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Learning the Ropes: General Experience, Task-Specific Experience, and the Output of Police Officers

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Learning the Ropes: General Experience, Task-Specific Experience, and the Output of Police Officers

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Abstract

We estimate the role that law enforcement officer experience has on the probability of punishment, using a unique data set of tickets issued by the Idaho State Police linked to human resource records. All else equal, officers issue fewer tickets earlier in their career than later in their career. Quasi-exogenous shocks to an officer's task-specific experience, generated by law changes, cause a temporary reduction in the frequency with which a subset of troopers "use" those laws, creating disparities in the likelihood that individual citizens are cited for law violations. The reduction in ticketing in response to a law change is largest for newer troopers, and law changes later in a trooper's career have a smaller effect on his use of that law.

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1. Introduction

Documenting and understanding the source of disparities in the application of laws, particularly criminal laws, is a pressing social problem. Since the presence of an official criminal record has negative consequences for employment, education, housing decisions, and eligibility for government assistance programs, variation across equally criminal individuals in the probability of arrest, conviction, and incarceration, is a major contributor to inequality.

A large literature in law and economics has identified the presence of criminal justice disparities based on an individual's racial or ethnic background, which can be exacerbated by the race of the criminal justice agent (e.g. police officer, jury member, judge) making the decision about criminal culpability or punishment. More recently, researchers have documented additional sources of disparities in the justice system, including an officer's perception of the expected cost of issuing a ticket, the severity of prior cases tried in the same court, and the time until a judge's next meal.

In this paper, we identify disparities in the treatment of American motorists in the state of Idaho. Drawing on recent theoretical and empirical advances in labor economics (e.g. Abowd and Kramarz 1998, Gibbons and Waldman 2004, Bagger et al. 2014), we point out that legislative changes in the Idaho State Criminal and Traffic code are likely to be differentially enforced by different Idaho State Troopers in a predictable way. Specifically, we point out that in a simple model of trooper decision making, more experienced troopers will, rationally, issue more tickets than inexperienced troopers. In addition, accurately issuing tickets for different Idaho State Statutes constitutes different tasks a trooper must perform; identifying citizens who are driving too fast in a residential area is a different skill from identifying citizens who are driving under the influence, which is also different from identifying people with improper towing

permits. Recent research on the importance of task-specific experience suggests that changes to a law or legal code may involve a cost of temporarily reduced enforcement while troopers gain experience with a new task.

Between 1997 and 2009, the Idaho State Legislature made a total of 90 amendments to 66 of the 286 criminal and traffic laws that the Idaho State Police (ISP) regularly enforce.[1] Using an administrative data set of all tickets issued by the ISP between 2002 and 2009, we show that when the Idaho state legislature revises a state statute and changes one of the tasks that troopers must perform, certain troopers become temporarily less likely to issue tickets for the changed statute.

By linking the ticketing data with human resources records, we estimate that, on average, a trooper with one more semester of experience on the force will issue about 2.8 more tickets in total, about 0.01 for each law on average. In comparison, a one semester increase in the length of time a trooper has been enforcing a particular version of a law is associated with an imprecisely estimated 0.004 fewer tickets for that specific law. This null effect masks substantial predictable heterogeneity in the return to task-specificexperience. First, we find that controlling for the types of laws that troopers enforce consistently results in a positive relationship between task-specific experience and tickets, especially for troopers early in their careers. Second, after a law changes, troopers with less general experience change the frequency with which they accuse people of violating that particular law much more than experienced troopers. Third, we find that more experienced "senior" troopers have flatter general and task-specific experience-ticketing profiles.

[1] We limit our sample to laws for which at least 10 citations are issued during our sample period. This excludes 334 laws that are enforced, at some point, from our sample. In robustness tests, we will limit our sample to only laws used at least 200 times, and find similar results.

This could be due to decreasing returns to "ticketing capital", variation in the work environment for senior troopers, or sample attrition.

In a series of robustness checks, we show that the large response of younger troopers to law changes is unlikely to be driven by differential attrition from trooper ranks. We observe this effect regardless of the type of law change - increasing penalties, expanding or reducing the number of things that are illegal – as all result in the same change in behavior on the part of troopers, suggesting that this is driven by trooper, rather than citizen behavior. We also utilize a non-parametric specification and are able to show that our results are driven by the data, rather than any functional form assumptions.

In addition to complementing the existing research on task-based worker productivity, the finding that a trooper's experience, both overall and with a given law, affects the rate at which individuals are accused of crimes has important implications for criminal justice policy, and in particular the social cost of changing a law. These results suggest that the impact of any state or city level policy change on individual behavior is, in part, determined by the experience of the law enforcement troopers tasked with enforcing the law.

The paper proceeds as follows: in section two, we review the existing empirical evidence on task-specific experience and output. We then provide some institutional background on the Idaho State Police in section three, and present an intuitive theoretical framework for thinking about the incentives faced by state troopers when enforcing the Idaho Statute in section four. In section five, we describe our data, and we present our analytic framework and reduced form results in section six, perform a number of robustness and specification checks in section seven, and conclude with a brief discussion in section eight.

2. Related Literature

Documenting how workers adapt to changes in the particulars of their jobs is important for our understanding of human capital and productivity, but the fact that we are studying the behavior of state troopers means that our findings have particular relevance for law and economics as well. State troopers are expected to enforce state laws, and the issuance of tickets is a byproduct of their job duties; by observing citizen behavior and issuing citations when that behavior falls outside of legal bounds, state troopers provide justice in society generally, and produce roadway safety in particular (Bates et al. 2012).

Understanding the factors that affect the probability that someone is arrested, particularly when those factors are not related to that person's actual behavior, is of central importance in law and economics. There is a growing body of evidence in empirical legal studies identifying extra-legal factors which produce individual disparities in criminal justice outcomes. For example, Makowsky and Stratmann (2009) found that police officers were more likely to issue tickets to out of state drivers than people who appear to be local. DeAngelo et al. (2015) finds that reporting districts immediately adjacent to locations that impose low-priority law mandates for misdemeanor marijuana offenses experience significant increases in the probability of misdemeanor marijuana arrests despite no change in legal code. Danziger et al. (2012) presented evidence that Israeli judges who hear cases shortly after lunch tended to make rulings that were more favorable to the defense. Schanzenbach and Tiller (2008) demonstrate that US federal court judges tend to make decisions that reflect the sentencing regime under which they were appointed, even if the regime has since changed. Bushway et al. (2012) found similar "stickiness" of judicial opinion in response to changing sentencing guidelines US state courts.

A larger literature on racial profiling has found that a police officer's race, or the average racial makeup of the police force, affects the racial composition of people who are arrested

(Donohue and Levitt 2001, Antonovics and Knight 2009, Sanga 2014). Further along in the process, the probability that a black defendant is convicted at trial appears to be a decreasing function of the fraction of jurors who are black (Bayer et al. 2009). We provide an additional piece of evidence documenting the role that individual characteristics of criminal justice agents play in determining how criminal laws are enforced. To the best of our knowledge, we are the first to identify police officer-level heterogeneity in response to a criminal justice event that, unlike the race or residence of a citizen, is completely under a policy maker's control – the introduction, revision, or repeal of a law.

Economists have recognized the importance of experience, as distinct from innate skill, since Mincer (1958). However, what is meant by experience and how it should be measured, is somewhat ambiguous and has been driven in large part by data availability. Most population surveys record when a person finished school, and so "experience" is often simply measured as time in the labor force (Blau and Kahn 2013). Administrative records often report how long a person has worked at a particular firm, allowing economists to track the relationship between firm specific experience and wages (Abowd et. al 2004, Topel 1991), and some datasets even track and individual's occupation, allowing researchers to identify how much experience someone has in a specific job (Neal 1995). However, comprehensive data on exactly what tasks a worker preforms as part of their job are still not widely available.

Using a cross section of forecast analysts, Clement et al. (2007) estimate how a given forecaster's ability to predict a firm's earnings after restructuring varies with their time at a firm, the number of forecast the analyst has previously done, and the number of specific, post-restructuring forecasts that the analyst has done for the firm. Analysts who have previously

studied firms undergoing a major organizational change are better at forecasting a given company's earnings after restructuring, but not any better at general forecasting tasks.

Gathmann and Schonberg (2010) build on Clement et al. (2007) by estimating the relationship between task-specific experience and productivity using German social security records. They find that a substantial amount of a persons' wage growth over their lifetime is due to task-specific experience, and that task-specific experience explains more of lifetime wage growth for people with higher levels of education. Ost (2014) disentangles job and task-specific experience using teachers who teach different grades at different points in time, with teacher "productivity" measured using changes in student test scores. Ost (2014) finds that general teaching experience raises test scores, but that experience with grade-specific math was also important; the impact of grade-specific experience on math scores is between ½ the size or equally as large as the impact of general experience on math scores. For reading scores, general experience was consistently more important than grade-specific experience. Finally, Cook and Mansfield (2014) use a more structural approach to identify the relationship between task and firm specific capital among teachers who teach up to three subjects at a time. While most quality differences are innate, they identify a steep increase in productivity, also measured using student test scores, in the first three years of teaching, most of which is driven by increasing task-specific experience.

Our analysis of the ISP builds on this literature in a number of ways. Similar to more recent work, we observe individual workers over time, allowing us to minimize bias due to unobserved time invariant differences in innate ability. We also observe a substantial component of an individual worker's output directly, rather than indirectly through wages or test scores. We also observe workers engaged in many tasks at the same time, allowing us to more credibly separate

job from task-specific experience. Finally, our variation in task-specific experience is both simpler, and plausibly more exogenous, than in Ost (2014) or Cook and Mansfield (2014). Specifically, while teachers may return to a subject they used to teach, Troopers never "revisit" a changed law, meaning that we do not have to model how "unused" task-specific human capital deteriorates over time. In addition, law changes are not related to any given trooper's performance, as teacher classroom assignment may be.

3. Institutional Background

The largest law enforcement agency in Idaho is the Idaho State Police (ISP), which employed 282 commissioned troopers and 225 full time staff in 2010. The roughly 150 troopers employed at any given time carry the largest burden in terms of enforcing the law, writing approximately 3,300 of the 4,600 tickets issued by the ISP each month. Turnover rates in the ISP are quite low relative to other state agencies; in 2010 there was a 7.2% turnover rate and only a 1.9% voluntary separation rate in the ISP, compared to a 12.8% turnover rate and 4.8% voluntary separation rate in the state as a whole (IHR 2012).

There are two major institutional characteristics of the ISP that impact the feasibility of our empirical analysis. First, we will describe how a trooper learns about the initial tasks assigned to them, and to changes in the penal code that affect the tasks they must perform. Second, we will summarize the specific incentives that an ISP trooper faces when enforcing the law.

In order to join ISP at the rank of trooper, an individual must complete training at the ISP academy and go through some additional post-academy training. Academy training provides a baseline level of knowledge that the trooper should have when enforcing the law, and the academy training, in particular, is focused on the law as it exists when the trooper is being

trained. [2] Post-academy training comes in the form of, for example, gun training seminars that the ISP offers at each staff office.

After a trooper joins the force, there are a number of mechanisms the ISP uses to ensure that troopers are educated about changes that the Idaho legislature makes to state statutes. First, when changes to the legal system result in major shifts in the way that troopers enforce the law, the ISP will hold in-service training sessions whereby specialists are sent to the field in order to carry out an educational program. In addition, troopers are required to complete DVD training at their field station. For less complicated changes, the troopers are informed in team meetings and via email, which contain information about changes in procedures that must be enacted but require little in the way of additional training. Finally, trooper vehicles are equipped with an electronic version of the Lexis-Nexis code for Idaho that is automatically updated to reflect the current state statute, and carry a Post-Trooper Standardized Training Book (which troopers refer to as their "cheat sheet") that includes all tickets they should issue.

Accurate knowledge about the changes in the legal system is critical for our analysis, and an equally important concern is the incentives that individual troopers have while enforcing the law. It is quite common to hear that troopers or police officers face arrest quotas and/or that their job depends upon raising revenues through fines. In Idaho, fines for traffic tickets do not end up directly funding the state police. In fact, for a standard speeding traffic infraction, approximately 40% of the fine goes to a state general fund, 20% goes toward court costs, 6% goes to a county justice fund, and 12% goes toward a law enforcement technology fund and emergency surcharge

[2] Before exiting the trooper academy, troopers are required to pass a Peace Trooper Standards and Training exam that requires the trooper to know detailed information about the Federal and State Constitution and Statutes.

fee.[3] It is therefore not obvious that troopers would believe that their supervisors view tickets as a source of department revenue.

At the individual trooper level, it is also unclear that issuing more tickets will lead to pay raises. The ISP, like most state departments in Idaho, pays their employees according to a pre-determined and fixed pay scale, with compensation determined entirely by state legislature. In FY 2011, ISP employees could earn an hourly wage of at least $16.59, and no more than $30.51. On average, most ISP employees receive a $24.41 "policy" wage, based on the nationwide average pay for similar types of jobs. The most direct incentive trooper's face when issuing tickets is, therefore, encouragement or reprimand by their supervisor.

4. Theoretical Foundation

With the exception of piece-rate work, measuring productivity across and within workers is complicated, and typical measures, like wages or student test scores, are noisy measures of true worker "output."[4] As law enforcement officers, troopers are charged with discerning illegal activity on the part of the civilians, and a "task" in this context consists of issuing a ticket to citizens who violate a particular law. In this section, we present an intuitive model of task- and general experience to provide a framework for thinking about our reduced form model of tenure and ticket issuing that captures key institutional features of the ISP.

Some mechanisms that relate tenure to the "production" of tickets apply to employees in any industry; on-the-job training in time management will allow experienced workers to do more in a given amount of time. In the particular context of law enforcement, after a trooper issues a ticket

[3] See http://www.isc.idaho.gov/rules/iir9.txt for a breakdown of how a fine is distributed across agencies and programs in Idaho.

[4] See Dynarski et al (2013) and Jackson (2013) for critiques of the validity of test scores as a measure of the impact of educational investments and teacher performance. Shaw and Lazear (2008) provide a comparison of output to wage growth, and show that initially, wages grow more slowly than output, but that output grows more slowly than wages for more experienced workers.

or makes an arrest, he or she must fill out paperwork recording the incident. Learning how to process a citizen interaction takes time, and as a trooper gains experience writing reports, they will have more time to patrol, and thus more time to issue tickets. To the extent that legislative changes require police to write reports and process cases for behaviors that have never previously been considered crimes, there will be an adjustment process as troopers learn these new tasks. If changes in a particular statute make it more difficult to process violations of a particular law, then it is possible that troopers of all experience levels may be hesitant to use it.

Other dimensions of output and productivity, as measured by total number of tickets issued, are more specific to law enforcement.[5] If troopers either issue tickets to civilians who have not actually violated a law, or fail to issue tickets to civilians who do violate the law, they will eventually be penalized by their supervisors. For the purposes of exposition, we will assume that citizens choose an action, a, that lies somewhere on a one dimensional line, and each law, v, in the Idaho statute establishes a legal threshold along that line, R_v. If $R_v < a$, then the behavior a is illegal, and if $R_v > a$, then a is legal. For example, an action could be a driving speed; in a commercial area, any speed less than or equal to 35 miles per hour is considered legal, and any speed greater than 35 miles per hour is a violation of the commercial district speed limit.

When performing their on-the-job tasks, the trooper faces two sources of uncertainty that can affect their incentive to write a ticket. First, the trooper must be able to accurately observe the actions taken by the citizen, in order to identify where a falls on the spectrum of legality. Ability to detect behavior is a general skill that the trooper needs to enforce all laws. For example, what spots on the highway allow you to observe citizens driving past, but at the same time not be

[5] Using tickets issued as a measure of productivity for law enforcement officers may not be first best from a social perspective, but in practice, tickets and arrests are readily available, low cost ways for sergeants to monitor the performance of the different officers they supervise. For more background on evaluating officer performance, see CALEA, 2003

readily seen yourself? What is the best way to use a radar gun? Both of these are general skills that likely improve with overall tenure.

The second source of uncertainty facing a trooper has to do with the exact location of R_v; even if they observe citizen behavior perfectly, does the trooper know how the behavior they observe compares to the behavior outlawed by statute? For example, when the legal threshold of blood alcohol content at which someone is Driving Under the Influence is lowered, (which amendments to Idaho traffic statutes 18-8004(1)–C(3) did in 1997), the cues that a trooper might look for as reference points, such as how quickly a person can count backwards from 97, will change.

Because of these two sources of uncertainty, troopers do not observe the exact value of a, but rather observe $A=a\sigma/ f(t_i,\tau_{iv})$, where $\sigma \sim N(0, 1)$ is a noise term that represents the citizens' ability to shade their own actions, and thus the trooper's ability to match what the citizen is doing to the particular law. This term can be either positive (meaning that the trooper perceives more "illegality" than is true) or negative (the citizen's actions appear "more legal" than they actually are). The function $f(t_i,\tau_{iv})$ represents the trooper's skill, which is a strictly positive, increasing function of the trooper's overall time working for the Idaho State Police (t_i), and the amount of time that the trooper has enforced the particular version of law, τ_{iv}. Intuitively $f(t_i,\tau_{iv})$ can represent the trooper's ability to collect the evidence required to make the ticket valid in court, or their experience with the amount of resistance a citizen will pose after being accused of a particular crime. In addition, as the trooper's experience with the particulars of a given law increases, they will be better able to accurately tell if a citizen's behavior exceeds legal bounds. We take no initial stance on the specific functional form that defines the relationship between the two types of experience and ability of a trooper to issue tickets.

Taking a citizen's choice of a as given, there are four possible outcomes for a trooper each time they interact with a citizen, with payoffs displayed below:

	$R_v - A > 0$ *(No Ticket)*	$R_v - A < 0$ *(Issue Ticket)*
$R_v - a > 0$ *(Legal)*	0	$-C_v$
$R_v - a < 0$ *(Illegal)*	$-W_v$	0

If the trooper engages in the "correct" behavior, meaning that both $R_v - a$ and $R_v - A$ have the same sign, then the payoff is normalized to zero. As previously discussed, this assumption is consistent with the state-determined pay and promotion schedule for troopers, which is essentially determined by tenure and national variation in state trooper wages. However, any type of mistake is costly from the trooper's point of view. If troopers mistakenly issue a ticket when they should not have, citizens have the option of complaining to the trooper's supervisor, meaning that the trooper will incur a penalty C_v. On the other hand, if the trooper "misses" a large number of tickets relative to their peers, they may eventually be penalized by their supervisor.[6] We define the expected cost to the trooper of not issuing a warranted ticket as W_v. Both C_v and W_v plausibly vary across laws, as a misapplication of statutes with serious punishments is plausibly more costly to the trooper.[7] As a result, mistakenly issuing a ticket becomes more costly to a trooper when the statutory punishment is raised.

A number of institutional factors mean that C_v (the cost of issuing too many tickets) is almost certainly larger than W_v (the cost of issuing too few tickets). First, in federal audits of local law enforcement agencies, the US Department of Justice places much higher weight on the frequency of citizen complaints than concerns that a trooper is failing to aggressively enforce the law (a

[6] This is a less certain outcome than the penalty imposed by a complaint.

[7] Intuitively, incorrectly ticketing someone for traveling 5 miles above the speed limit is less costly than incorrectly ticketing someone traveling 50 miles over the speed limit. Issuing a larger ticket when one should not be issued should be more likely to result in a citizen complaint, and overlooking more egregious speeders should be more of a cause for disciplinary action than ignoring marginal speeders.

phenomenon known as "de-policing") (USDOJ 2012). If the Idaho state legislature increases the penalties associated with a violation, the return to an individual challenging an unfairly issued ticket is larger, thus increasing C_v. This is consistent with evidence that police issue more tickets to out of town drivers who are less likely to appear in court to challenge the officer (Makowsky and Stratmann 2009). Second, not only is the federal government more concerned about citizen complaints than de-policing, but most local agencies also place more weight on them as well. At the local level, in 2007 approximately 39% of law enforcement agencies used some sort of computer-based "Early Intervention System" to monitor trooper behavior (USDOJ 2007). Citizen complaints are a standard component of the trooper performance metrics used by these systems, but tracking the number of arrests made by troopers is only recommended for particularly comprehensive systems (Walker 2003).[8] Finally, law enforcement agencies face significant public scrutiny when allegations of arrest "quotas" are raised, limiting supervisor's ability to punish troopers for issuing too few tickets, even if they suspect de-policing on the part of troopers.[9]

With this framework in mind, troopers will issue tickets in a way that minimizes the expected cost of making a mistake. For a given trooper and law, there is a particular threshold value of observed citizen behavior A that triggers the trooper's decision to issue a ticket. If $R_v = A$ then troopers will mistakenly issue tickets to citizens who are behaving legally at the same rate as they fail to issue tickets to lawbreakers. However, since the expected cost of issuing an incorrect ticket is larger than the cost of not issuing a warranted ticket, the cost minimizing value of R_v-A

[8] Additionally, heads of law enforcement agencies are moving in the direction of increased use of early-warning systems in light of citizen complaints, see Weitzer and Tuch (2004)

[9] For example, see news coverage of events in Arlington, VA, Logan, UT, and New York City http://www.wjla.com/articles/2012/03/arlington-county-police-quotas-memo-retracted-73982.html, http://news.hjnews.com/opinion/article_37325c38-4df9-11e1-bc81-001871e3ce6c.html , http://www.cbsnews.com/8301-201_162-57435418/judge-grants-class-action-status-to-suit-accusing-nypd-of-racial-bias-in-stop-and-frisk-policies/?tag=contentMain;contentBody

will be positive, and defined by $[1-\Phi(R_v - A)] / \Phi(R_v - A) = C_v / W_v$, where $\Phi(x)$ is a normal CDF with a mean of zero and a standard deviation of $1/f(t_i,\tau_{iv})$.

Intuitively, if $Cv > Wv$, troopers will tolerate a lower level of risk in issuing a ticket than in not issuing a ticket, and only issue tickets if the probability of observing such risky behavior, conditional on legal behavior, is particularly low.[10] As $f(t_i,\tau_{iv})$ increases, the optimal value of $(R_v - A)$ will approach zero as the variance of the distribution of $(R_v - A)$ falls. In other words, as general experience increases, the likelihood that actual citizen behavior is substantively different from what the trooper perceives becomes increasingly rare.

In practice, we observe the Idaho state legislature making three types of changes in the Idaho state code: positive or negative changes in the location of R_v, and increases in the severity of punishment when $R_v - A < 0$.[11] When a law changes, troopers should face two different "shocks" to their optimal use of a law. First, since troopers are notified of laws that change, this may serve to increase their knowledge of the location of R_v, particularly if the changing law was not one they used very often. Alternately, if troopers had a significant amount of experience issuing tickets for a particular law, and $f(t_i,\tau_{iv})$ was very large, the law change may temporarily increase the expected cost of issuing tickets.[12]

The total impact of a legal change on ticketing is a function of both citizen and trooper response to a law. If R_v is lowered, making behavior that used to be legal now illegal, all

[10] This behavior of regulators is consistent with Leaver (2009) and DeAngelo and McCannon (2015) who find that regulators will choose an enforcement policy so as to minimize "squawking" on the part of the regulated party.
[11] All of the law changes in our sample, along with how we coded the change, are listed in appendix table A1.
[12] Additional anecdotal evidence of the importance of task-specific experience can be seen in the response of the Washington, DC police to the Feb 26th, 2015 legalization of small amounts of marijuana. While officers had received a nine page description of this reduction in the scope of the law, the head of the officers' union stated that "for now ... it is easier to take no action" in the enforcement of DC's marijuana laws. http://www.washingtonpost.com/local/crime/first-day-of-legal-marijuana-in-district-goes-off-quietly/2015/02/26/af00b902-bdc8-11e4-b274-e5209a3bc9a9_story.html?tid=hpModule_99d5f542-86a2-11e2-9d71-f0feafdd1394&hpid=z12

troopers will issue more tickets, since $R_v - A$ will be less than zero at lower levels of A, although there may be fewer citizens who chose to engage in the now illegal behaviors than previously.[13] At the same time, the likelihood that a trooper makes a mistake also increases, since the variance of $R_v - A$ will increase. When the state legislature raises R_v, all troopers will issue fewer tickets, but mistakes are also more likely to occur as officers temporarily expect larger shocks to $\sigma/f(t_i,\tau_{iv})$. Over time, as troopers gain more experience identifying a relative to the new value of R_v, the variance of $R_v - A$ will fall again. Finally, incorrectly accusing a citizen of violating a more harshly punished law raises C_v, and the optimal ratio of $[1- \Phi(R_v - A)] / \Phi(R_v - A)$. As a result, troopers will optimally issue fewer tickets, particularly troopers with lower values of $f(t_i,\tau_{iv})$. Part of the overall reduction should come from fewer citizens optimally choosing to engage in the illegal behavior, sine the penalty is higher, but under the assumption that the location of former-lawbreakers is not related to how much experience a trooper has, any differential reduction in ticketing for less experienced troopers will be driven entirely by a trooper's response to the law.

5. Data

Through a research agreement, we obtained data on all tickets issued by the ISP between January of 2002 and December of 2009. For each ticket, we know the most serious state statute that a motorist was accused of violating, the date of the ticket, and the current rank and badge number of the primary trooper who issued the ticket. We were able to link the trooper identifying information with Human Resource records of the ISP, indicating the date that the trooper was hired.

[13] In the absence of a violation of IIA, lowering R_v should not change the behavior of a rational person who previously chose $a > R_v^{Old}$. There may be some individuals deterred by the legal penalties, meaning fewer will choose an a' where $R_v^{Old} > a' > R_v^{New}$ than before the law change.

We then documented the history of all of the 286 laws that the troopers in our data referenced more than ten times when citing citizens over this time period. We recorded every instance in which the legislatively recommended penalty increased, increasing C_v, (49 times), and every instance in which an amendment changed the scope of a law, moving the location of R_v (51 times). Of the changes in scope, 39 increased the scope of the law, e.g. by lowering the speed limit in business districts, and the other twelve changes reduced the scope of the law, e.g. by amending a ban on loaded firearms in vehicles to allow for hunting rifles. All amendments to the Idaho statute go into effect on July 1st of each year.

After merging the ticket database with information on the history of the Idaho statutes, we then calculated how many times each trooper issued a ticket for each individual law in each six-month period, beginning January 2002. We then calculated two measures of experience for each law in each half-year interval (semesters): Starting at one, how many semesters of experience did the trooper have with the ISP? This is our measure of general human capital, which is trooper-time specific. We also calculated a measure of task-specific experience: In each period, how much experience has a given trooper had with the current vintage of each particular law? If a law has not changed since the trooper was hired, their task-specific and general experience measures are the same. When a law changes, the amount of task-specific experience a trooper has with that law falls back to one, but their general experience continues to increase.[14]

We have a total of 536,690 trooper/law/semester observations in our final data set. On average, each trooper uses a given law 0.596 times a semester, or just over one time per year. Not surprisingly, the distribution is highly skewed with speeding laws in particular being "used" frequently by a handful of troopers. Just over 14% of enforced laws will change in the future,

[14] This is equivalent to τ dropping to one in the model.

and in 14% of our observations, troopers are enforcing a law that has substantively changed since they started the job. On average, troopers have 7.25 years of experience with the ISP, but 6 years of experience with a given law in its current form.

The overall distribution of general experience is bimodal - there are essentially two groups of troopers; "senior" troopers with over 10 years of experience and are unlikely to acquire new positions in the ISP, and "junior" troopers, who may be promoted to higher ranks within the ISP during the course of their career. The difference between general experience and task-experience is larger for older officers than for junior officers; on average we observe senior officers with 13 years of job experience and 10 years of task experience, and junior officers with 4.5 and 4 years, respectively. As it is highly plausible that heterogeneity in unobserved characteristics across these two types of troopers will affect their productivity and response to law changes, so in addition to pooled specifications we will present results for these groups separately.

In Figure 1, we plot the average number of times a junior trooper uses a given law against their experience as a trooper and against their experience with a given law.[15] For the first two years on the force, troopers issue more tickets each semester they are employed. After the end of the second year, the number of tickets issued by each trooper slowly declines and a trooper with 10 years of experience uses each law about 30% less frequently than a second-year trooper. While ticket issuing is not the only thing that troopers do, this concave growth in "output" is strikingly similar to the pattern of output of auto-glass manufacturers (Shaw and Lazear 2008), and wages of Danish workers (Bagger et al. 2014).

The cause of the decline in ticketing over time is plausibly attributed to a combination of two factors. First, it is possible that the most highly "active" or skilled troopers are promoted to

[15] For ease of comparison, we focus just on junior troopers, who we observe with similar levels of general and task-specific experience that can be easily plotted on the same axis.

higher non-trooper ranks, which is a common selection problem in work on experience and performance; the number of troopers with more than 14 semesters of experience is only 11% of the number of troopers with less than 14 semesters of experience.[16] Second, as troopers gain general experience, they are increasingly likely to be enforcing laws that have changed since they were hired - meaning that their average task-specific experience is actually declining relative to their general experience as general experience grows.

Plotting the average number of tickets issued by officers as task-specific experience increases can shed light on these two productivity reducing mechanisms. If we only observed less active troopers at high levels of task-specific experience, then we would see a similar decline in ticketing as task-specific experience increases. However, if the relationship between general experience and output fell because task-specific experience was falling, the task-output curve should be flatter- and this is what we observe. Compared to the impact of general experience, the number of times that a trooper uses a law hardly declines as task-specific experience increases, implying that the reduction in output seen in the general experience measure is more likely to be the result of more junior troopers responding to legal changes, as opposed to compositional change in the quality of officers.

In Figures 2 and 3, we focus our attention on tickets issued for laws in the semesters leading up to, and following, any 2002-2009 changes in the Idaho State Statute. We divide our sample into junior (Figure 2) and senior (Figure 3) troopers. Comparing across figures, senior troopers issue roughly 20% fewer tickets than junior troopers in the six semesters leading up to a law change, likely a combination of both selection and variation in work conditions, although 95%

[16] Alternatively, reputational concerns could matter for both younger and older officers. For example, younger officers could fear developing a reputation for improperly issuing citations or older officers might have already established a reputation of being tough on crime.

confidence intervals around the means do overlap. In each figure, semester to semester variation in how frequently junior and senior officers issue citations for laws that will/will not change roughly mirror each other, which is a necessary assumption for our difference-in-differences approach. In fact, prior to the laws changing, junior officers in particular appear to issue tickets for changing laws at similar rates as other laws (indicated by the shaded area). Senior officers seem to systematically issue fewer tickers for laws that are rewritten by the state legislature, which could reflect senior troopers being able to anticipate legislative changes roughly two years before they happen, or it could reflect senior troopers being assigned to work in areas or times where they are less likely to encounter people violating the types of laws that are rewritten.

In both figures, the first semester that a new version of a law goes into effect, there is a small increase in the number of citations issued. This is consistent with troopers receiving additional training or notification about the law, per Idaho regulations, and potentially noticing more people potentially violating those statutes. However, in the year after the change, there is a sharp reduction in the frequency with which troopers at both points in their careers use the "new" laws. Over time, we observe that the number of times troopers use the "new" laws slowly converges back towards the rate at which these same troopers are issuing tickets for other violations.

6. Analysis and Results

Based on Figure 1 it appears that, on average, troopers experience a steep "learning curve" during the first two years of their career, and the average number of tickets is roughly stable afterward, although it does decline over time. This decline is potentially driven by changes in the tasks they must perform. When we look at the response of troopers to changes in their tasks, we also see a clear learning curve overall, where tickets increase for a year but then level off quickly and do not appear to decline over time. Figures 2 and 3 suggest that legal changes are reasonably

unanticipated, particularly for junior troopers, as there is no clear trend in the use of a particular law in the semesters leading up to a change that we do not also see in the frequency with which troopers use other laws.

Our baseline specification allows for general- and task-specific human capital to make separate contributions to trooper *i*'s use of law *v* in semester *t* as follows:

$$Tickets_{ivt} = \propto_i + y_t + s_t + \delta_{vT} + Tenure_{it}\beta_G + LawTenure_{itv}\beta_{TG} + X_{it}\theta + \varepsilon_{ivt}$$

where $Tenure_{it}$ is the number of semesters that trooper *i* has worked for the ISP in semester *t*, and $LawTenure_{itv}$ is the number of semesters that this same trooper has used the version of law *v* that is in effect in semester *t*. If a law has not changed since the trooper was hired, both of these variables are exactly the same. However, when a law is revised, the trooper will have less experience enforcing that particular law than he has as a trooper more generally. Our trooper fixed effects, α_i, mean that we are looking at changes in the productivity of each individual trooper over time, our season fixed effects s_t allow us to capture any behavior that is specific to the beginning versus end of each year, with each year also getting's its own fixed effect y_t. We also include a matrix X_{it} of annual demographic characteristics of the Idaho region where trooper *i* is assigned, specifically the natural log of the population, the fraction of the population that is male and between 18 and 24, and the natural log of vehicle crashes.

We also include a "statute vintage" fixed effect, δ_{vT}, that identify each version of each law in the Idaho State Statute. These statute vintage effects net out any behavioral change on the part of Idaho citizens that should influence the number of tickets issued by all troopers for as long as that version of the law is in effect. For example, one might expect that increasing the penalty associated with drunk driving might deter some citizens from driving drunk. Similarly, if the highway speed limit is lowered in business districts, then we might expect more speeding tickets

to be issued.[17] Our identification of general- and task-specific human capital is based on the assumption that, under equal application of the law, these first order effects of the law change should create changes in ticketing that are common to all state troopers, and do not vary over the pre- and post- periods around a legal change. We identify β_{TG} off of variation in the range of task-specific experience that troopers with different amounts of general experience have across the 286 different laws they can enforce. When trooper i is hired, both $Tenure_{it}$ and $LawTenure_{itv}$ are equal to one for all laws v, and as each semester t passes, all measures increase by 1. What separately identifies β_G and β_{TG} are the passage of amendments to Idaho state law, at which point $LawTenure_{itv}$ is reset back to 1 for that specific law, for all troopers. Because our identification is based on variation within laws and within troopers, we will allow for arbitrary correlation in ε_{ivt} within laws and officers using the two-way clustering approach as described in Cameron et al. (2011).[18] In addition, since the low base citation rate may lead to unusual distributions of ε_{ivt}, we also present p-values based on 1000 permutation tests, where we "shuffle" the values of general or task-specific experience within each trooper, and compare our point estimates to this distribution of hypothetical effect sizes.

As shown in Table 2, we find that, on average, a trooper issues approximately 0.01 more tickets per citation with each additional semester of experience, a total of 2.86 tickets overall. This result is robust to the inclusion of separate trooper and law fixed effects (column 1) and law by vintage fixed effects (column 2). The first order average impact of additional experience on ticketing increases once we include trooper by law fixed effects (column 3), which allows each trooper to, on average, issue a different number of tickets for each law. This suggests that not

[17] Troopers enforce both traffic and criminal law. In results, available on request, we find no difference in the responses of troopers to criminal versus traffic statutes.

[18] Standard errors calculated in this way are only marginally different than conventional standard errors which assume independence across either of those two dimensions.

only do more experienced troopers issue more tickets, but that the types of laws that troopers "use" varies with experience.

In columns 4 and 5 of Table 2, we separately identify the impact of general and task-specific experience. First, we use all troopers and law by vintage fixed effects (column 4), which includes changes that occurred prior to 2002, to identify the relationship between task-specific experience and output, estimating that on average one additional semester of general experience increases tickets by 0.01, although our permutation tests suggest this is not a statistically anomalous result (p=0.597). One additional semester increase in experience with a specific vintage of a law leads to a 0.004 decrease in its use, although this effect is imprecisely estimated, and 5.7% of our falsified estimates are larger in magnitude.

Averaging across all state troopers, separately identifying general and task-specific experience is muddied by simultaneous changes in the frequency with which older troopers enforce a given law and changes in the types of laws that more junior and more senior troopers enforce. When we include trooper by law fixed effects in our analysis (column 5), our estimates now reflect how troopers choose to differentially enforce changing laws, holding each officer's propensity to use any particular law fixed. In practice, our task-specific experience effects are now identified entirely off of the 62 legal changes that occurred during our sample period, as opposed to laws that changed prior to our sample period but after an older trooper was hired. When we include these effects, we find that a one semester increase in the amount of experience that a trooper in general is associated with 0.0097 more tickets (2.77 more tickets overall), and an additional semester of experience with a given law is associated with a 0.004 increase in the number of times that particular law is used. Both our standard error estimates and permutation tests imply that these results are statistically significant at conventional levels. Overall, when a

law changes and task-specific experience falls for that law relative to others, troopers become less likely to enforce it on average, consistent with troopers facing a higher expected cost of ticketing someone for a violation they are less familiar with.

In Table 3 we differentiate between three different types of law changes - changes that increased the number of things that are illegal (lowering R_v), decreased the number of things that are illegal (raising R_v), and changes that increased the statutory penalty for a violation (increasing C_v). For conceptual simplicity, we initially only consider laws that either do not change, or changed exactly once, so we are able to compare the response of troopers to one type of task change. The relationship between general experience and productivity remains qualitatively similar across these samples, as a one semester increase in general experience increases productivity by roughly 0.005 to 0.01, or 1.4 to 2.9 additional tickets each semester.

Separating the data by type of law change provides suggestive evidence that law changes that make previously legal actions illegal or increase the penalties for law violation have the biggest impact of trooper behavior- changing these types of laws will reduce the number of tickets a trooper issues by 0.0014 to 0.00186 tickets per semesters of officer experience. Recall that this is over and above the expected reduction in ticketing we would observe if citizens were deterred by a harsher law, and (in magnitude, although not in precision) we find essentially no change when laws make fewer actions illegal.

As previously discussed, all troopers are simultaneously reminded about the particulars of a law and each must readjust their use of the law after a legal change, but the magnitude of that reduction in experience varies across officers with different levels of tenure. While this allows for simultaneous estimation of trooper and citizen response to the law changes, it does mean that differential attrition from our sample, due to the promotion or dismissal of troopers with different

propensities to issue tickets, will influence our estimates- we observe the largest reductions in task-specific experience for troopers with the most general experience.[19]

In Table 4, we provide a sense of the importance of attrition on our estimates this by allowing for heterogeneity in the impact of a law change on productivity in two ways. First (column 1), we simply include a continuous interaction between general and task-specific experience, allowing younger troopers to respond differently than older troopers. In this specification, we find that the first order effects of both general and task-specific are positive and statistically significant, consistent with the existing literature on experience and productivity. The coefficient on the interaction between the two experience measures is negative and significantly different from zero, suggesting that as troopers become more experienced generally, their productivity is less dependent on their experience with the particulars of a given law. This is also consistent with our basic theoretical formulation of general and task-specific experience, in which changes in the threshold of culpability increase the likelihood that a trooper issues a costly mistaken ticket. When we include trooper-by-law fixed effects (column 2) the interaction terms remain the same size, confirming that trooper productivity is less affected by their experience with the current vintage of a law as the trooper gains general experience. To put the estimates in context, the marginal impact of one additional semester enforcing a particular law for a trooper with one year of experience is 0.0137 tickets per semester enforcing that law. A trooper with two years of experience will issue 0.0121 additional tickets for each semester of specific experience that they have with each Idaho statute - an 11.7% reduction in the return to task-specific experience.

While not necessarily eliminated, for small differences in experience (e.g. two semesters difference) there will be less problematic attrition, simply because we are looking at small

[19] Idaho troopers can be promoted at any point in the year, whenever a vacancy becomes available.

changes where there is not that much time to be fired or promoted. However, for larger differences in tenure, e.g. nine years difference, the assumption that underlying unobserved productivity determinates are roughly similar across experience groups is even less likely to be true.[20] In the remaining columns of Table 4, we divide our sample into "junior" and "senior" troopers, based on whether or not we observe this trooper with more than 10 years of general experience. Within these two samples, the range of values of general experience is lower, thus focusing more of the identification on changes in individual ticketing, rather than changes in who is issuing tickets at different points in the distribution of experience.

Columns 3 - 6 of table 4 only look at junior troopers. We find that task-specific experience is very important for this group, and that the importance of general experience in determining output is driven by heterogeneity in the types of laws that troopers with different levels of experience enforce (e.g. whether or not trooper by law fixed effects are included). When we allow for heterogeneity in the impact of task-specific experience with respect to general experience (columns 5 and 6), we find that the first order effect of both types of experience is positive, but from a standpoint of statistical significance, general experience primarily influences ticketing by reducing the marginal effect of task-specific experience on output.

We observe a somewhat different pattern when we focus on older troopers. Senior troopers also issue more tickets as they continue to gain general experience; a 1 semester increase in general experience is associated with 0.02 more citations. The smaller increase in productivity (comparing, for example, columns 5 and 6 to 9 and 10) by senior troopers could be the result of

[20] In Appendix Figure 1 we display a kernel density plot of the junior and senior fixed effects estimates that correspond with column 4 of Table 2. We conducted a Kolmogorov-Smirnov test of the equality of the distribution of fixed effects estimates, which yielded a maximum distance of 0.4483 and p-value of 0.00. Thus, we can reject the null hypothesis that the distributions of fixed effect estimates are identical across junior and senior officers.

older workers choosing to alter their work environment in a way that requires less "output," particularly if they are able to work in areas where fewer tickets need to be issued, like state fairs or weekday afternoon shifts.[21] When laws change, senior officers appear to increase their use of the law, albeit by a small amount. Additionally, as senior officers continue gaining more experience we find that their response to the law change also falls in magnitude, but this effect is not precisely estimated.

When we focus on different types of law changes, it is clear that junior troopers are driving the positive relationship between task-specific experience and productivity. As seen in Table 5, each semester of experience increases ticketing by junior troopers by twice as much as it increases for senior troopers. The positive coefficient associated with task-specific experience implies that when laws change, junior troopers become significantly less likely to use those laws. However, as junior troopers gain general experience, that negative response to enforcing a new law diminishes by about 10% for each semester of tenure. Unlike when we pooled all officers (table 3), the magnitude of the response to legal changes is roughly the same, regardless of the direction of the law change, which limits the scope for citizen, rather than trooper, behavior impacting the observed change in ticketing. The increased stability in the estimated relationship between experience and output is further evidence that the types of laws troopers enforce changes as they mature.

More experienced senior troopers issue more tickets on average, but the impact of task-specific experience on productivity is negative, implying that when laws change senior troopers increase their use of that law- potentially implying that the law changes are drawing senior officer's attention to the changing laws. The interaction effect between general and task-specific

[21] This is likely to be the case if, for example, shift assignments are allocated on the basis of seniority.

experience for senior officers is positive, implying that as senior officers obtain more experience as a trooper, they are less (negatively) responsive to law changes. Columns 3, 6 and 9 differ from columns 2, 5, and 8 in that they include data on laws that change more than once during our sample period. Doing so yields more precise estimates with slightly smaller point estimates, but the sign of our main results remain the same.

7. Robustness Tests

7.1 Newly Hired Officers ("Rookies") only.

As in previous research on experience and output, we find that the greatest growth in productivity occurs in the first few years of employment, and in the first few years of experience with a particular task. While our baseline specification includes officer fixed effects, the early years of general experience are identified off of a different group of officers than the early years of task-specific experience. This means that there is some scope for heterogeneity across individuals to be driving the observed heterogeneity in the impact of task-specific experience on output.

In order to address this concern, in Table 6 we report results for only officers who are hired during our sample period (meaning we observe them for at most eight years), enforcing common support across all possible values of general and task-specific experience. There are fewer observations in this sample, but the estimated increase in output with experience in this group is consistent with our previous results for junior troopers. If we ignore the role of task-specific experience (column 1), a one semester increase in general experience is associated with a roughly 0.03 citation increase per law for each trooper, and general experience appears to be an order of magnitude more important than task-specific experience if we separately identify the two (column 2). When we include controls for differences in the types of laws that different

troopers enforce, experience with each task become much more important (column 3). Allowing for heterogeneity in the impact of task-specific experience with respect to general experience (column 4), and simultaneously allowing for time invariant variation in the propensity of each officer to use each law (column 5), suggests that the primary way that general experience impacts output is through its moderating effect on task-specific experience.

7.2 Modeling Infrequent Events

Despite limiting our sample to laws that are used at least 10 times, the likelihood that a trooper issues a citation in a six month period is low; in 93% of our observations the number of citations issued is zero. This mass point at zero makes interpretation of our estimated marginal effects potentially misleading. We examine the sensitivity of our results to modeling assumptions about this low probability event in two ways. First, we replace our measure of the number of citations issued with a simple binary variable equal to one if the officer issues any ticket for this statute, and zero otherwise, transforming our basic equation into a linear probability model. Second, we limit our sample only to the 71 laws that are used 200 times or more over the course of our time frame. Of these laws, 30 are rewritten by the state legislature at some point after a trooper in our sample is hired, similar to the overall fraction of laws that change in our full sample.[22] In this sample, 24% of our observations are non-zero.

In Table 7, we replicate Table 4 with these two modifications. Panel A presents our linear probability estimates. Regardless of whether or not we control for variation across officers in the types of laws that they use, on average, a one semester increase in general experience is associated with 0.0014 more citations being issued for any law, and officers issue approximately 0.002 more citations per semester for laws that they have enforced "as is" for one more semester.

[22] This further speaks to the exogeneity of the shocks to task-specific experience in our sample, as the probability that a law changes does not appear to be correlated with the frequency with which it is used.

Each additional semester increase in general experience increases this task-specific experience effect by almost no citations. Dividing the sample into junior and senior troopers reveals roughly the same relationship between general and task-specific experience that we observed in Table 4.

In panel B of Table 7, we limit our sample to laws that are used at least 200 times. The mean of our dependent variable is roughly four times larger than in the full sample, and our point estimates are all between 10 and 70 times larger in magnitude, and always the same sign as our estimates in the full sample. This indicates that the observed effects in Table 4 are driven by issuing tickets for common offenses, where troopers actually do gain experience issuing over time, in a real sense.[23]

7.3 Changes in "Similar Laws"

Could legal changes to a specific law be "spilling over" to laws that are similar to the changing law, but did not change themselves? For example, if a law change reduces the speed limit within city limits, it might be the case that this draws officer's attention to speeding in general, resulting in the officer enforcing all speeding limits with more rigor than they did prior to the change in the law.

To test for this possibility, we grouped laws by their "proximity" within the Idaho Statutes. Specifically, laws were placed into the same group if the first five or six digits of the statute were identical. This resulted in 179 groupings of the laws in our data, and we defined an officer's task-specific experience with each group of laws as the minimum amount of task-specific experience for that group, so that the mean level of general experience that each officer has is 13.5 semesters, and the mean level of task-specific experience with each law group is 11.7 semesters.

[23] We have also replicated these results with a set of laws that are used 1000 times or more, where 42% of our observations have a non-zero dependent variable, and observe the same pattern.

We then added up all tickets issued for all laws that fell into each of these groups for each officer within a semester, and re-analyzed the specification in Table 4 at the group level.

The estimated relationships between general experience and ticketing are similar across specifications to those reported in Table 4. Increases in task-specific experience also lead to increases in the use of a specific law for junior officers and continue to display decreases in the use of the law for senior officers. Finally, the interaction between general and task-specific experience is negative for all officers, indicating that with more general experience, changes in laws have less of an impact on their willingness to utilize laws that fall within this group.

The magnitudes of the estimates in this group sample do imply some positive spillover effects of law changes; for example, when we focus on junior troopers, and allow for differences across officers in their use of different laws and for general experience to affect the important of task-specific experience (column 6), we estimate that one semester of general experience increases ticketing by 0.059 tickets (versus 0.035 in table 4), and an additional semester of task-specific experience increases tickets by 0.12 per group, minus 0.009 tickets for each semester of general experience (versus a 0.077 – 0.0059 x general experience effect in table 4). Rather than shifting their ticketing behavior from a changing law to a similar one that stayed constant, the data are more consistent with a world in which troopers know that, for example, the legislature has changed a law about drunk driving (i.e. that 18 8004 changed, rather than 18 8004(1)A changed specifically). In response to this change, troopers temporarily issue fewer tickets for all laws that may have changed.

7.4 Non Parametric analysis of Experience and Output

Our estimates of the relationship between general and task-specific experience have imposed a linear, multiplicative, interactive effect between the two types of human capital. In order to

verify that the data, rather than our choice of functional form, is driving our finding that troopers with more experience are less responsive to shifts in law, we replaced our continuous measures of $Tenure_{it}$ and $LawTenure_{itv}$ with 386 dummy variables, $D_{G,GT}$. Each of these dummies represent a unique general (G) (ranging from 1 to 28 years) and task-specific (T) years (which can also range from 1 to 28 years, but is always less than or equal to G) pair; e.g. three years of experience as a trooper (G=3) and one year of experience with this vintage of the law (T=1).[24] We exclude the dummy variable for a trooper's first year of job and task-specific experience, and so each estimated experience coefficient is simply the difference in the mean number of tickets issued by troopers in each possible experience pair relative to a trooper's first year on the job, conditional on time, statute vintage, and officer fixed effects, as well as the coefficient matrix X_{it}, as specified below:

$$Tickets_{ivt} = \propto_i + y_t + s_t + \delta_{vT} \sum_G \sum_{T \leq G} (Tenure_{it} = G, LawTenure_{itv} = T)\beta_T^G + X_{it}\theta + \varepsilon_{ivt}.$$

In order to summarize this gradient, we estimated a series of 27 regressions, one for each possible year of experience as a trooper, of the following form:

$$\beta_T^G = \alpha + T\theta^G + \varepsilon_T \,, \forall G \in (2{,}28)$$

Here, T is simply a count variable that ranges from 1 (denoting the first year of experience enforcing a law) to G. Note that there are, at most, 27 observations per regression, as troopers can only have up to G years of experience with a particular law, and since each value of β_T^G is an average over groups of varying size, we weight each observation to reflect this. The 27 estimated values of θ^i represent the average "task-specific experience gradient" for troopers at each level of general experience. In Figure 4, we plot each estimated value of θ^i against the corresponding

[24] We use years, rather than semesters, for tractability. We also exclude 19 general and task-specific experience pairs for which we have no observations, all of which involve general and task-specific experience values of over 20 years.

years of general experience. We also include a fitted regression line, also weighted by the total number of officer-law-semesters that identified each estimate of θ^i. The data clearly indicate that the "task-specific experience gradient" falls as general experience increases, confirming our parametric analysis. The estimated slope of the regression line relating general experience to the average effect of task-specific experience on output is -0.004, with a robust standard error of 0.001. In other words, each year of general experience reduces the return to task-specific experience by 0.004 citations.

7.5 Day vs. Night Time Analysis

While junior and senior troopers are not assigned to significantly different locations[25], it could be the case that specific officers are assigned different shifts. For example, one could imagine that working the night shift is a less desirable assignment than working the day shift. Moreover, if seniority dictates which shift an officer works, then we might expect to see more senior officers working day shifts. As laws change it is likely easier to enforce laws during day time hours - see Grogger and Ridegway (2006) and Horace and Rohlin (2015). In order to test this hypothesis, we replicated tables 2 – 7 twice, once examining only citations issued between 5 am and 9 pm, and once examining only citations issued between 9 pm and 5 am. These results are presented in Appendix B.

By separating our data into day and night time citations, we find a few interesting insights. First, the results are qualitatively identical to the results that have already been reported. Citations during day time hours are approximately 3 times more likely to be issued across all officers than night-time citations. The positive coefficient on general experience becomes a bit less significant, however, for more commonly enforced laws at night. Specifically, junior officers

[25] A comparison of the distribution of junior and senior officers fails to reject the hypothesis that these officers are assigned to the same locations.

enforcing laws that have been used more than 200 times experience a slow-down in productivity during night time hours. Since laws that are issued more than 200 times are most likely traffic related citations, this could be a product of changes in citizen behavior (e.g. not driving as quickly during night time hours).

8. Conclusion

More experienced workers are, for the most part, more productive workers, and we present evidence that the frequency with which a law enforcement officer accuses citizens of law violations is a function of that officer's experience. During their first years on the job, troopers appear to gain productivity as they gain experience; the steep early learning curve that we observe is very similar to the tenure-productivity relationship observed in manufacturing and education. In addition to building on a growing literature in labor economics, the relationship between tenure and output among law enforcement troopers is of particular relevance for empirical law and economics, as enforcement of criminal law is typically assumed to be independent of officer experience. To the best of our knowledge, this is the first study to explicitly identify a source of within- and across- trooper variation in law enforcement.

Based on our analysis of Idaho state troopers, we conclude that as troopers gain general experience, the importance of task-specific experience in determining output declines. This pattern is evident for both junior and senior troopers, although on average older troopers actually issue more tickets for the laws they have less specific experience with. We do not find much evidence that there is an asymmetric response to law changes, in the sense that, once we allow for variation in the types of laws different troopers enforce, law changes that decrease the scope of the law appear to reduce tickets as much as changes which increase the number of actions that

are illegal. Legislative changes that increase the recommended penalties also temporarily reduce trooper enforcement.

The reduction in citations when laws change has significant economic impact. Specifically, when the legislature changes laws, approximately 0.047 fewer citations are issued by each junior trooper in the following semester. To offer perspective on the impact of these legal changes, we separately focus on traffic citations and felony arrests. During our sample, the Idaho State Police enforced traffic laws 67 percent of time, felony and misdemeanor offenses not related to traffic laws 12 percent of the time, while the remaining offenses were for administrative infractions (e.g. fishing and hunting licenses). Focusing only on traffic related laws that changed between 2004 and 2009, we estimate that this resulted in 1,944 fewer traffic related citations than would have been issued if ticketing had been independent of task-specific experience. Using estimates of the effect of trooper presence on roadway safety from DeAngelo and Hansen (2014), this reduction in traffic citations implies an estimated 0.85 percent increase in fatalities during our sample. Focusing on changes in misdemeanor and felony charges and utilizing the estimates in Mas (2006), the reduction in citations associated with legal changes results in a 0.82 percent increase in crimes in the ISP's jurisdiction.[26] Thus, the transitory impacts of new legal changes are not without cost.

In most countries, policies are written by legislatures, but enforced by government agents who have different incentives, and so in practice policy changes may not be implemented

[26] These numbers are calculated using estimates from column 6 of Table 4. Given that the impact of legal changes are significant and negative for junior officers, we focus on the reduction in ticket issuances from officers with 6 or fewer semesters. First, we calculated the counterfactual average number of citations for traffic citations and felony/misdemeanor laws separately. We then subtracted the counterfactual from the actual number of citations issued when the law changes and summed this difference for officers with 6 or fewer semesters of experience, which is 5,864 for traffic citations and 662 for felony/misdemeanor citations. The aggregated average of citations issued for all levels of experience is 343,296 traffic and 37,094 misdemeanor/felony citations, implying a 0.017 and 0.018 percent reduction for traffic and felony/misdemeanor laws, respectively.

uniformly. While persistent judicial discretion in the face of legal changes has been well documented, to the best of our knowledge, we present some of the first evidence of systematic patterns in the way police officers choose to enforce changes in legislation. We find that predictable and easily quantifiable individual differences matter; police officers are less likely to enforce laws they are less familiar with, regardless of whether the law has become more or less punitive. Data on the identity or experience of police officers are rarely collected as part of publicly available data sources, suggesting an important gap in our knowledge about the administration of criminal justice systems.

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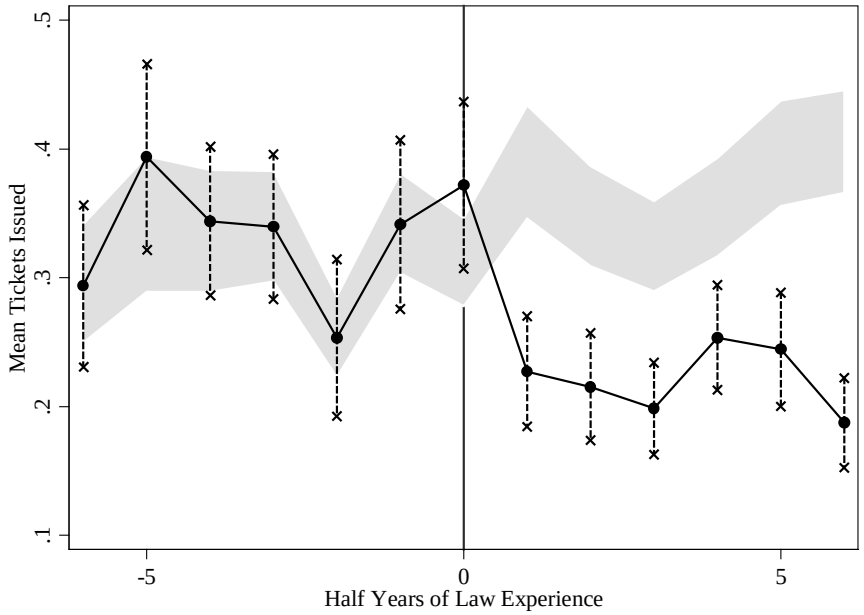
Figure 1: Mean Tickets Issued per Semester, by Job and Law-Specific experience

Note: Junior Troopers Only

Figure 2: Mean Tickets Issued around Law Change, Junior Troopers

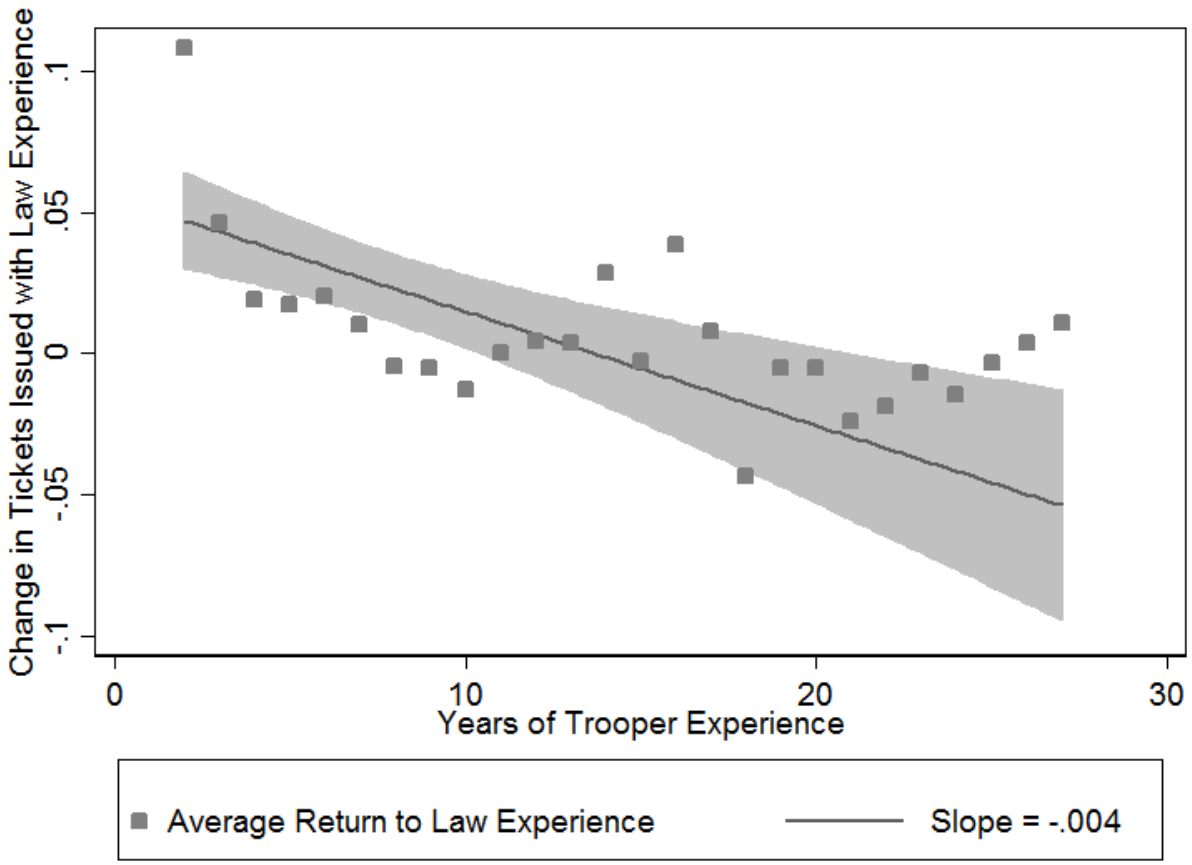


Note: Dashed lines indicate 95% confidence intervals around means. Shaded area represents 95% confidence interval for citations for non-changing laws, weighted to represent similar time periods, for junior troopers

Figure 3: Mean Tickets Issued around Law Change, Senior Troopers

Note: Dashed lines indicate 95% confidence intervals around means. Shaded area represents 95% confidence interval for citations for non-changing laws, weighted to represent similar time periods, for senior troopers.

Figure 4: Non-Parametric Estimates of Ticketing, General Experience, and Law Experience, 2002-2009



Note: Average Return to Law Experience is based on non-parametric estimates of Table 4, Column 1. Average values, along with estimated slope, are weighted by the total number of observations in each Law-General experience pair.

Table 1: Tickets Issued by Idaho State Troopers, 2002-2009

All Troopers (n=537,680)	Mean	SD	Min	Max
Tickets Issued	0.596	8.08	0	735
General Experience	14.5	12.0	1	55
Task-Specific Experience	12.1	10.5	1	55
Law will have More Deterrence	0.077		0	1
Law will have Larger Scope	0.033		0	1
Law will have Smaller Scope	0.032		0	1
Law has More Deterrence?	0.087		0	1
Law has Larger Scope?	0.044		0	1
Law has Smaller Scope?	0.009		0	1
Junior Troopers (n=350,064)				
Tickets Issued	0.633	8.64	0	735
General Experience	8.11	5.07	1	21
Task-Specific Experience	7.22	4.83	1	21
Law will have More Deterrence	0.082		0	1
Law will have Larger Scope	0.045		0	1
Law will have Smaller Scope	0.032		0	1
Law has more Deterrence?	0.082		0	1
Law has Larger Scope?	0.031		0	1
Law has Smaller Scope?	0.009		0	1
Senior Troopers (n=187,616)				
Tickets Issued	0.535	6.91	0	475
General Experience	26.6	12.0	7	55
Task-Specific Experience	21.1	12.3	1	55
Law will have More Deterrence	0.067		0	1
Law will have Larger Scope	0.010		0	1
Law will have Smaller Scope	0.032		0	1
Law has more Deterrence?	0.097		0	1
Law has Larger Scope?	0.066		0	1
Law has Smaller Scope?	0.010		0	1

Note: "Junior" and "Senior" troopers are defined by their maximum general experience in our sample. All Senior troopers are observed with more than 10 years of experience (21 semesters)

Table 2: Fixed Effect Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers, 2002-2009

	(1)	(2)	(3)	(4)	(5)
Experience as Trooper	0.00792 [0.00525] (0.000)	0.00792 [0.00389] (0.000)	0.0137 [0.0116] (0.000)	0.0111 [0.00695] (0.597)	0.00968 [0.0111] (0.000)
Experience with Current Law				-0.00378 [0.00545] (0.057)	0.00401 [0.00181] (0.000)
R^2	0.441	0.441	0.703	0.441	0.703
N	537680	537680	537680	537680	537680
Trooper Fixed Effects	x	x		x	
Law x Vintage Fixed Effects		x	x	x	x
Trooper x Law Fixed Effects			x		x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). Two-tailed p-values are calculated by performing a Monte Carlo permutation test with 1,000 iterations over each of the independent variables, which are reported in parenthesis. All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, Ln(Vehicle Crashes), year and fall semester fixed effects.

Table 3: Fixed Effects Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers by Type of Law Change, 2002-2009

	Increase Law Scope				Decrease Law Scope				Increase Penalties			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Experience as Trooper	0.0515 [0.0419] (0.000)	0.0592 [0.0474] (0.000)	0.0109 [0.0122] (0.000)	0.0112 [0.0121] (0.000)	0.00688 [0.00283] (0.000)	0.00803 [0.00312] (0.121)	0.00698 [0.00664] (0.000)	0.0065 [0.00666] (0.000)	0.00572 [0.00272] (0.000)	0.00729 [0.00308] (0.036)	0.00552 [0.00597] (0.000)	0.00542 [0.00599] (0.000)
Experience with Current Law	-0.0434 [0.0411] (0.000)	-0.00512 [0.0467] (0.000)	0.00162 [0.00105] (0.364)	0.0014 [0.00112] (0.387)	-0.0000 [0.0006] (0.930)	-0.00121 [0.00121] (0.962)	-0.0004 [0.0002] (0.521)	0.0000 [0.0004] (0.945)	0.0006 [0.00109] (0.486)	-0.00108 [0.00170] (0.547)	0.00178 [0.0009] (0.000)	0.00186 [0.0010] (0.000)
R^2	0.442	0.442	0.704	0.704	0.227	0.227	0.531	0.531	0.227	0.227	0.53	0.53
N	428640	428640	428640	432400	417360	417360	417360	419240	486920	486920	486920	490680
Trooper Fixed Effects	x	x			x	x			x	x		
Law x Vintage Fixed Effects		x	x	x		x	x	x		x	x	x
Trooper x Law Fixed Effects			x	x			x	x			x	x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). Two-tailed p-values are calculated by performing a Monte Carlo permutation test with 1,000 iterations over each of the independent variables, which are reported in parenthesis. All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, Ln(Vehicle Crashes), year and fall semester fixed effects. Columns 4, 8, and 12 differ from columns 3, 7, and 11 by including laws that change more than once during our sample period.

Table 4: Fixed Effects Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers by General Experience, 2002-2009

	All		Junior (n=350,064)				Senior (n=187,616)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Experience as Trooper	0.0157 [0.0101] (0.951)	0.00574 [0.00989] (0.000)	0.147 [0.189] (0.000)	-0.0164 [0.0146] (0.000)	0.293 [0.148] (0.000)	0.0349 [0.0342] (1.000)	0.184 [0.100] (0.000)	0.018 [0.0137] (0.000)	0.163 [0.0812] (0.000)	0.0169 [0.0140] (0.000)
Experience with Current Law	0.0226 [0.0137] (0.000)	0.0315 [0.0206] (0.000)	0.00532 [0.00570] (0.018)	0.0286 [0.0109] (0.000)	0.0837 [0.0456] (0.000)	0.0768 [0.0355] (0.000)	-0.0305 [0.0260] (0.000)	-0.00197 [0.00150] (0.000)	-0.0625 [0.0552] (0.000)	-0.00726 [0.0117] (0.012)
Experience as Trooper x Experience with Current Law	-0.0007 [0.0005] (0.000)	-0.0008 [0.0006] (0.000)			-0.00582 [0.00320] (0.000)	-0.00592 [0.00349] (0.000)			0.000628 [0.000517] (0.000)	0.000119 [0.000237] (0.258)
R^2	0.441	0.703	0.429	0.703	0.429	0.704	0.487	0.704	0.487	0.704
N	537680	537680	350064	350064	350064	350064	187616	187616	187616	187616
Trooper Fixed Effects	x		x		x		x		x	
Law x Vintage Fixed Effects	x	x	x	x	x	x	x	x	x	x
Trooper x Law Fixed Effects		x		x		x		x		x

Columns 1 and 2 include all officers, while columns 3-6 examine junior officers a columns 7-10 examine senior officers. Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). Two-tailed p-values are calculated by performing a Monte Carlo permutation test with 1,000 iterations over each of the independent variables, which are reported in parenthesis. All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, Ln(Vehicle Crashes), year and fall semester fixed effects. Columns 6 and 10 differ from columns 5 and 9 by including laws that change more than once during our sample period.

Table 5: Fixed Effects Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers by Experience and Type of Law Change, 2002-2009

	Increase Law Scope			Decrease Law Scope			Increase Penalties		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: Junior Troopers (n=350,064)								
Experience as Trooper	0.347 [0.000] (0.000)	0.0704 [0.0470] (0.000)	0.0564 [0.0404] (0.000)	0.315 [0.171] (0.000)	0.0232 [0.0122] (0.000)	0.0232 [0.0111] (0.000)	0.294 [0.104] (0.000)	0.0187 [0.0114] (0.000)	0.0171 [0.0114] (0.000)
Experience with Current Law	0.0789 [0.0488] (0.021)	0.0500 [0.0291] (0.000)	0.0636 [0.0392] (0.000)	0.0297 [0.00892] (0.038)	0.0296 [0.00746] (0.000)	0.0295 [0.00945] (0.000)	0.0309 [0.00689] (0.000)	0.0319 [0.00908] (0.000)	0.0335 [0.00924] (0.000)
Experience as Trooper x Experience with Current Law	-0.00644 [0.00364] (0.000)	-0.00646 [0.00395] (0.000)	-0.00642 [0.00392] (0.000)	-0.00287 [0.000882] (0.469)	-0.00287 [0.000926] (0.000)	-0.00286 [0.000924] (0.000)	-0.00263 [0.000716] (0.000)	-0.00270 [0.000854] (0.000)	-0.00270 [0.000851] (0.000)
R^2	0.43	0.704	0.704	0.243	0.542	0.542	0.243	0.541	0.54
N	279072	279072	281520	271728	271728	272952	317016	317016	319464
	Panel B: Senior Troopers Senior (n=187,616)								
Experience as Trooper	0.42 [0.318] (0.000)	0.0153 [0.0169] (0.000)	0.0164 [0.0168] (0.000)	0.0623 [0.000] (0.000)	0.0112 [0.00957] (0.000)	0.0102 [0.00947] (0.000)	0.0557 [0.000] (0.000)	0.01 [0.00829] (0.000)	0.0104 [0.00820] (0.000)
Experience with Current Law	-0.288 [0.242] (0.000)	-0.00774 [0.0116] (0.036)	-0.00871 [0.0115] (0.000)	-0.00618 [0.0122] (0.191)	-0.00965 [0.0108] (0.000)	-0.00874 [0.0107] (0.000)	-0.00769 [0.00258] (0.000)	-0.00795 [0.0103] (0.134)	-0.00836 [0.0103] (0.000)
Experience as Trooper x Experience with Current Law	0.000567 [0.000400] (1.000)	0.000168 [0.000260] (0.470)	0.000166 [0.000259] (0.022)	0.000155 [0.000211] (0.544)	0.000154 [0.000219] (0.363)	0.000154 [0.000218] (0.139)	0.000155 [0.000032] (0.395)	0.00014 [0.000207] (0.372)	0.00014 [0.000206] (0.047)
R^2	0.49	0.705	0.705	0.213	0.504	0.504	0.214	0.504	0.504
N	149568	149568	150880	145632	145632	146288	169904	169904	171216
Law x Vintage Fixed Effects	x	x	x	x	x	x	x	x	x
Trooper x Law Fixed Effects		x	x		x	x		x	x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). Two-tailed p-values are calculated by performing a Monte Carlo permutation test with 1,000 iterations over each of the independent variables, which are reported in parenthesis. All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, Ln(Vehicle Crashes), year and fall semester fixed effects. Columns 3, 6 and 9 differ from columns 2, 5, and 8 by including laws that change more than once during our sample period

Table 6: Fixed Effects Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers, Hired Troopers only, 2002-2009

	(1)	(2)	(3)	(4)	(5)
Experience as Trooper	0.0345 [0.0372] (0.000)	0.273 [.] (0.000)	-0.0584 [0.0316] (0.000)	0.256 [0.200] (1.000)	0.020 [0.0463] (1.000)
Experience with Current Statute		0.0399 [0.0190] (0.000)	0.0952 [0.0434] (0.000)	0.165 [0.090] (0.000)	0.165 [0.0786] (0.000)
Experience with Current Statute x Experience with Current Law				-0.014 [0.0070] (0.000)	-0.014 [0.0077] (0.000)
R^2	0.683	0.40	0.683	0.401	0.683
N	217360	217360	217360	217360	217360
Law x Vintage Fixed Effects	x	x	x	x	x
Trooper x Law Fixed Effects	x		x		x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). Two-tailed p-values are calculated by performing a Monte Carlo permutation test with 1,000 iterations over each of the independent variables, which are reported in parenthesis. All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, Ln(Vehicle Crashes), year and fall semester fixed effects. Column 5 differs from column 4 by including laws that change more than once during our sample.

Table 7: Alternate Specifications of General and Task-Specific Experience and Productivity for Idaho State Troopers by General Experience, 2002-2009

	All		Junior (n=350,064)				Senior (n=187,616)			
	Panel A: Linear Probability Model									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Experience as Trooper	0.00136 [0.000138] (0.000)	0.00247 [0.00071] (0.000)	0.020 [.] (0.000)	-0.00166 [0.00165] (0.000)	0.0187 [.] (0.818)	0.00295 [0.00156] (0.000)	0.0227 [0.000986] (0.000)	0.0030 [0.00094] (0.000)	0.0214 [0.000877] (0.000)	0.0028 [0.000823] (0.000)
Experience with Current Law	0.00221 [0.000272] (0.000)	0.00257 [0.00122] (0.000)	0.00123 [0.000428] (0.000)	0.00545 [0.00161] (0.000)	0.00828 [0.00092] (0.000)	0.00971 [0.00212] (0.000)	0.000146 [.] (0.000)	-0.00087 [0.00048] (0.000)	-0.00179 [.] (0.000)	-0.00254 [0.0041] (0.000)
Exp. as Trooper x Exp. with Current Law	-0.000045 [0.000005] (0.000)	-0.0000591 [0.000028] (0.000)			-0.00053 [0.0000053] (0.000)	-0.00053 [0.00010] (0.000)			0.00000 [.] (0.000)	0.00000 [0.00000] (0.000)
R^2	0.293	0.457	0.302	0.468	0.304	0.47	0.29	0.44	0.29	0.44
N	537680	537680	350064	350064	350064	350064	187616	187616	187616	187616
	Panel B: Laws used more than 200 times									
Experience as Trooper	0.0513 [0.0352] (0.000)	0.0208 [0.0351] (0.000)	0.451 [0.664] (0.000)	-0.0724 [0.0551] (0.000)	0.967 [.] (0.000)	0.104 [0.120] (1.000)	0.605 [0.347] (0.000)	0.0681 [0.0448] (0.000)	0.535 [0.286] (0.000)	0.0637 [0.0463] (0.000)
Experience with Current Law	0.0815 [0.050] (0.000)	0.113 [0.0737] (0.000)	0.0217 [0.0179] (0.000)	0.117 [0.0429] (0.000)	0.304 [0.159] (0.000)	0.291 [0.131] (0.000)	-0.101 [0.0836] (0.000)	-0.00882 [0.00579] (0.000)	-0.207 [0.173] (0.000)	-0.0273 [0.0403] (0.000)
Exp. as Trooper x Exp. with Current Law	-0.00246 [0.00174] (0.000)	-0.00292 [0.00211] (0.000)			-0.0206 [0.011] (0.000)	-0.0208 [0.0124] (0.000)			0.0021 [0.00163] (0.316)	0.00043 [0.00081] (0.235)
R^2	0.439	0.7	0.427	0.7	0.428	0.701	0.486	0.702	0.486	0.702
N	148520	148520	96696	96696	96696	96696	51824	51824	51824	51824
Law x Vintage Fixed Effects	x	x	x	x	x	x	x	x	x	x
Trooper x Law Fixed Effects		x		x		x		x		x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). Two-tailed p-values are calculated by performing a Monte Carlo permutation test with 1,000 iterations over each of the independent variables, which are reported in parenthesis. All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, Ln(Vehicle Crashes), year and fall semester fixed effects.

Table 8: Fixed Effects Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers by General Experience and Similar Laws, 2002-2009

	All		Junior (n=350,064)				Senior (n=187,616)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Experience as Trooper	0.0473 [0.0388] (0.000)	0.0125 [0.0159] (0.995)	0.129 [.] (0.000)	-0.0954 [0.0499] (0.000)	0.356 [.] (0.000)	0.0587 [0.0478] (1.000)	0.286 [.] (0.000)	0.0447 [0.0372] (0.000)	0.583 [0.390] (0.000)	0.028 [0.0233] (0.000)
Experience with Current Law	0.213 [0.187] (0.000)	0.0457 [0.0337] (0.035)	0.114 [0.0710] (0.000)	0.124 [0.0863] (0.000)	0.221 [0.129] (0.000)	0.120 [0.0649] (0.332)	-0.0404 [0.0361] (0.000)	-0.0404 [0.0364] (0.000)	0.303 [0.302] (0.000)	-0.0117 [0.0153] (0.000)
Experience as Trooper x Experience with Current Law	-0.00553 [0.00498] (0.000)	-0.00126 [0.000924] (0.000)			-0.00873 [0.00499] (0.000)	-0.00949 [0.00568] (1.000)			-0.00791 [0.00764] (0.000)	0.000172 [0.000353] (0.391)
R2	0.00716	0.706	0.00393	0.00107	0.00432	0.705	0.00529	0.0028	0.0195	0.708
N	336520	336520	219096	219096	219096	219096	117424	117424	117424	117424
Trooper Fixed Effects	x		x		x		x		x	
Law x Vintage Fixed Effects	x	x	x	x	x	x	x	x	x	x
Trooper x Law Fixed Effects		x		x		x		x		x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). Two-tailed p-values are calculated by performing a Monte Carlo permutation test with 1,000 iterations over each of the independent variables, which are reported in parenthesis. All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, Ln(Vehicle Crashes), year and fall semester fixed effects. Columns 6 and 10 differ from columns 5 and 9 by including laws that change more than once during our sample period.

Appendix A

Table 1: Idaho Law Changes

Violation	Description	Amend Date	Amendment Description	Coded As
18 1501	Injury to children	2005	Willfully to be injure or failing to prevent injury to child	Increase Scope
18 1501(3)	Injury to children during transport	1997	Threshold BAC decreased from 0.10 to 0.08	Increase Deterrence
		2001	Penalties for operating a vessel under influence	Increase Scope
18 1801(1)	Interruption of court proceedings and respect	2005	Increased max fine for misdemeanors from $500 ($300 for some cases) to $ 1000	Increase Deterrence
18 2407(1)	Physical injury/property damage/ abusing position as a public servant/ taking a property exceed $1000 or taking check, credit cards name as Grand theft	2000	Stealing property with aggregate value over $50 for three or more incidents in a period of three days constitutes a grand theft	Increase Deterrence
		2002	Now theft of ammonia to make methamphetamine drugs is a grand theft	Increase Deterrence
		2002	Now include every type of cards widely used/checks/checking account numbers	Increase Scope
18 3302	Carrying concealed weapon without permit	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
18 3302(9)	Carrying concealed weapon in any motor vehicle	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
18 3302B	Carrying a concealed weapon under influence of alcohol or drugs	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
18 4006(3)(C)	Vehicular manslaughter-commission without gross negligence	2002	Killing of human embryo also a manslaughter	Increase Scope
18 4116	Willfully and lewdly exposing genital in place where public and present another	2006	Max imprisonment for second offense increased from 5 years to 10 years	Increase Deterrence
18 4628	Transporting forest products without proof of ownership	2006	Increased max fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
18 6409	Disturbing the peace or quite of any family, person, or any funeral or memorial service	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
18 7001	Damage on property owned by another or jointly owned	2005	Damaged caused by a common scheme or plan is now being included in the $ 1000 threshold	Increase Scope
18 7005	Damage to forage on public lands	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
18 7031	Placing debris on public or private property	2006	Increased max fine from $300 to $1000	Increase Deterrence
18 8002	Refusing to submit or complete evidentiary alcohol testing	2006	Added $250 fine	Increase Deterrence

18 8004	Driving under influence of alcohol or any other substance	1997	BAC lowered from 0.10 to 0.08	Increase Scope
		1998	License suspension time excludes incarceration	Increase Scope
		2006	Any prior violations will stay on your record for ten years as of 2006.	Increase Scope
		2009	After 45 days of driving suspension, restricted driving privilege may be granted	Reduce Scope
18 8004(1)(A)	Driving a non-commercial vehicle under influence of alcohol	1997	BAC lowered from 0.10 to 0.08	Increase Scope
		1998	License suspension time excludes incarceration	Increase Scope
		2006	Any prior violations will stay on your record for ten years as of 2006.	Increase Scope
		2009	After 45 days of driving suspension, restricted driving privilege may be granted	Reduce Scope
18 8004(1)(D)	Minors DUI (BAC 0.02-0.08)	1997	BAC lowered from 0.10 to 0.08	Increase Scope
		1998	License suspension time excludes incarceration	Increase Scope
		2006	Any prior violations will stay on your record for ten years as of 2006.	Increase Scope
		2009	After 45 days of driving suspension, restricted driving privilege may be granted	Reduce Scope
18 8004C	DUI(Driving non-commercial vehicles when BAC>0.020)	1997	BAC lowered from 0.10 to 0.08	Increase Scope
		1998	License suspension time excludes incarceration	Increase Scope
		2006	Any prior violations will stay on your record for ten years as of 2006.	Increase Scope
		2009	After 45 days of driving suspension, restricted driving privilege may be granted	Reduce Scope
18 8004C(1)	1st offense-DUI(Driving non-commercial vehicles when BAC>0.20)	1997	BAC lowered from 0.10 to 0.08	Increase Scope
		1998	License suspension time excludes incarceration	Increase Scope
		2006	Any prior violations will stay on your record for ten years as of 2006.	Increase Scope

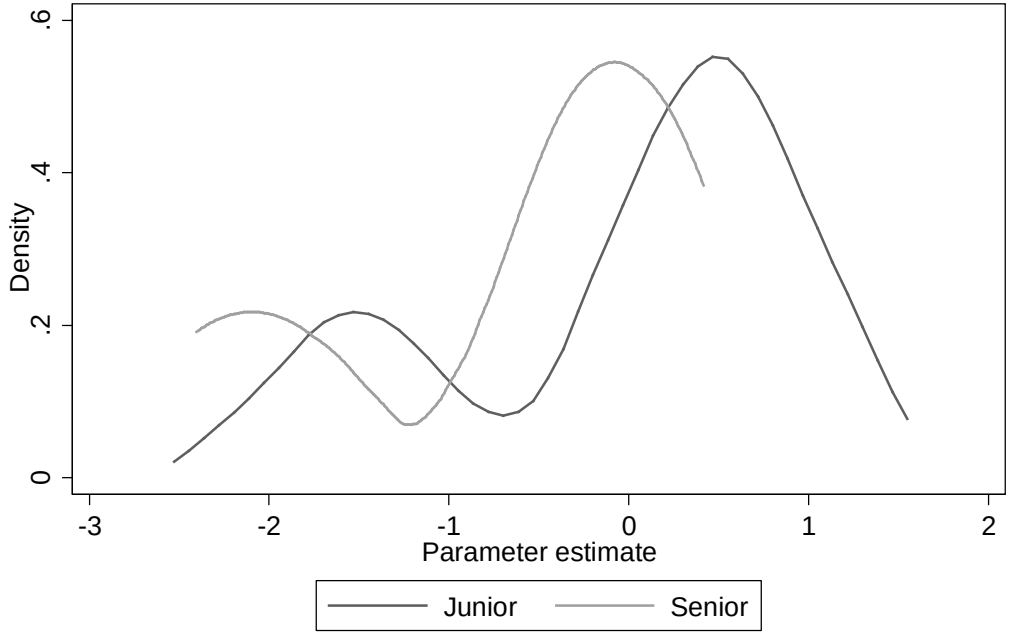
		2009	After 45 days of driving suspension, restricted driving privilege may be granted	Reduce Scope
18 8004C(3)	Defines conditions under which court may grant a restricted driver's license.	1997	BAC lowered from 0.10 to 0.08	Increase Scope
		1998	License suspension time excludes incarceration	Increase Scope
		2006	Any prior violations will stay on your record for ten years as of 2006.	Increase Scope
		2009	After 45 days of driving suspension, restricted driving privilege may be granted	Reduce Scope
18 8005	Defines punishments for section 18 8004	1997	BAC lowered from 0.10 to 0.08, stricter definition of "actual physical control of vehicle"	Increase Scope
		1998	License suspension time excludes incarceration	Increase Scope
		2006	Any prior violations will stay on your record for ten years as of 2006.	Increase Scope
		2009	After 45 days of driving suspension, restricted driving privilege may be granted	Reduce Scope
18 8006	Aggravated driving while under influence of alcohol (BAC>0.8)	2000	Now max. imprisonment is 10 years	Increase Deterrence
		2006	Max imprisonment increased from 10 years to 15 years	Increase Deterrence
18 901	Unlawful attempt to commit a violent injury, threat by word, act to do violence	2005	Increased max fine from $300 to $1,000	Increase Deterrence
18 903	willful and unlawful use of force or violence on another by all A,B,C of 18 903	2005	Increased max fine from $300 to $1,000	Increase Deterrence
18 915	Battery with intent to commit a serious felony upon judge, law enforcement agent, social worker, firemen or paramedic; assault or battery upon a former or present justice, judge or law enforcement officer	1999	Added Magistrates	Increase Scope
		2000	Added an agent of the state tax commission and employees at private correctional facilities	Increase Scope
		2001	Now assaulting retired or off duty former judge/jailer is felony charge	Increase Deterrence
		2008	Added misdemeanor probation officers	Increase Scope
18 918(3)	Committing a battery which does not result in traumatic injury	2004	Offense occurred outside Idaho now is counted as a subsequent violation	Increase Scope
18 918(5)	Two further violations of 18 918 within 15yrs, is guilty of felony and punished by $10000 and 10yrs in jail	2004	Offense occurred outside Idaho now is counted as a subsequent violation	Increase Scope

18 920	Violation of no contact order	2008	Created enhanced penalty for the third violation	Increase Deterrence
19 3901(A)	Failure to appear on a misdemeanor citation	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
19 3901A	Failure to appear on a misdemeanor citation complied by a counsel	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
19 3901A(B)	Duty to appear at misdemeanor citation complied by appearance by a counsel	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
23 1012(3)	Beer can be sold only within a period allowed by law	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
23 1023	Minors can possess beer in the course of employment or by the order of his parent	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
23 603	Any adult over 18 selling or giving alcohol beverages to minor under 21	2004	Removed felony and increased fines for the 2nd and subsequent violation	Increase Deterrence
36 401	License required for hunting, trapping, and fishing	2006	Children with life-threatening medical conditions are exempt from required license purchase	Reduce Scope
		2009	Military veterans are exempt from license requirement	Reduce Scope
39 6312	Violates the provisions of a domestic violence protection order; a peace officer may arrest without a warrant	1999	Out-of-state court order may be presumed that the person against whom the order has been issued already has notice of the order	Increase Scope
392 16	Use of seatbelts required for commercial motor drivers	2003	Fine increased to $10 from $5. Enforceable only when the driver violated another law.	Increase Deterrence
40 511	Failing to stop at port of entry or checking station	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
49 1010	Violation of vehicle size limit	2003	Created restrictions on lengths of truck tractors	Increase Scope
		2005	Added size limitation for vehicles transporting class 1 explosive materials	Increase Scope
49 1230	Cease to maintain the insurance shall immediately surrender registration card and license plates	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
49 1301	Driver involved in an accident who does not make a stop at the scene of accident	2005	Specified, stops distance for minor accidents on highways, and freed motorists to move	Reduce Scope
49 1302	Driver, willfully fails to provide relevant/false information in an accident	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
49 1304	Driver on highway, abandoning duty to stop and notify the owner of fixtures	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,001	Increase Deterrence
49 1308	Person filing false accident reports	2005	Double the fine from1st to 2nd offence and max. Penalties for repeated violation is 5 yrs	Increase Deterrence

49 1401(1)	Reckless driving	2005	Double the fine from1st to 2nd offence and max. penalties for repeated violation is 5 yr	Increase Deterrence
		2006	New fines are $1000 instead $500 and $2000 instead $1000	Increase Deterrence
49 1401(3)	Inattentive driving (inattentive, careless or imprudent driving)	2005	Created penalties for inattentive driving	Increase Deterrence
49 1403	Direction to operate the vehicle on a highway by contrary to law	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
49 1404(1)	fleeing or attempting to elude a peace officer	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
49 1419	Fails to comply with traffic direction by peace officer/fireman/adult school crossing guard	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
49 1421	Driving over dividing space on highway or onto controlled access highway	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
49 1421(2)	Driving onto/from any controlled access highway except at entrances and exits	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,001	Increase Deterrence
49 1424(1)	Racing on public highways	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,001	Increase Deterrence
49 1426	Having alcohol/drugs, Pedestrians shall not walk or be upon a highway except on a sidewalk	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,002	Increase Deterrence
49 1627	Rules on using dealer and manufacturer license plate	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,001	Increase Deterrence
49 1627(2)(C)	Dealer plates can't use on laden vehicles transporting cargo	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
49 1801(1)	Prohibits vehicle abandonment upon any highway	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
49 227	Prohibits operating vehicle without owner's consent	2005	Person who causes $1,000 or more damage is charged as a felony	Increase Deterrence
49 2446	Prohibits producing, selling fake ID card	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
49 301	Prohibits driving motor vehicles without a valid license	2001	Add terms stating "a violation of this section is a misdemeanor"	Increase Scope
		2005	Now maximum fine for misdemeanors is $1000	Increase Deterrence
49 301(1)	Prohibits driving motor vehicle on a highway without a license	2002	Allowing persons with driving permit to drive upon a highway with restrictions	Reduce Scope
		2005	Now maximum fine for misdemeanors is $1000	Increase Deterrence

49 301(2)	Prohibits driving a motorcycle upon a highway without a valid license	2005	Increased max. fine for misdemeanors from $500 ($300 for some cases) to $1,000	Increase Deterrence
		2006	Now commercial motor vehicles on highway is allowed	Reduce Scope
49 304(5)	Prohibits operation of Motorcycle without "M" license on highway	2002	Section created, as a part of 49-304(3)	Increase Scope
		2008	Separate section of 49-304(5)	Increase Scope
49 320	License holders should keep a current address on file with the department	2000	Subsection (3) was added, defining violation of this section is an infraction	Increase Scope
49 654(2)	No driving past the assigned speed limit	1997	Substituted "business or" for "neighborhood of any" preceding "urban district", substituted "on state highways" for "in other locations" and created subdivision (2)(e) by transferring "in other location	Increase Scope

Appendix Figure 1: Junior & Senior Fixed Effects Distribution



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APPENDIX B – Day vs. Night Time Hours

Table B2a: Fixed Effect Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers During Day Time Hours, 2002-2009

	(1)	(2)	(3)	(4)	(5)
Experience as Trooper	0.00174	0.00174	0.00174	0.00452	0.00153
	[0.000654]	[0.000373]	[0.000373]	[0.000360]	[0.000411]
Experience with Current Law				0.000255	0.000726
				[0.000196]	[0.000168]
R^2	0.46	0.46	0.46	0.641	0.46
N	537680	537680	537680	537680	537680
Trooper Fixed Effects	x	x	x	x	x
Semester Fixed Effects	x	x	x	x	x
Law Fixed Effects	x	x	x	x	x
Law x Vintage Fixed Effects		x	x	x	x
Trooper x Law Fixed Effects			x		x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, and Ln(Vehicle Crashes)

Table B2b: Fixed Effect Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers During Night Time Hours, 2002-2009

	(1)	(2)	(3)	(4)	(5)
Experience as Trooper	5.77E-05	5.77E-05	5.77E-05	0.00111	-0.0003

	[0.000283]	[0.000151]	[0.000152]	[0.000181]	[0.000190]
Experience with Current Law				0.000426	0.000420
				[0.000132]	[0.0000892]
R^2	0.351	0.351	0.352	0.55	0.352
N	537680	537680	537680	537680	537680
Trooper Fixed Effects	x	x	x	x	x
Semester Fixed Effects	x	x	x	x	x
Law Fixed Effects	x	x	x	x	x
Law x Vintage Fixed Effects		x	x	x	x
Trooper x Law Fixed Effects			x		x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, and Ln(Vehicle Crashes)

Table B3a: Fixed Effects Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers by Type of Law Change During Day Time Hours, 2002-2009

	Increase Law Scope				Decrease Law Scope				Increase Penalties			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Experience as Trooper	0.00271	0.00299	0.0040	0.0043	0.00185	0.00171	0.0040	0.0038	0.0014	0.0016	0.0032	0.0032
	[0.00114]	[0.00126]	[0.00044]	[0.00052]	[0.00071]	[0.00077]	[0.00094]	[0.00057]	[0.00037]	[0.000373]	[0.000364]	[0.000368]
Experience with Current Law	-0.00085	-0.00114	0.000317	0.000104	1.57E-05	0.000158	-0.00037	-0.00017	0.00038	0.000207	0.00051	0.00053
	[0.00105]	[0.00118]	[0.00014]	[0.00031]	[0.00059]	[0.00067]	[0.00087]	[0.00045]	[0.00012]	[0.000152]	[0.000188]	[0.000196]
R^2	0.471	0.471	0.65	0.649	0.341	0.341	0.561	0.561	0.338	0.339	0.558	0.557
N	428640	428640	428640	432400	417360	417360	417360	419240	486920	486920	486920	490680
Trooper Fixed Effects	x	x	x	x	x	x	x	x	x	x	x	x

Semester Fixed Effects	x	x	x	x	x	x	x	x	x	x	x	x
Law Fixed Effects	x	x	x	x	x	x	x	x	x	x	x	x
Law x Vintage Fixed Effects		x	x	x		x	x	x		x	x	x
Trooper x Law Fixed Effects			x	x			x	x			x	x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, and Ln(Vehicle Crashes). Columns 4, 8, and 12 include laws that change more than once.

Table B3b: Fixed Effects Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers by Type of Law Change During Night Time Hours, 2002-2009

	Increase Law Scope				Decrease Law Scope				Increase Penalties			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Experience as Trooper	-0.00029	-0.00029	0.0009	0.0009	2.08E-05	7.52E-05	0.000984	0.000769	9.09E-05	0.00021	0.0006	0.0006
	[0.00071]	[0.00081]	[0.00024]	[0.00023]	[0.00032]	[0.00036]	[0.00056]	[0.00030]	[0.00013]	[0.000134]	[0.000172]	[0.000174]
Experience with Current Law	0.000366	0.000361	-1.1E-05	1.66E-05	5.92E-05	4.64E-06	-0.00034	-0.00012	-1.2E-05	-0.000143	0.000117	0.000142
	[0.00070]	[0.00079]	[0.00013]	[0.0001]	[0.00029]	[0.00033]	[0.00053]	[0.00025]	[0.00005]	[0.000066]	[0.000081]	[0.000084]
R^2	0.358	0.358	0.55	0.55	0.237	0.237	0.447	0.447	0.229	0.23	0.438	0.436
N	428640	428640	428640	432400	417360	417360	417360	419240	486920	486920	486920	490680
Trooper Fixed Effects	x	x	x	x	x	x	x	x	x	x	x	x
Semester Fixed Effects	x	x	x	x	x	x	x	x	x	x	x	x
Law Fixed Effects	x	x	x	x	x	x	x	x	x	x	x	x
Law x Vintage Fixed Effects		x	x	x		x	x	x		x	x	x
Trooper x Law Fixed Effects			x	x			x	x			x	x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, and Ln(Vehicle Crashes). Columns 4, 8, and 12 include laws that change more than once.

Table B4a: Fixed Effects Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers by General Experience During Day Time Hours, 2002-2009

	All		Junior (n=350,064)				Senior (n=187,616)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Experience as Trooper	0.00196	0.00343	0.0275	-0.00199	0.0436	0.00361	0.0343	0.00654	0.0328	0.00617
	[0.000414]	[0.000396]	[0.0160]	[0.000701]	[0.0161]	[0.000734]	[0.00516]	[0.000684]	[0.00510]	[0.000694]
Experience with Current Law	0.00272	0.00344	0.00131	0.00586	0.00994	0.0112	-0.00033	-0.00076	-0.00272	-0.0025
	[0.000300]	[0.000289]	[0.000501]	[0.000586]	[0.000569]	[0.000635]	[0.000436]	[0.000272]	[0.000896]	[0.000544]
Experience as Trooper x Experience with Current Law	-0.0001	-0.0001			-0.0006	-0.0007			0.00005	0.00004
	[0.0000068]	[0.0000072]			[0.0000282]	[0.0000296]			[0.0000130]	[0.0000107]
R^2	0.461	0.641	0.463	0.644	0.464	0.645	0.47	0.637	0.47	0.637
N	537680	537680	350064	350064	350064	350064	187616	187616	187616	187616
Trooper Fixed Effects	x	x	x	x	x	x	x	x	x	x
Semester Fixed Effects	x	x	x	x	x	x	x	x	x	x
Law Fixed Effects	x	x	x	x	x	x	x	x	x	x
Law x Vintage Fixed Effects	x	x	x	x	x	x	x	x	x	x
Trooper x Law Fixed Effects		x		x		x		x		x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, and Ln(Vehicle Crashes). Columns 1 and 2 have all troopers. Columns 3-6 have Junior troopers only. Columns 7-10 have Senior troopers only.

Table B4b: Fixed Effects Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers by General Experience During Night Time Hours, 2002-2009

	All		Junior (n=350,064)				Senior (n=187,616)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Experience as Trooper	-0.00016	0.000579	0.0159	-0.0023	0.0225	-7.5E-05	-0.00525	0.00157	-0.0060	0.00131
	[0.000194]	[0.000202]	[0.00876]	[0.000558]	[0.00878]	[0.000570]	[0.00172]	[0.000293]	[0.00177]	[0.000300]
Experience with Current Law	0.00123	0.00126	0.000786	0.00345	0.00433	0.00555	0.000187	-0.00034	-0.00103	-0.0016
	[0.000183]	[0.000155]	[0.000391]	[0.000517]	[0.000393]	[0.000529]	[0.000293]	[0.000116]	[0.000563]	[0.000274]
Experience as Trooper x Experience with Current Law	-0.000021	-0.00003			-0.00002	-0.00003			0.000024	0.00003
	[0.00000369]	[0.0000037]			[0.0000037]	[0.0000037]			[0.0000073]	[0.0000056]
R^2	0.352	0.55	0.363	0.562	0.364	0.563	0.343	0.521	0.343	0.521
N	537680	537680	350064	350064	350064	350064	187616	187616	187616	187616
Trooper Fixed Effects	x	x	x	x	x	x	x	x	x	x
Semester Fixed Effects	x	x	x	x	x	x	x	x	x	x
Law Fixed Effects	x	x	x	x	x	x	x	x	x	x
Law x Vintage Fixed Effects	x	x	x	x	x	x	x	x	x	x
Trooper x Law Fixed Effects		x		x		x		x		x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, and Ln(Vehicle Crashes). Columns 1 and 2 have all troopers. Columns 3-6 have Junior troopers only. Columns 7-10 have Senior troopers only.

Table B5a: Fixed Effects Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers by Experience and Type of Law Change During Day Time Hours, 2002-2009

	Increase Law Scope			Decrease Law Scope			Increase Penalties		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: Junior Troopers (n=350,064)								
Experience as Trooper	0.0459	0.0084	0.0066	0.0448	0.00757	0.0073	0.0429	0.0044	0.0039
	[0.0178]	[0.00127]	[0.00129]	[0.0175]	[0.00464]	[0.00209]	[0.0160]	[0.000698]	[0.000723]
Experience with Current Law	0.0089	0.0068	0.0085	0.00615	0.0053	0.00558	0.0080	0.0080	0.0086
	[0.000748]	[0.00116]	[0.00121]	[0.00248]	[0.00462]	[0.00206]	[0.000511]	[0.000595]	[0.000621]
Experience as Trooper x Experience with Current Law	-0.0007	-0.0007	-0.0007	-0.0006	-0.0006	-0.0006	-0.0005	-0.0006	-0.0006
	[0.000030]	[0.000032]	[0.000032]	[0.000025]	[0.000027]	[0.000027]	[0.000024]	[0.000025]	[0.000025]
R^2	0.475	0.655	0.654	0.358	0.573	0.573	0.354	0.568	0.567
N	279072	279072	281520	271728	271728	272952	317016	317016	319464
	Panel B: Senior Troopers (n=187,616)								
Experience as Trooper	0.0371	0.0054	0.0060	0.0320	0.00725	0.00604	0.0285	0.0051	0.0054
	[0.00619]	[0.000815]	[0.000934]	[0.00552]	[0.00157]	[0.000973]	[0.00468]	[0.000608]	[0.000615]
Experience with Current Law	-0.00512	-0.0022	-0.0028	-0.00253	-0.00448	-0.00330	-0.0022	-0.0023	-0.0025
	[0.00299]	[0.000559]	[0.000712]	[0.00132]	[0.00153]	[0.000931]	[0.000557]	[0.000561]	[0.000566]
Experience as Trooper x Experience with Current Law	0.0001	0.0001	0.0001	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004
	[0.000014]	[0.000012]	[0.000012]	[0.000011]	[0.000011]	[0.000011]	[0.000010]	[0.000011]	[0.000011]
R^2	0.0371	0.0054	0.0060	0.0320	0.00725	0.00604	0.0285	0.00514	0.00537
N	[0.00619]	[0.000815]	[0.000934]	[0.00552]	[0.00157]	[0.000973]	[0.00468]	[0.000608]	[0.000615]
Law x Vintage Fixed Effects	x	x	x	x	x	x	x	x	x
Trooper x Law Fixed Effects		x	x		x	x		x	x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, and Ln(Vehicle Crashes), along with trooper, law, and semester fixed effects. Columns 3, 6, and 9 include laws that change more than once.

Table B5b: Fixed Effects Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers by Experience and Type of Law Change During Night Time Hours, 2002-2009

	Increase Law Scope			Decrease Law Scope			Increase Penalties		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: Junior Troopers (n=350,064)								
Experience as Trooper	0.0266	0.0033	0.0027	0.0242	-0.00139	0.000487	0.0211	0.0016	0.0013
	[0.00856]	[0.000905]	[0.000721]	[0.00808]	[0.00243]	[0.00103]	[0.00700]	[0.000356]	[0.000364]
Experience with Current Law	0.0026	0.00189	0.0025	0.00302	0.00553	0.0037	0.0021	0.0024	0.0027
	[0.000437]	[0.000867]	[0.000681]	[0.00136]	[0.00243]	[0.00101]	[0.000259]	[0.000307]	[0.000315]
Experience as Trooper x Experience with Current Law	-0.0003	-0.0003	-0.0003	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002
	[0.000015]	[0.000016]	[0.000015]	[0.000013]	[0.000013]	[0.000013]	[0.000012]	[0.000012]	[0.000012]
R^2	0.37	0.561	0.561	0.255	0.465	0.465	0.248	0.456	0.454
N	279072	279072	281520	271728	271728	272952	317016	317016	319464
	Panel B: Senior Troopers (n=187,616)								
Experience as Trooper	-0.00673	0.000831	0.000764	-0.0079	-0.00065	-2.7E-05	-0.0060	0.00073	0.00081
	[0.00263]	[0.000409]	[0.000380]	[0.00228]	[0.00121]	[0.000650]	[0.00178]	[0.000263]	[0.000266]
Experience with Current Law	-0.00155	-0.0018	-0.0017	-0.0006	-0.00046	-0.00108	-0.0017	-0.0017	-0.0018
	[0.00200]	[0.000364]	[0.000331]	[0.00109]	[0.00122]	[0.000664]	[0.000263]	[0.000270]	[0.000272]
Experience as Trooper x Experience with Current Law	0.00004	0.00004	0.00004	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003
	[0.00000750]	[0.00000595]	[0.00000592]	[0.00000549]	[0.00000567]	[0.00000566]	[0.00000507]	[0.00000534]	[0.00000533]
R^2	0.349	0.525	0.525	0.214	0.401	0.401	0.208	0.393	0.39
N	149568	149568	150880	145632	145632	146288	169904	169904	171216
Law x Vintage Fixed Effects	x	x	x	x	x	x	x	x	x
Trooper x Law Fixed Effects		x	x		x	x		x	x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, and Ln(Vehicle Crashes), along with trooper, law, and semester fixed effects. Columns 3, 6, and 9 include laws that change more than once.

Table B6a: Fixed Effects Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers, Hired Troopers only During Day Time Hours, 2002-2009

	(1)	(2)	(3)	(4)	(5)
Experience as Trooper	0.0369	0.00293	0.0352	-0.0101	0.0328
	[0.0198]	[0.000668]	[0.0199]	[0.00203]	[0.0198]
Ln(Experience with Current Statute)		0.0017	0.0134	0.0173	0.0222
		[0.00108]	[0.00202]	[0.00120]	[0.00205]
Ln(Experience with Current Statute) x Experience with Current Law				-0.00175	-0.00176
				[0.0000728]	[0.0000774]
R^2	0.459	0.642	0.459	0.643	0.462
N	217360	217360	217360	217360	217360
Law x Vintage Fixed Effects	x	x	x	x	x
Trooper x Law Fixed Effects	x		x		x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 82). All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, and Ln(Vehicle Crashes), along with trooper, law, and semester fixed effects.

= p 0.10 , = p < 0.05 , = p < 0.01

Table B6b: Fixed Effects Estimates of General and Task-Specific Experience and Productivity for Idaho State Troopers, Hired Troopers only During Night Time Hours, 2002-2009

	(1)	(2)	(3)	(4)	(5)
Experience as Trooper	0.0318	0.000648	0.0292	-0.00913	0.0280
	[0.0106]	[0.000352]	[0.0106]	[0.00156]	[0.0106]
Ln(Experience with Current Statute)		0.00262	0.0100	0.0102	0.0144
		[0.000858]	[0.00162]	[0.000916]	[0.00164]
Ln(Experience with Current Statute) x Experience with Current Law				-0.000851	-0.000861
				[0.0000395]	[0.0000419]
R^2	0.37	0.562	0.37	0.562	0.372
N	217360	217360	217360	217360	217360
Law x Vintage Fixed Effects	x	x	x	x	x
Trooper x Law Fixed Effects	x		x		x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 82). All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, and Ln(Vehicle Crashes), along with trooper, law, and semester fixed effects.

Table B7a: Alternate Specifications of General and Task-Specific Experience and Productivity for Idaho State Troopers by General Experience During Day Time Hours, 2002-2009

	All		Junior (n=350,064)				Senior (n=187,616)			
	Panel A: Linear Probability Model									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Experience as Trooper	0.00291	0.00816	0.0381	-0.0081	0.0724	0.00354	0.0687	0.0176	0.0653	0.0166
	[0.000849]	[0.000987]	[0.0371]	[0.00227]	[0.0371]	[0.00230]	[0.00932]	[0.00164]	[0.00930]	[0.00166]
Experience with Current Law	0.00627	0.00789	0.00366	0.0175	0.0225	0.0290	-0.00022	-0.00327	-0.0054	-0.0076
	[0.000582]	[0.000819]	[0.00118]	[0.00213]	[0.00132]	[0.00218]	[0.000633]	[0.00106]	[0.00118]	[0.00140]
Ln(Exp. as Trooper) x Ln(Exp. with Current Law)	-0.0001	-0.0002			-0.0014	-0.0014			-0.0014	-0.0014
	[0.0000134]	[0.0000148]			[0.0000529]	[0.0000555]			[0.0000529]	[0.0000555]
R^2	0.272	0.434	0.273	0.437	0.281	0.444	0.287	0.435	0.288	0.436
N	148520	148520	96696	96696	96696	96696	51824	51824	51824	51824
	Panel B: Laws used more than 200 times									
Experience as Trooper	0.00526	0.0116	0.0591	-0.0096	0.113	0.00854	0.0997	0.0231	0.0947	0.0218
	[0.00139]	[0.00152]	[0.0566]	[0.00287]	[0.0566]	[0.00294]	[0.0164]	[0.00254]	[0.0163]	[0.00259]
Experience with Current Law	0.00915	0.0120	0.00495	0.0235	0.0343	0.0415	-0.00151	-0.00347	-0.00911	-0.00902
	[0.00106]	[0.00118]	[0.00178]	[0.00252]	[0.00206]	[0.00266]	[0.00136]	[0.00133]	[0.00289]	[0.00207]
Ln(Exp. as Trooper) x Ln(Exp. with Current Law)	-0.0002	-0.0003			-0.002	-0.002			0.00015	0.00013
	[0.0000236]	[0.0000257]			[0.0000978]	[0.000103]			[0.0000433]	[0.0000370]
R^2	0.453	0.631	0.45	0.629	0.455	0.634	0.476	0.638	0.476	0.638
N	148520	148520	96696	96696	96696	96696	51824	51824	51824	51824
Law x Vintage Fixed Effects	x	x	x	x	x	x	x	x	x	x
Trooper x Law Fixed Effects		x		x		x		x		x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, and Ln(Vehicle Crashes) along with trooper, law, and semester fixed effects. *= p 0.10 , = p < 0.05 , = p < 0.01*

Table B7b: Alternate Specifications of General and Task-Specific Experience and Productivity for Idaho State Troopers by General Experience During Night Time Hours, 2002-2009

	All		Junior (n=350,064)				Senior (n=187,616)			
	Panel A: Linear Probability Model									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Experience as Trooper	-5.1E-05	0.00238	0.0576	-0.0072	0.0748	-0.00144	-0.0053	0.00540	-0.00737	0.00471
	[0.000539]	[0.000672]	[0.0263]	[0.00186]	[0.0263]	[0.00189]	[0.00486]	[0.00104]	[0.00489]	[0.00107]
Experience with Current Law	0.00326	0.00395	0.00261	0.0115	0.0121	0.0172	0.000355	-0.00140	-0.00277	-0.0043
	[0.000422]	[0.000544]	[0.000941]	[0.00178]	[0.00102]	[0.00181]	[0.000512]	[0.000644]	[0.000937]	[0.000888]
Ln(Exp. as Trooper) x Ln(Exp. with Current Law)	-0.0001	-0.0001			-0.0001	-0.0001			-0.0001	-0.0001
	[0.0000092]	[0.0000097]			[0.0000092]	[0.0000097]			[0.0000092]	[0.0000097]
R^2	0.247	0.398	0.254	0.41	0.258	0.413	0.244	0.375	0.244	0.375
N	148520	148520	96696	96696	96696	96696	51824	51824	51824	51824
	Panel B: Laws used more than 200 times									
Experience as Trooper	-0.00057	0.00173	0.0519	-0.0100	0.0738	-0.00275	-0.0160	0.00552	-0.0185	0.00459
	[0.000665]	[0.000778]	[0.0305]	[0.00238]	[0.0306]	[0.00242]	[0.00569]	[0.00109]	[0.00582]	[0.00112]
Experience with Current Law	0.00432	0.00472	0.00334	0.0141	0.0154	0.0212	0.000546	-0.00131	-0.00333	-0.0052
	[0.000645]	[0.000631]	[0.00141]	[0.00226]	[0.00144]	[0.00230]	[0.000915]	[0.000527]	[0.00180]	[0.000996]
Ln(Exp. as Trooper) x Ln(Exp. with Current Law)	-0.00008	-0.0001			-0.0001	-0.0001			-0.0001	-0.0001
	[0.0000128]	[0.0000133]			[0.0000128]	[0.0000133]			[0.0000128]	[0.0000133]
R^2	0.358	0.548	0.367	0.557	0.37	0.56	0.352	0.525	0.353	0.526
N	148520	148520	96696	96696	96696	96696	51824	51824	51824	51824
Law x Vintage Fixed Effects	x	x	x	x	x	x	x	x	x	x
Trooper x Law Fixed Effects		x		x		x		x		x

Standard errors in brackets allow for two-way clustering at Law (g = 286) and Trooper level (k = 152). All regressions include controls for Ln(Region Population), the fraction of the population that are males between 18 and 24 years old, and Ln(Vehicle Crashes) along with trooper, law, and semester fixed effects. *= p 0.10 , = p < 0.05 , = p < 0.01*