$  account for quarter and locality-specific fixed effects, while  $X_{lt}$  contains covariates that vary across time and locality. When estimating this model, the key parameter of interest will be  $\tau$ ; the effect of body-worn camera adoption (the treatment) on the outcome of interest.

## 5.2 Methods: Imputation Estimator

Underlying the above model is the assumption that  $\tau$  is time and locality invariant. However, oftentimes treatment effects will exhibit heterogeneity in these dimensions. When treatment timing is staggered these heterogeneities can cause the traditional TWFE estimator to underperform. As described in Goodman-Bacon (2021) and Borusyak, Jaravel, and Spiess (2021), estimates of  $\tau$  or even more flexible estimates of  $\tau_{lt}$  through conventional event studies are not reliable and reflect weighted averages of many comparisons across groups that may not reflect the intentions of the researcher. For example, some comparisons can be given a negative weight in the treatment effect aggregation, and the “forbidden comparison” of newly treated to previously-treated groups are not excluded from the treatment effect calculation. Multiple new and modified estimators emerged in recent years to address these shortcomings (Borusyak, Jaravel, and Spiess, 2021; Callaway & Sant’Anna, 2020; Sant’Anna and Zhao, 2020; Chaisemartin & D’Haultfoeuille 2020 ; Sun & Abraham, 2020 ; Wooldridge, 2021).

In my context, law enforcement adopt body-worn cameras at different points in time, and it is theoretically plausible that body-worn camera effects are heterogeneous over time due to changes in salience at the policing stage and attorney adaptation within the courts. In light of this, I additionally implement the modified event study framework developed by Borusyak, Jaravel, and Spiess (2021). This imputation estimator (BJS), implemented within Stata using code generously provided by the authors, uses untreated observations to estimate unit and time fixed effects, which are subsequently used to impute counterfactual untreated outcomes for treated observations. The difference between the observed outcomes and their imputed counterfactuals gives a unit and time specific treatment effect which can then be aggregated into an estimate of the desired treatment effect. That is, I estimate

$$Y(0)_{it} = A'_{it}\lambda_i + X'_{it}\delta + \epsilon_{it}$$

, and use these estimates,  $\hat{\lambda}_i$  and  $\hat{\delta}$ , to calculate  $\hat{\tau}_{it} = Y_{it} - Y(\hat{0})_{it}$  for each locality in each quarter.<sup>31</sup> I aggregate these in two ways; one showing an overall ATT across all treated unit-

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<sup>31</sup>Wooldridge (2021) describes the BJS estimator with unit-specific and time dummies as identical to his extended TWFE (ETWFE) estimator.

quarters and one showing estimated average treatment effects for each of the four periods following implementation. In doing so, I can discuss short term treatment dynamics.

### 5.3 Identifying Assumption

The key underlying assumption for the difference-in-differences strategy employed by both of the above methods is that of parallel trends, or that the untreated potential outcomes for both treated and untreated localities evolve according to the model:  $Y_{it} = \alpha + \delta X_{it} + \gamma_t + \lambda_i + \epsilon_{it}$ .<sup>32</sup> This is often tested using event studies with , however in a recent working paper Roth (2021) demonstrated that common pre-trends tests used to validate the plausibility of the parallel trends assumption can inadvertently introduce a survivor bias to estimates that pass these tests. To mitigate this issue, BJS (2020) propose an alternative parallel trends test that complements their imputation estimator.

In this test, the researcher estimates an expanded version of the BJS imputation model,

$$Y(0)_{it} = A'_{it}\lambda_i + X'_{it}\delta + W'_{it}\gamma + \tilde{\epsilon}_{it}$$

where  $W_{it}$  is a vector of indicator variables for some determined number of periods before treatment. This model is estimated using only untreated observations,  $Y(0)_{it}$ . After obtaining estimates  $\hat{\gamma}$  of  $\gamma$ , the researcher conducts a joint significance test (F-test) of the null hypothesis that  $\gamma = 0$ . Using this procedure, I show results in appendix table B.1 for all of the main case filing, process, and resolution models using indicators for the (a) four and (b) eight periods prior to body-worn camera adoption. Overall, while certain variables of interest do show evidence of differential trends between the untreated and the treated units, there does not appear to be evidence of systematic violations of the parallel trends assumption. In the cases where the test does raise concerns regarding trends, I discuss results in light of the expected biases from such a violation.

Importantly, the parallel trends assumption does not require that the treatment is ran-

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<sup>32</sup>A distinct but related assumption is that of no anticipatory effects, however the same methods used to test for parallel trends can reveal violations of the no anticipatory effects assumption. With a long enough panel correcting for violations of this assumption is simple: one can redefine event dates to account for anticipation.



domly assigned and it allows for localities to differ across characteristics as long as these differences do not alter the parallel paths of the outcome variable across groups. To bolster the evidence from pre-trends tests that the parallel trends assumption is plausible, I argue that police departments will non-randomly select into using body-worn cameras but that this choice is plausibly exogenous to the courts. While adopting and non-adopting localities demonstrate baseline differences across certain demographic characteristics reflective of the communities they are based in, they show baseline similarities across many court processes and case outcomes. Adding to this, the LEMAS-BWCS survey provides evidence of police intentions when adopting body-worn cameras and shows that body-worn camera adoption was driven by police in pursuit of improvements to police interactions rather than desired changes in court processes or resolutions. Of the 53 adopting agencies in Virginia, only three cited evidentiary or prosecutorial reasons as the primary reason they began using body-worn cameras. These arguments, taken along with the pre-trends tests, lend support to a causal interpretation of my estimates of court-based effects.

To strengthen the causal claims for policing outcomes I provide supplementary analyses which directly mitigate selection concern. While my primary analyses use all localities with sufficient pre- and post- treatment observations to estimate a treatment effect, I repeat the analyses using only localities treated during the surge in adoptions from 2014-2017. To do so, I end the sample period at the fourth quarter of 2017 and use the 2018 adopters as untreated controls. Since this estimator will use not-yet-treated units to calculate the imputed counterfactual outcomes for treated units, including the 2018 adopters enables me to calculate treatment effects for the 2017 adopters. This sample restriction weakens the criteria for exogeneity of treatment: now adoption itself can be endogenous but the timing of adoption for this group should not be. Deshpandi and Li (2019) use this strategy in their study of the effects of social security office closings on disability program participation, as does Kim (2020) in his national study of the effects of body-worn cameras on policing. Intuitively, early adopters could break this assumption. For example, they may be more innovative or motivated than the typical department. By omitting early adopters to use a subset of localities that adopted during a narrow period of national body-worn camera expansion and popularization, I strengthen the claim of plausibly exogenous adoption timing.

For this group factors such as administrative hurdles, as Kim (2020) demonstrated and exploited, can stagger the timing of adoption amongst an otherwise similarly selected group.

## 6 Results

### 6.1 District Court Results

I begin by testing for effects of body-worn cameras on the set of cases that enter the courts (case filings). Subsequently, I test for effects of body-worn cameras on the outcomes of these cases and the process by which these outcomes are realized. The first step of testing provides two primary benefits. At the district court level changes to the cases that enter the courts after body-worn camera adoption are indicative of changes to police interactions and evaluating such changes allows me to contribute directly to the developing consensus on the effects of body-worn cameras on policing. Secondly, these analyses are critical for interpreting estimates on outcomes that occur later in the criminal justice process. If the cases entering the courts appreciably change after body-worn camera adoption due to policing changes, then estimates of body-worn camera effects on case outcomes may reflect not only the court-based evidentiary and time use effects but also these policing-based case changes. For example, if police make fewer marginal arrests after body-worn camera adoption then we could erroneously attribute higher conviction rates to evidentiary or time use channels when in reality the cases that entered the courts were stronger simply on the basis of police forgoing the weaker arrests. If, however, case filings appear stable after adoption then court-stage outcomes will reflect only the evidentiary and time use channels.

#### 6.1.1 Case Filing Effects

There are four primary measures I use to examine whether the set of cases entering the courts changed after body-worn camera adoption. The first two provide information about the number of cases that enter the courts, while the third and fourth outcomes provide information about the composition of these cases.

First, I look at broadly at the number of cases that are filed in each quarter after

adoption. Because of heterogeneity in court activity, I define this outcome variable  $Y_{it} = \ln(case\_counts_{it})$ . This definition allows me to approximately interpret estimates in percent change terms. The second outcome of interest is the number of “civilization effect cases” that are filed within district courts. These cases are less common, occurring on average 33.1 times per court per quarter. In some court-quarters, there are no such cases. Zero-counts are meaningful in this context and so to include these courts I define this second outcome variable as  $Y_{it} = \ln(civ\_case\_counts_{it} + 1)$ .<sup>33</sup> I provide estimates of the overall ATT for all four outcomes in table 4a using the traditional TWFE estimator, the new BJS imputation estimator, and the BJS estimator on the restricted sample of only 2014-2017 adopters, with 2018 adopters included to .

<i>Table 4a: BWC adoption effect estimates, district court case filings</i>				
VARIABLES	TWFE	BJS	BJS 2014-2017 Adopters	Mean Value
Ln(Cases)	-0.006 (0.029)	0.015 (0.030)	0.007 (0.035)	3,578.8
Ln(Civilization Cases + 1)	-0.106** (0.035)	-0.115** (0.037)	-0.081† (0.049)	33.1
Share Multi-charge	-0.004 (0.004)	-0.004 (0.005)	-0.001 (0.005)	0.188
Share Misdemeanor Cases	-0.003 (0.003)	-0.002 (0.003)	-0.003 (0.004)	0.924
Observations	4,141	4,141	2,340	

Cluster-robust standard errors in parentheses

\*\*p<0.01, \* p<0.05, † p<0.1

*Note: Means of rows 1 and 2 reflect the average counts for the underlying variable, but the outcomes used to calculate estimates are  $\ln(count)$  and  $\ln(count+1)$ , respectively. Mean values shown are for the full sample.*

I find limited evidence that body-worn cameras affected the cases entering district courts.

<sup>33</sup>While adding 1 before taking a log is an oft-used technique, the selection of the value to add can alter results at times. In practice, I do not find that to be a problem in this context; the results are similar whether I add 1 or 0.1 to the civilization case count before taking the log. Both estimates are statistically significant at the 5% level and the point estimates vary from -0.110 to -0.115.