Estimates of Law Enforcement Costs by Crime Type for Benefit-Cost Analyses

Abstract: Crime is an important outcome in many social policy evaluations. Benefits to society from preventing crime are based on avoiding victimization and freeing criminal justice system resources. For the latter, analysts need information about the marginal cost of policing for different types of crime across jurisdictions; however, this information is not readily available. This paper details key economic concepts relevant to law enforcement services, and then combines publicly available police expenditure data with insights from observational and time-diary studies to generate state-level, crime-specific, average variable cost estimates for crime-response services conducted by police by crime type. Since there is considerable uncertainty concerning various parameters underpinning these calculations, we use Monte Carlo simulation methods to incorporate the uncertainty into our estimates. This study finds that the U.S. population-weighted average variable cost of law enforcement response per police-reported Part 1 violent crime is $10,900, ranging from $6900 to $15,400 at the 10th and 90th percentiles, respectively. For a Part 1 property crime, the equivalent figure is $1300, with a range from $700 to $1700.

Keywords: cost; crime; law and regulation; police; policy.

JEL classifications: K42; D61; H72.

1 Introduction

Crime matters, and not just in lives affected, but also in dollars and cents. Indeed, in many social policy evaluations, the monetized societal value of crime-related outcomes can dominate the results. For example, some prenatal and early childhood interventions appear to be terrific societal investments largely because they reduce criminal activity in the future (Heckman et al., 2010; Reynolds et al., 2001; Olds et al., 1999).

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The most obvious and arguably most important benefits from preventing crime are reduced victimization costs. Avoided expenditures by criminal justice agencies are often a prominent second (Vining & Weimer, 2010), hence, analysts need sound information about policing costs in order to understand how much benefit, in freed up law enforcement resources, would be gained by preventing crime. Pairing this information with costs to victims and other parts of the criminal justice system, program cost data, and evidence on effects will allow researchers to conduct benefit-cost analyses (BCAs) to inform decisions about programming.

It may seem straightforward to calculate the law enforcement cost per crime reported to the police – simply divide law enforcement’s total budget by the number of crimes – but there are at least three complications with this approach. First, police provide many services, some of which have nothing to do with responding to a reported crime. Policing includes controlling traffic and being a first responder to medical emergencies, for example. Indeed, in the most recent nationally representative Police-Public Contact Survey conducted by the U.S. Census Bureau, 47.3% of contacts with police were not related to a crime (Langton & Durose, 2013). Police are also involved in many prevention activities, such as community policing and motor or foot patrol. Second, not all crimes impose the same cost. Some relatively minor crimes, such as vandalism or possession of stolen property, are rarely reported and investigated; those arrests occur as a side effect of routine policing activities. By contrast, responding to more serious crimes can involve extended work for many people in various fields and roles (e.g., investigators, supervisors, forensic interviewers, case preparation support, nurse examiners, crime scene processing officers). Therefore, the unit costs should be disaggregated by crime type. The FBI has created a common definition of these in their Uniform Crime Reporting (UCR) system, which organizes serious offenses into their Part 1 classification of violent crime (homicide, rape/sexual assault, robbery, aggravated assault) and property crime (burglary, larceny, motor vehicle theft, and arson), while less serious crimes are classified as Part 2 offenses. Third, there can be economies of scale and scope, so the cost of responding to an additional 10% of crimes (a marginal cost) might be very different than 10% of the current cost of responding to that type of crime.

While there are some cost estimates for some crime types in a handful of states including Vermont (Schlueter et al., 2014), Utah (Fowles & Nyström, 2012), and Washington state (Aos et al., 2006), the costs of reported crimes associated with particular crime types that could be applied to any jurisdiction are not readily available. A study published in this journal investigated whether analysts had theoretically and empirically grounded estimates of all significant impacts of crime and found “[b]etter estimates of the marginal costs of criminal justice system
resources . . . would improve the comprehensiveness of BCAs in the many social policy areas that affect crime” (Vining & Weimer, 2010). To address this gap, this study reviews key economic concepts relevant to BCAs incorporating costs of law enforcement by crime type, and develops “off-the-shelf” cost per unit of reported crime estimates by crime type for local and state police services (e.g., Sheriff’s offices, local police) that can be used in BCAs.

This paper is organized as follows. Section 2 provides previous estimates of law enforcement costs by crime type. Section 3 provides a conceptual and practical understanding of what is and is not included in the costs per unit developed in this study. The section demonstrates law enforcement involves far more than responding to crimes. Section 4 presents the methodology and data used in this study to generate new law enforcement costs per unit estimates. These estimates include the costs of police to “respond” to crime (e.g., control crime scene, investigate, arrest, testify in court), but we do not include their other job responsibilities such as any prevention activities, including community policing; motor or foot patrol; traffic enforcement; or non-crime-related tasks (e.g., non-crime-related administration. Therefore, these estimates are most appropriate for estimating the cost implications of an intervention that reduces the number of crimes and therefore decreases workload associated with crime response. We use operating expenses as the spending on policing response services, which includes sworn and non-sworn payroll (salaries, wages, fees, commissions paid salaries, employee contributions, and employer contributions) and equipment/supply overheads. We use Monte Carlo (MC) simulation to take into account uncertainty concerning the value of model parameters, and do this for each type of FBI Index crime (murder, rape and sexual assault, robbery, aggravated assault, burglary, larceny/theft, and motor vehicle theft), excluding arson.¹ Section 5 provides results and sensitivity analyses, and we conclude with a discussion about how these new estimates compare to previous estimates in the literature and how the results can be used for BCAs.

2 Review of unit cost estimates by crime type

One of the most widely cited studies on the cost of criminal justice activities is Cohen (1998), which estimates the average variable cost per unit of crime. The study uses data from the DADE Justice Improvement Model for Dade County, Florida (MDDJA, 1994) on resources applied to each main stage of the criminal

¹ Those interested in estimating the costs associated with policing drug offenses should consult Carey et al. (2005), Caulkins and Kilmer (2013), and Schlueter et al. (2014).
The time and cost estimates for each stage are not crime-specific; they are averages over all Part 1 violent and property crimes and Part 2 drug-related arrests.\(^2\) By averaging over all Part 1 crime types and drug-related arrests, this study may have underestimated the cost of relatively more violent crime types (e.g., murder and rape) and slightly overestimated relatively less resource-intensive crime types (e.g., motor vehicle theft).\(^3\) The study then applies the likelihood of a crime, specific to each Part 1 crime type, of reaching each main stage to generate the cost per Part 1 crime type. Cohen et al. (1994) use the estimate of police and investigation time in Dade County and apply the average police on-time pay to generate a cost of $477 in 1987 dollars ($1097 adjusted to 2010 using the National Average Wage Index; SSA, 2015) on average for Part 1 violent and property crime and drug-related crimes. For a detailed description of this study, see Appendix A.1.

Table 1 presents results of our review of studies calculating crime type-specific marginal, average total, or average variable unit cost of policing services. We identified four key studies, none of which are directly comparable. Two studies express results in terms of cost per arrest, yet differed in that Aos et al. (2006) estimated a marginal cost per arrest using a top-down, regression approach whereas Schlueter et al. (2014) estimated average variable\(^4\) costs per arrest using a bottom-up approach. Further, the regression model in Aos et al. (2006) combines the count of rapes/sexual assaults, robberies, and aggravated assaults and provides an average over all the crimes, which may overestimate the cost of aggravated assault and underestimate rape/sexual assault costs.\(^5\) The impact of using different data sources and methodologies leads to substantially differential estimates for some crime types. For example, the cost of an aggravated assault (in 2010 dollars) is estimated as $192 in Schlueter et al. (2014) and $7610 in Aos et al. (2006).

Fowles and Nyström (2012) also estimated marginal costs, but nonetheless differ from Aos et al. (2006) by estimating costs per reported crime, not per arrest. Likewise, McCollister et al. (2010) is not directly comparable to Schlueter et al. (2014) even though both estimated average costs: McCollister et al.’s (2010) averages were average total cost per victimization, not per arrest, and Fowles and

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\(^2\) The FBI makes a distinction between Part 1 and Part 2 crimes. The former are more serious and include murder and non-negligent homicide, rape, robbery, aggravated assault, burglary, motor vehicle theft, larceny-theft, and arson (https://www.ucrdatatool.gov/offenses.cfm).

\(^3\) Using the study estimates of $477 dollars and salary of approximately $33 per hour, the result suggests that law enforcement spends 14 hours on the investigation and arrest for each crime. For violent crime, this figure is much lower than more recent estimates.

\(^4\) Defined by labor inputs and measured using data from sworn officers recording time in RMS/CAD.

\(^5\) We would expect the cost of investigating and closing a rape/sexual assault case is more resource-intensive than it would be for an aggravated assault.
Table 1  Law enforcement per unit costs by crime type estimates, in 2010 dollars$^a$.

<table>
<thead>
<tr>
<th>Crime Type</th>
<th>Marginal cost of an arrest, Washington state, top-down approach</th>
<th>Average variable cost of an arrest, Vermont, bottom-up approach</th>
<th>Marginal cost of a reported crime, Utah, top-down approach</th>
<th>Average total cost of a victimization, National, top-down approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Violent crime</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murder</td>
<td>$37,408</td>
<td>$59,988</td>
<td></td>
<td>$2,162</td>
</tr>
<tr>
<td>Rape/sexual assault</td>
<td>$7,610</td>
<td>$15,233</td>
<td></td>
<td>$2,162</td>
</tr>
<tr>
<td>Robbery</td>
<td>$7,610</td>
<td>$192</td>
<td></td>
<td>$2,162</td>
</tr>
<tr>
<td>Aggravated assault</td>
<td>$7,610</td>
<td></td>
<td></td>
<td>$2,162</td>
</tr>
<tr>
<td>Property crime</td>
<td>$6,347</td>
<td></td>
<td></td>
<td>$880</td>
</tr>
<tr>
<td>Burglary</td>
<td></td>
<td>$213</td>
<td></td>
<td>$2,162</td>
</tr>
<tr>
<td>Larceny/Theft</td>
<td></td>
<td>$102</td>
<td></td>
<td>$2,162</td>
</tr>
<tr>
<td>Motor vehicle theft</td>
<td></td>
<td>$80</td>
<td></td>
<td>$2,162</td>
</tr>
<tr>
<td>Arson</td>
<td></td>
<td>$7,731</td>
<td></td>
<td>$2,162</td>
</tr>
</tbody>
</table>

Nyström (2012) estimates are average variable cost per reported crime. Furthermore, only McCollister et al. (2010) attempt to provide national figures; the other three studies estimated the cost in one state only: Washington state (Aos et al., 2006), Vermont (Schlueter et al., 2014), and Utah (Fowles & Nyström, 2012). For a detailed description of each study, see the Appendix A.1.

3 Theoretical framework for understanding quantity and costs of police services

To develop a theoretically and empirically consistent estimate of the policing cost per unit of crime, researchers start by defining a cost function or production function. This immediately raises the question: what is the appropriate measure of output? Since police generate multiple services for the public, it is not completely obvious how to think about what police services are “produced” and how they are measured.

A BCA uses the marginal cost of (or benefit of avoiding) crime when the evaluation involves the change in crime due to a program or policy. When an intervention reduces the number of reported crimes, the question becomes what cost inputs (labor and capital) can be reduced, increased, or reallocated for another use (i.e., what are the variable costs). The general approach in the theoretical literature for firms is to consider labor as the variable cost, but dealing with law enforcement services can be more complicated. On the one hand, it would often be both unusual and difficult for a police department to cut its staff just because crime rates fell. On the other hand, a department could reduce the use of overtime and/or reallocate sworn and non-sworn officers to general service activities (e.g., traffic, community engagement). In the absence of the marginal labor resources to specifically address the additional reported crimes, a potentially useful measure would be an average variable cost per unit in each U.S. state; which are the new estimates provided in this study. The System of National Accounts (Inter-Secretariat Working Group on National Accounts, 1993) recommends valuing non-market services produced by the government with the value of the inputs to produce those outputs. Therefore, even though there is not a market price for public policing services, we can use the cost of labor and capital/equipment to determine the price per reported crime.

The main point when calculating the policing costs for benefit-cost analysis is to consider how an intervention might affect policing behavior and be clear about what is, and is not, included in the price generated. Our estimates only include the costs incurred when the police respond to a crime that has been committed (e.g., the time spent by various officers and staff to call out officers to a scene, controlling a
crime scene, investigations, filling out crime paperwork, conducting interrogations and arrests, appearing in court). The estimates do not include other costs that might change in response to a reduced crime rate, such as fewer prevention activities, traffic stops, or a reduction in capital costs (e.g., vehicle purchases). Since our estimates only include the costs associated with the police’s response to crime, their most appropriate use is in examining short-run effects of interventions that reduce crime.

Labor is the predominant input into policing, as a comparison of payroll data and total operating expenditures (BJS, 2011) suggests labor costs are on average 68.1% of spending. Police labor includes not only sworn officers (patrol officers, detectives, sheriffs, and highway patrol officers, etc.), of whom there were approximately 780,000 in 2012, but also civilian, or non-sworn, personnel whose roles include crime analysts, dispatchers, civilian investigators, equipment or fleet management, and records management. Our study follows the work of Darrough and Heineke (1978) which distinguished two types of outputs. In particular, they considered the production of: (1) general service activities characterized by traffic control and emergency first aid, and (2) “crime solving-related activities”. They found production of these outputs was jointly determined in the sense that if a policy reduces crime and thus the level of resources needed for crime-responding services, law enforcement adjusts how many resources are devoted to general services.

The most visible capital items are police vehicles (e.g., police-modified and special service vehicles, mobile command centers, and light bars) and weapons (e.g., firearms, ammunition), but police personnel use a range of communication systems (e.g., police radios, telephone, and PBX Private Branch Exchange Systems) and information technology hardware and software (e.g., 911 software, police and court management software, jail management software, Records Management Software, Computer Aided Police Dispatch). Like any other enterprise, law enforcement agencies also have office furniture and equipment, and more

6 There are also privately funded law enforcement bodies, e.g., university police departments (Heaton et al., 2015).
7 Early studies collapsed all law enforcement outputs into one aggregate (Chapman et al., 1975; Ehrlich, 1973; Walzer, 1972), usually measured by arrest rate or clearance rate, under the assumption that this is ultimately the service demanded by the public.
8 Police officers perform a number of activities unrelated to responding to a crime, or general services, for example: assistance or service (discuss or encounter citizen/business/motorist), community-oriented service (e.g., community meeting, contact service providers, etc.), security check/check suspicious activity, education/prevention, intelligence (information gathering), and administrative duties (non-crime-related or unspecified).
9 Law enforcement conduct a number of activities when they become aware of a crime (Korre et al., 2014; Liederbach & Frank, 2003; Parks et al., 1999; Frank et al., 1997): control a crime scene, investigate a reported crime, complete an arrest, travel to and from various locations (e.g., crime scene, department), and perform crime-related administrative duties (e.g., reporting).
specialized accoutrements such as evidence toolkits (e.g., finger print and image recognition), security and surveillance devices (e.g., metal detectors, police surveillance equipment, speed radar, in-car video systems), and tactical equipment (e.g., body armor, ballistic shields). Most of this capital can be used for both crime-responding and general service outputs (e.g., traffic); although, it is likely that weapons, tactical equipment and evidence toolkits are used only for crime-responding. These equipment/supply expenses are included in this study, along with more minor purchases (e.g., paper).

Law enforcement agencies also have building resources. The main building input for a law enforcement agency is its department facilities. In addition, agencies purchase or lease firing ranges, training facilities, and gyms/fitness centers (LeBlanc, 2006). Property expenses are typically not considered because these costs are fixed over a long period of time, and are therefore unaffected by policies in the short or medium run. However, departments sometimes rent their facilities to other departments, so there is scope for considering that a sufficiently large change in crime could lead to changes in building costs. We note that cost estimates in this study do not include any large capital outlays, as we develop shorter-run estimates in which there are no changes to fixed capital costs.

4 New cost estimates for law enforcement services

4.1 Method

This study applies a top-down approach to estimate state-specific average variable costs of Part 1 crimes by crime type for law enforcement services. A top-down approach breaks down total expenditures into a relevant unit (e.g., total labor cost) using shares that could be attributed to costs of producing crime-responding services per specific crime (Chalfin, 2015).

We start with operating expenditures for all local and state\textsuperscript{10} law enforcement expenses in a state, thereby implicitly assuming labor inputs and equipment/supply inputs are the variable cost in policing. That figure is then multiplied by the proportion of time spent responding to crime in the state, as opposed to providing any other services (like prevention (e.g., patrol), traffic control, or other non-crime activities). Those state-level crime-related variable costs are then apportioned across crime

\textsuperscript{10} We do not include federal law enforcement costs.
types based on the findings of two recent studies in Houston, Texas (Police Executive Research Forum, and Justex Systems, 2014) and Vermont (Schlueter et al., 2014). To generate a total variable cost by crime type, adjustments are made for the proportion of crimes by type – giving us our state-specific numerators for each Part 1 crime type. These figures are then divided by the number of incidents of that crime type to yield an average variable unit cost for each crime type per state. Population weighting generates the overall national result.

Three twists complicate that otherwise straightforward calculation. First, the proportion of time that personnel spend on crime, as opposed to other services, varies by role. Patrol officers are less focused on crime-related activities than are detectives, for example. Jurisdictions also vary in how many staff members are assigned to those roles. So rather than using one proportion within a jurisdiction, each jurisdiction’s proportion of staff time spent on crime is computed as a weighted sum of role-specific proportions, based on how many of that jurisdiction’s staff is assigned to each of those roles. Next, the proportion of time spent on crime differs between rural and urban jurisdictions, so we use urban/rural proportion-weighted average time spent on crime for role-specific proportions; thereby adjusting for the state’s degree of urbanization and distribution of roles. Second, there is variation in the distribution of types of crimes across states. In a jurisdiction with a lot of violent crime, police will spend a larger proportion of their time on violent crimes than in a jurisdiction where property crimes predominate. So, we take into account the specific distribution of crimes by type in each state when adjusting for the total time spent on crime by type. Third, there is limited information on the time spent by crime type by law enforcement. Therefore, using the data that are available, we apply a probabilistic simulation approach known as Monte Carlo simulation (Metropolis & Ulam, 1949; Mooney, 1997; Gelman & Hill, 2006; Hunt & Miles, 2015). By using a Monte Carlo approach, we take into account the uncertainty in two input parameters in particular – time spent on crime and time spent by crime type – and generate thousands of separate and independent costs representing a possible set of state and national estimates. The resulting distribution from those calculations explicitly quantifies the uncertainty of the inputs, thus providing a more reliable estimate of the cost of law enforcement services by crime type than using only the few point estimates available.

Formally, we calculated the following for each crime type \( r \) for each state \( s \):

\[
C_{r,s} = \frac{\text{Expenditure on crime} \times \text{Share of time spent on a crime by a crime type}}{\text{Number of crimes of a crime type}}
\]

\[
= \left( E_s \times \left( \sum_i d_{i,s} \times (u_s p_{i,\text{urban},s} + (1 - u_s) p_{i,\text{rural},s}) \right) \right) \times \left( u_s \times \left( \frac{N_{r,s} \times N_{r,\text{urban},s}}{\sum_{r,s} N_{r,s} \times N_{r,\text{urban},s}} \right) + (1 - u_s) \times \left( \frac{N_{r,s} \times N_{r,\text{rural},s}}{\sum_{r,s} N_{r,s} \times N_{r,\text{rural},s}} \right) \right). 
\]
where

\[ E_s \] is the annual law enforcement operating expenditure in state \( s \),

\[ d_{i,s} \] is the density-adjusted proportion of officers assigned to role \( i \) in state \( s \),

\[ u_s \] is the urban density in state \( s \),

\[ p_{i,urban,s} \] is the proportion of time spent on crime by officers in urban areas serving in role \( i \),

\[ p_{i,rural,s} \] is the proportion of time spent on crime by officers in rural areas serving in role \( i \),

\[ t_{r,urban,s} \] is the number of hours spent on a crime type \( r \) in urban areas of state \( s \),

\[ t_{r,rural,s} \] is the number of hours spent on a crime type \( r \) in rural areas of state \( s \),

and

\[ N_{r,s} \] is the number of offenses of crime type \( r \) in state \( s \).

Reasonably strong data exist on state-level law enforcement payroll expenditures in 2010 (\( E \)), state-average proportions of officers in different roles in 2007 (\( d_i \)), the urban density in each state in 2010 (\( u \)), and the number of reported crimes (\( N_r \)) as the share of all crimes (\( f_r \)) addressed by police for each type of Part 1 crime (\( r \)) in 2010 in each state (\( s \)). By contrast, data for the time spent responding to crime by role (\( p_i \)) and time spent by crime type (\( t_r \)) are limited. We have estimated ranges for each of those quantities for urban and rural areas generally, but not by state. So we draw values for \( p \) and \( t \) for urban areas and rural areas separately for each state, using a uniform probability distribution with the minimum and maximum values based on the literature and data. We chose the uniform distribution because it gives the largest standard deviation.

Using these simulated values of \( p \) in urban and rural areas in each state, we weight the simulated values based on each state’s urbanization levels from the 2010 U.S. Census (\( u \)) and multiply by the payroll expenditure (\( E \)) to generate the expenditure on crime (first term in the numerator of the equation above). Simultaneously, we use the simulated values of \( t \) for a crime type in urban and rural areas of each state and the number of crimes (\( N \)) in the state to generate a share of time spent overall on each crime type (second term in the numerator of the equation above). Lastly, we divide by the relevant number of crimes (\( N \)) from 2010. This generates a unit cost for each crime type in each state. In addition, we provide a national estimate by using the share of the national population in each state (\( w \)) to generate a population-weighted average variable cost per unit for each crime type (\( C_r = \sum_s w_s \times C_{r,s} \)).

Using Monte Carlo simulation, we replicate this process 10,000 times to create a distribution of mean estimates for the average variable unit costs per
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UCR-reported crime type.\textsuperscript{11} Since the mean of a Monte Carlo simulation is the most likely estimate, not the exact “correct” value, we also consider that analysts may be interested in the wider, more reliable, range of cost estimates, so we report the 10th and 90th percentile values across trials.

4.2 Data

4.2.1 Variable costs (E)

This study uses local and state law enforcement operating expenditures – labeled “direct current expenditures” – from the Justice Expenditure and Employment Extracts for 2010 published by the Bureau of Justice Statistics, which is the most recent complete dataset available (BJS, 2011). The U.S. Bureau of Justice Statistics compiles data from the annual surveys of governmental finances and employment of the U.S. Census Bureau for “the function of enforcing the law, preserving order and traffic safety, and apprehending those who violate the law, whether these activities are performed by a police department, a sheriff’s department, or a special police force maintained by an agency whose primary responsibility is outside the justice system but that has a police force to perform these activities in its specialized area (geographic or functional)” (BJS, 2011). The surveys are completed using state government audits, budgets, and other financial reports. Employment in law enforcement refers to “the provision of regular police services, police patrols and communications, crime prevention activities, temporary lockups and holding tanks, traffic safety and engineering (but not highway planning and engineering), vehicular inspection and licensing, the maintenance of buildings used for police purposes, medical examiners and coroners, law enforcement activities of sheriff’s offices, non-sworn school crossing guards, parking meter readers, and animal wardens, if employed by a police agency” (BJS, 2011). Special police forces are included in the data if they are part of a general-purpose government. Short-term custody and detention (holding arrestees less than 48 hours) are considered part of the police protection function. Data for employees working in institutions with the authority to hold arrestees 48 hours or more are not included; this would be considered corrections services. In most states, sheriff’s departments are multifunctional agencies providing police protection, judicial, or correctional services. To allocate expenditure and employment data to the proper activity, the data for sheriff’s departments

\textsuperscript{11} We also conducted an analysis in which we use total costs of law enforcement for $E$, rather than only labor costs. These results are available upon request of the authors.
are prorated. In other words, only their services that fit the definition of policing services provided (e.g., holding arrestees for less than 48 hours) are included.

The labor costs included are all salaries, wages, fees, or commissions paid to employees during a pay period. The data are gross payrolls before deductions for a one-month period (March), meaning paid leave, supplemental pay (e.g., overtime), taxes, and pension or retirement contributions by the employee are included. Employer contributions (“fringe benefits”) are included in this figure, such as insurance, retirement and savings, and legally required benefits (Social Security and Medicare, federal unemployment, state unemployment, and workers’ compensation), but does exclude self-administered retirement system benefits. We multiply monthly payroll by 12 to generate an annual labor cost (Table A-1 in the appendix). To standardize the relative dollar wages for law enforcement across all the state jurisdictions, we use an index of public administration wages across states (BLS, 2012b), also shown in Table A-1.12

Operating expenses also include equipment/supply purchases. The types of equipment and supplies purchased are not specified in the documentation. These can be considered the capital overhead expenses, with labor overheads, such as non-sworn labor (e.g., administration), already included in our labor costs.

Finally, we take into account the inefficiencies that arise from behavioral responses to taxes (deadweight loss of taxation). The social cost of raising revenue for law enforcement services is the net incremental changes in government budget outlays funded by taxes (Boardman et al., 1997; Boardman, 2011). Government spending on law enforcement services for crimes prevented leads to less deadweight loss and is considered a benefit. We follow a summary of deadweight loss estimates for local jurisdictions in Boardman (2011) by including 20% of government spending as deadweight loss. Specifically, we multiply payroll expenditures by 20% since all of this spending is funded through taxation.

4.2.2 Police officer roles of a department (d)

The amount of time spent responding to crime depends on the role of the officer. A state-representative dataset, Law Enforcement Management and Administrative Statistics (LEMAS), surveys state police, local police, and sheriff’s departments and includes questions regarding the level of employment across job types and roles (USDOJ, 2011). As shown in Table A-2 in the appendix, LEMAS

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12 Ideally, we could use data for Police Protection (NAICS code 922120) specifically, but the data are not complete. Rather than impute for states with missing data, we elect to use the higher NAICS code 92: Public Administration.
identifies three key roles: general officer (“uniformed officers with regularly assigned duties that include responding to citizen calls for service”), community police officers (“full-time sworn personnel specifically designated to engage in community policing”), and school resource officers (“number of sworn personnel whose primary duties are related to school safety, excluding crossing guards”). Personnel can be counted more than once for these roles. Regarding task forces, within the category of sworn officer, LEMAS data also includes the number of sworn personnel assigned to various task forces (“full-time sworn personnel with general arrest powers assigned to multiagency task force”) including gang, drugs, human trafficking, and anti-terrorism. Personnel can be counted to more than one task force. For detectives, within the category of sworn officers, officers can be assigned to general patrol duties, investigative duties (e.g., detective), jail-related duties, court security duties, or process serving duties. Personnel are only counted once to a role in this categorization.

We create an index for all roles for each state using the most recent year of LEMAS data available at the time of this study, 2007 (Table A-3 in the appendix). The state-average proportions for a department are: 51.0% (general officers), 14.1% (community police officers), 15.7% (investigators), and 2.3% (task force officers). 16.9% are considered other (e.g., school resource officers, internal affairs, court security, process serving) that we assume are involved in a negligible proportion of Part 1 crimes. We scale the simulated values to sum to one.\footnote{Since the proportion of officers in each role is independently drawn, the total proportion of a department could exceed one. Therefore, we use the proportion of the total simulated values.}

4.2.3 Urbanization (u)

The U.S. Census provides data on several measures of the urban and rural population, including the percentage of the total population of a state that lives in urbanized areas (U.S. Census Bureau, 2012). The percentage of the population that lives in urban areas ranges from 17.4% (Vermont) to 92.2% (New Jersey), with a median value of 59% (Indiana).
4.2.4 Police time allocated to crime-responding services (p)

In a search of nationally representative estimates of police time use on crime specifically, we identified one national survey of police chiefs and “frontline” officers asking respondents how much time they spent on a list of activities (Korre et al., 2014). Given we identified only one study using national data based on a survey approach, we also searched for state-specific studies, particularly those using time diary or observation approaches. We identified seven studies using time diary or observational approaches that provide estimates for community policing officers, task force officers or detectives/investigators specifically (see Table A-4 in the appendix). As described earlier, the literature distinguishes inputs used to “solve crime” from inputs used to produce “other services”. Activities identified within each of the two categories can be assigned as follows:

- **Crime-response activities**: Administrative (crime-related); Arrest; Crime scene; Court time; Investigate; En Route/Waiting.

- **Non-Crime-response activities**: Assistance or Service (discuss or encounter citizen/business/motorist); Community-Oriented Service (community meeting, contact service provider, etc.); Education/prevention/training; Intelligence (information gathering); Issuing of subpoenas; Meet Other Police; Non-Task/Personal; Other (car maintenance, shift preparation); Problem-Directed; Traffic; Patrol – General or Directed (foot, motor); Ordinance Enforcement (citations/tickets); Security check, check suspicious, Welfare check.

In the survey of self-reported time use by 951 frontline officers across the country, the mean and 95% confidence intervals of time spent on crime-response and non-crime-response activities are provided for rural, metropolitan and suburban areas (Korre et al., 2014). We use the mean of metropolitan and suburban areas to generate the urban share. For general patrol, the proportions of time spent on crime in rural jurisdictions yield a mean of 23%, with a 95% confidence interval of 18% to 35%. The corresponding proportions in the urban jurisdictions yield a mean of 27% (confidence interval: 24%–31%). Four estimates each were found for community policing and task forces (and all were gang-oriented task forces that came from one study). These estimates spread over broader ranges (4%–41% and 22%–49%, respectively), with medians of 30.5% and 44%, respectively. Since we only have general patrol literature estimates for rural areas, for the other job types, we use the ratio of general patrol to the other job types in urban areas.14 We identified

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14 For example, in urban areas, the ratio of time spent on crime by general patrol officers to task force officers is 1.0 (0.44 to 0.44). This ratio is applied for rural areas so the proportion of time spent on crime
just one study providing information about time spent by detectives (Greenwood & Petersilia, 1975). The study collected data using computer readable case assignment files maintained by the Kansas City, Missouri police department in 1975, and found 55.7% of detectives’ time were devoted to case work, while the other 44.3% was spent on administrative details unrelated to cases, such as surveillance, crime prevention, youths, and time for which there are no accounted tasks or activities. For the simulation, we assume these values follow a uniform distribution with minimum and maximum from the literature.

4.2.5 Hours of police time spent by Part 1 crime type (t)

Thus far, we reduce labor expenditures to those resources spent working on crime. However, this study focuses on costs by crime type. To do so, we follow the standardization of the types of crimes in the United States developed by the Federal Bureau of Investigation (FBI). The FBI Uniform Crime Reporting (UCR) Program indexes offenses into two groups, Part 1 and Part 2 crimes, and provides data across jurisdictions and over time (FBI, 2013a). Contributing law enforcement agencies submit month-specific information on the number of Part 1 offenses known to law enforcement, categorized as violent crime (homicide, rape & sexual assault, robbery, and aggravated assault) and property crime (burglary, larceny/theft, motor vehicle theft, and arson); agencies provide only arrest data for Part 2 offenses, which include offenses such as drug possession and sales, disorderly conduct, driving under the influence, gambling, among many others.

We need to eliminate some of the labor included for officers and detectives working non-index crimes (Part 2 crimes), such as vice or narcotics. Information about the share of time spent on Part 1 crimes by type across many urban and rural areas of the U.S. were not available. Two recent studies provide information about how much time local, county and/or state police officers spent on different crimes by collecting administrative data or using time-diary approaches: one was conducted in Houston, TX (Police Executive Research Forum, and Justex Systems, 2014) and the other in Vermont (Schlueter et al., 2014). We use Houston to proxy for urban areas and Vermont for rural areas across the U.S. Clearly, there are issues with using one site to proxy for multiple locations. However, the proxies are not unreasonable when comparing the extent to which officers respond to property and violent crimes in Houston, Vermont, and rural and urban areas across the country. Table A-5 in the appendix shows that the average number of violent and property

for task force officers is 0.12 (the same as general patrol in rural areas in the time diary and observational studies).
crimes per officer in cities, 29.13 and 164.50 respectively, is more similar to Houston (approximately 41 and 203) than Vermont and other rural counties. In Vermont, an officer handles one violent crime and 22 property crimes on average annually, which is far more similar to small areas where officers deal with 1.3 violent crimes and 11.5 property crimes. Given the uncertainty of the literature estimates in areas outside of Houston and Vermont, however, we use these minimum and maximum percentage differences in urban areas and rural areas (compared to their proxy) to generate urban/rural minimum and maximum values for drawing from a uniform distribution in the simulation.

Regarding the time spent by crime type data, for Houston, the data were for investigators/detectives specifically, not general police officers (see Table A-6 in the appendix). A total of 167 Houston Police Department (HPD) investigators maintained a time expended log on a case-by-case basis during a 60-day period in the spring of 2013. Time spent was recorded for 19 categories of effort. The investigators represented all investigative units that respond to a complaint, meaning detectives that work all the crime types ranging from vice (gambling, prostitution), homicide, robbery, sex crimes, etc. The time data were combined with caseload data provided by HPD to obtain the annual number of cases investigated by offense category and within each offense category by the four suspect statuses. For Vermont, the time spent per arrest for each crime type is based on three years of data collected from CAD/RMS for law enforcement officers and a survey for all other roles, as described earlier (Table A-7 in the appendix), which we reclassified to align with the FBI Index crime types.

The Houston and Vermont data (Police Executive Research Forum, and Justex Systems, 2014; Schlueter et al., 2014) reflect the time it takes for an investigation by crime type (e.g., more time for a homicide, rape, or robbery). We summarize the data from the two studies used in the simulation in Table A-8 (in the appendix). There are few substantial differences between the urban and rural jurisdictions apart from far more time on violent crime being spent on robberies in Houston than in Vermont (Schlueter et al., 2014). Indeed, the relative time spent on robberies and aggravated assault in Houston is surprising; thus, we conduct a sensitivity analysis to assess the implications for the results (see Section 5.2). Conversely, in Vermont, relatively more time is spent on rape cases, although, this may be because the Vermont study included all roles involved in addressing a crime (e.g., sex assault nurse examiners), while the Houston study included only investigators.

15 Interviewing (victim, witnesses, perpetrator/suspect), conferring with HPD personnel (e.g., responding officers), attempting to locate someone involved with the case (e.g., witness, relative), database or records check (e.g., credit check), running a warrant, reviewing case file, etc.
16 Suspect Unknown, Possible Suspect ID, Known Suspect at Large, and Suspect in Custody.
In the simulation, the number of hours spent per crime, by crime type, is drawn from a uniform distribution using the Houston and Vermont literature and the data on crimes per officer (Table A-9 in the appendix) to generate the minimum and maximum values. Specifically, to obtain a minimum and a maximum, the hours spent for each crime type in the urban areas is multiplied by the percentage differences in the share of a crime per officer.

To generate the overall share of time spent on a crime type, we need to use the frequency of crimes by type as well. So, we multiply the time spent on a crime type \( t_r \) by the number of reported crimes of that type \( N_r \), and sum for all Part 1 and Part 2 crimes \( \sum t_r \times N_r \) in the state. We divide the total time spent on a crime type by the total time spent for all crimes to generate a share. We provide more details regarding the data for the number of crimes in the next subsection.

### 4.2.6 Part 1 crimes reported to police (N)

The number of reported crimes is taken from the 2010 FBI’s Uniform Crime Report (FBI, 2011). The key advantage of using the UCR-reported crimes is that the definitions of crimes by type are standardized and comparable across jurisdictions. A disadvantage, however, is that there is missing data particularly for smaller agencies and the missing-data imputation method is not described in enough detail to use these data to generate costs at a more local level (Maltz & Targonski, 2002).

We use 2010 data to be consistent with the most up-to-date expenditure data (see Table A-10 in the appendix for the number of crimes by state). The UCR is based on the Hierarchy Rule, in which only the most severe crime is counted per incident. The importance of this for our purposes is that it takes into account economies of scale when multiple offenses occur during an incident. For example, where two offenses (e.g., homicide and theft) occurred during an incident, we assume police did not have twice the work. Rather, we considered the activities performed by police applied to all the crimes that occurred during an incident (e.g., paperwork, investigation). This is an important point for the purposes of this paper because it means that in the main equation we do not divide by all offenses that...

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Note the unit of measurement is the number of incidents, not the number of offenses. One incident can involve multiple offenses (e.g., a victim is both assaulted and had their car stolen), which results in multiple charges. The distinction is blurred in the UCR system which recognizes only the most serious offense associated with any given incident, under its so-called “Hierarchy Rule” (FBI, 2011). For example, if an incident involves an aggravated assault and a theft, the incident is recorded in UCR as an aggravated assault. This is helpful for cost studies because the investigation of those two separate offenses can share labor time (e.g., investigation by detectives, paperwork) and equipment (e.g., fuel for travel, police surveillance equipment, police radios). Thus, denoting activities in terms of incidents helps take account of economies of scope in production of crime-resolving services.
were reported; rather, we divide by the number of incidents known to the police. This means we estimate the cost of (or benefit from avoiding) additional incidents, not additional offenses, arrests or victimizations.

4.2.7 Summary of simulation value assumptions

Tables A-8 and A-9 in the appendix summarize the values of the parameters for the simulations where \( p \) and \( t \) are drawn from a uniform distribution. This distribution means we implicitly assume that all effects on the reported value, between the minimum and maximum, are equally likely for the particular source of uncertainty. As described earlier, the values for the other variables in the cost equation (\( w, E, d, u, \) and \( N \)) are actual values for each state from various data sources described earlier and do not vary across runs of the simulation.

To better understand how these parameters come together for our calculations, we provide a four-step example using one state for one crime type. Let us consider the cost of robberies in Illinois in the first trial of the simulation. The first step focuses on wages: Starting with the payroll of law enforcement services in Illinois; adding employer simulated benefits rate; adding deadweight loss; and normalizing for public administration wages in Illinois (\( E_{\text{Illinois}} = \$3,452,928,662 = \$2,900,100,000 \times (1 + 0.40 \text{ simulated fringe benefit rate} + 0.2 \text{ deadweight loss}) \times 0.74414 \) using row 13 in Table A-1). Second, we generate the proportion of police time allocated to responding to crime, taking into account the variation between rural and urban areas and officer roles. To do so, we generate simulated values of the share of time spent on crime in urban Illinois for each role (suppose we obtain \( p_{\text{commodo,urban,Ill}} = 0.21, p_{\text{general,urban,Ill}} = 0.27, p_{\text{task,urban,Ill}} = 0.40, p_{\text{detect,urban,Ill}} = 0.65 \) using rows 8–11 in Table A-8 Table 1) and in rural Illinois for each role (suppose \( p_{\text{commodo,rural,Ill}} = 0.05, p_{\text{general,rural,Ill}} = 0.12, p_{\text{task,rural,Ill}} = 0.07, p_{\text{detect,rural,Ill}} = 0.17 \) using rows 3–6 in Table A-8). These are weighted by the urban density (\( u_{\text{Ill}} = 0.80 \)) or rural density (\( 1 - u_{\text{Ill}} = 0.20 \)) accordingly, and adjusted for the proportion of each role across departments of Illinois in the LEMAS data (\( d_{\text{general,Ill}} = 0.57, d_{\text{task,Ill}} = 0.01, d_{\text{commodo,Ill}} = 0.10, d_{\text{invest,Ill}} = 0.18 \) using row 13 in Table A-3). Thus far, we have the pieces of information to generate a total variable cost of responding to all Part 1 and Part 2 crimes.

The third step is to break down costs further for each crime type, specifically robbery in this example, by simulating a value of hours spent per crime for each crime type in urban areas (suppose \( t_{\text{murder,urban,Ill}} = 250, t_{\text{rape,urban,Ill}} = 25, t_{\text{robbery,urban,Ill}} = 9, t_{\text{aggassault,urban,Ill}} = 40, t_{\text{burglary,urban,Ill}} = 4.8, t_{\text{theft,urban,Ill}} = 5.1, t_{\text{mvft,urban,Ill}} = 2.7, \) and \( t_{\text{other,urban,Ill}} = 0.21 \) using column 1 in Table A-9). These are multiplied by the relevant number of crimes in the state (\( N_{\text{murder,,Ill}} = 704, \)
Estimates of law enforcement costs by crime type for benefit-cost analyses

\[ N_{\text{rape, Ill}} = 3066, N_{\text{robbery, Ill}} = 20,386, N_{\text{aggression, Ill}} = 32,976, N_{\text{burglary, Ill}} = 77,472, N_{\text{theft, Ill}} = 242,681, N_{\text{mvt, Ill}} = 28,911, \text{ and } N_{\text{other, Ill}} = 119,068 \] (using row 13 in Table A-10). The hours spent for each crime, in this example robbery \((= 183,474)\), is divided by the sum of the total number of hours \((= 3467,767)\) to generate the share of time spent on robbery in urban areas \((= 0.0529)\) and weighted by the proportion of the population in urban areas in Illinois \((u_{\text{Ill}} = 0.80)\) to generate the weighted share of time spent on robbery in urban areas \((= 0.0423)\). The procedure is replicated for rural areas (suppose \(t_{\text{murder, rural, Ill}} = 1201, t_{\text{rape, rural, Ill}} = 217, t_{\text{robbery, rural, Ill}} = 6, t_{\text{aggression, rural, Ill}} = 5.2, t_{\text{burglary, rural, Ill}} = 4.8, t_{\text{theft, rural, Ill}} = 2.5, t_{\text{mvt, rural, Ill}} = 4.2, \text{ and } t_{\text{other, rural, Ill}} = 2.0\) using the second column in Table A-9). Using the same number of crimes, we have the hours spent for each crime \((= 122,316 \text{ for robbery})\), which is divided by the sum time spent \((= 3142,748)\) to generate the share of time spent on robbery \((= 0.0389)\) and weighted by the proportion of the population in rural areas \((1 - u_{\text{Ill}} = 0.20)\) accordingly to generate the weighted share of time \((= 0.0078)\). Added to the urban weighted time spent, we have the share of time spent in Illinois on robbery \((0.0501)\).

These key three steps thus far would result in our total variable cost per crime type. In order to generate a “per unit” measure, in the fourth step, we divide by the number of UCR-reported crimes \(N_{\text{robbery, Illinois}} = 20,386 \text{ using row 13 in Table A-10}\) thereby generating an average variable cost per unit. Using all these pieces for our example of robberies in Illinois, we plug the values into Equation (1):

\[
C_{\text{Robbery, Illinois}} = \frac{3,733,295,616 \times \left[ (0.10 \times (0.8 \times 0.21 + 0.2 \times 0.05)) + \right]}{20,386} \times 0.0501
\]

We conduct this procedure simultaneously for each crime type for every state. We then multiply the cost per unit estimate in each state by its proportion of the national population, and sum across all states for each crime type to generate a population-weighted mean estimate of the first round of the simulation. We also store the 10th percentile and 90th percentile estimates for each crime type. Then, we repeat this procedure 9999 times. The results shown are the mean (and min, max) 10th percentile value of the 10,000 trials, mean of the population-weighted averages (and min, max), and mean 90th percentile value (and min, max).
5 Results: monetized benefits of crime reduction by crime type for law enforcement services

5.1 Cost per unit by crime type

Table 2 presents results of the Monte Carlo simulations in terms of the weighted average of the average variable cost per crime estimates by crime type, as well as the mean estimate at the 10th percentile and 90th percentile (see Table A-11 for results by state). For violent crimes, the population-weighted average benefit of avoiding a UCR-reported crime ranges from $158,216 for a murder to $2768 for a robbery. This is consistent with what we might expect because in the event of a murder, there are typically many more sworn officers (e.g., patrol officers and detectives), non-sworn officers (e.g., dispatchers, lab technicians, crime analysts), and equipment/supplies involved than for a robbery. The policing-related benefit of avoiding a reported FBI Index violent crime (murder, rape & sexual assault, robbery, and aggravated assault) is $10,880. The minimum and maximum national means are $9846 and $12,155 respectively.

For property crimes, the population-weighted average benefit per unit of UCR-reported crime avoided ranges from $966 for a motor vehicle theft to $1482 for a burglary. The benefit of avoiding a FBI Index property crime (burglary, larceny/theft, motor vehicle theft), excluding arson, is $1294 (mean min: $1335, mean max: $1446).

The mean 10th percentile and mean 90th percentile average variable cost per unit estimate by crime type of the MC simulation are shown in the last two columns of Table 2. The mean cost per unit for UCR-reported Part 1 violent crimes are $6901 to $15,415, at the 10th and 90th percentile respectively, and $696 to $1678 for UCR-reported Part 1 property crimes, excluding arson. The wide range implies there is variation across states. For example, the 10/90 unit cost estimates for murder are about $118,000 to $250,000, whereas the weighted average estimate is approximately $160,000. The percentile estimates are not population-weighted averages. They are the low and high estimates in each round of the simulation, which means the differences across jurisdictions are driving the wide range between the 10th and 90th percentiles. This is supported by findings for each state shown in Table A-11.

18 These values reflect the states with the lowest cost in each round (10th percentile) and the greatest cost in each round (90th percentile).
Table 2  Monte Carlo simulation results of average variable cost per unit of UCR-reported crime, in 2010 dollars.

<table>
<thead>
<tr>
<th></th>
<th>Weighted Mean</th>
<th>Percentiles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td><strong>Violent crime</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murder</td>
<td>$158,216 (144,278–176,517)</td>
<td>$118,440 (99,100–138,855)</td>
</tr>
<tr>
<td>Rape &amp; sexual assault</td>
<td>$24,120 (21,944–26,581)</td>
<td>$17,103 (13,702–20,445)</td>
</tr>
<tr>
<td>Robbery</td>
<td>$2768 (2454–3178)</td>
<td>$1312 (1031–1581)</td>
</tr>
<tr>
<td>Aggravated assault</td>
<td>$10,257 (9145–11,639)</td>
<td>$3493 (2657–4354)</td>
</tr>
<tr>
<td><strong>Property crime</strong></td>
<td>$1294 (1335–1446)</td>
<td>$696 (552–819)</td>
</tr>
</tbody>
</table>

Note. N = 10,000 for each value. Minimum and Maximum values shown in parentheses. Weighted Mean refers to the mean of all the population-weighted average estimates of the MC simulation of average variable costs. Percentiles refer to the (unweighted) mean of all the 10th percentile or 90th percentile estimates of the MC simulation.

5.2 Sensitivity analyses

We conduct two sensitivity analyses, assessing the influence of the two input parameters using simulated values. The first column of Table 3 displays results of an analysis using only time-diary or observational studies, thereby not including the national self-report survey (Table A-3), for proportion of time spent on crime-response activities. This has the immediate impact of reducing the upper bound for rural jurisdictions and increasing the upper bound for urban jurisdictions. Running the simulation with these values, we find that our results are robust because there are relatively small increases in violent and property crime.

We then test the sensitivity of results to the other input parameter in the model using simulated values, hours of time spent per crime by type (Table 3, column two).
Table 3  Results of sensitivity analyses.

<table>
<thead>
<tr>
<th>Crime Type</th>
<th>Change share of time spent on crime</th>
<th>Change time spent by crime type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Violent crime</td>
<td>$11,832</td>
<td>$5,410</td>
</tr>
<tr>
<td>Murder</td>
<td>$170,645</td>
<td>$199,687</td>
</tr>
<tr>
<td>Rape &amp; sexual assault</td>
<td>$25881</td>
<td>$30,149</td>
</tr>
<tr>
<td>Robbery</td>
<td>$3031</td>
<td>$3594</td>
</tr>
<tr>
<td>Aggravated assault</td>
<td>$11,272</td>
<td>$3595</td>
</tr>
<tr>
<td>Property crime</td>
<td>$1414</td>
<td>1673</td>
</tr>
<tr>
<td>Burglary</td>
<td>$1616</td>
<td>$1910</td>
</tr>
<tr>
<td>Larceny/Theft</td>
<td>$1394</td>
<td>$1652</td>
</tr>
<tr>
<td>Motor vehicle theft</td>
<td>$1050</td>
<td>$1238</td>
</tr>
</tbody>
</table>

Note. $N = 10,000 for each value. Values shown are the weighted mean, or mean of all the population-weighted average estimates of the MC simulation, and the unweighted mean of all 10th percentile to 90th percentile estimates are in parentheses.

In particular, we are concerned that the amount of time spent on aggravated assaults seemed relatively high compared to robberies in the study we had to use for urban areas (over 300% more time), and that this may not be the experience of officers in many other urban jurisdictions. Therefore, we use the same ratio of time spent on robberies to aggravated assaults as in our rural study, which was 1-to-1. This has the immediate impact of reducing time on aggravated assaults in urban areas by approximately 300%. The analysis, in column two, shows these new results fit in between the mean 10th and 90th percentile estimates in the main body of the paper. Perhaps more importantly from a methodological point of view is that this sensitivity analysis shows some mechanics of our estimation because not only does the cost of aggravated assault fall, but the cost is now the same as robberies and the other costs changed. That is because the time spent is a share measure, so by reducing the time spent on one crime type, the relative time spent to other crimes changes; and thus, the costs per unit for other crime types change.
6 Conclusion

The social benefits of crime prevention include both the value to individuals and society of less victimization and of increased availability of criminal justice resources. This study estimates the law enforcement resources that can be saved when police have fewer crimes to which they must respond. The resources considered are labor (measured by salaries, overtime, paid leave, employee contributions, and fringe benefits) and equipment/supply costs. Using a Monte Carlo simulation approach to account for some uncertainties about the exact parameter values in the calculation for each state, we find the following population-weighted mean, average variable costs per UCR-reported crime for law enforcement services are approximately (in 2010 dollars): $144,000–$175,000 (homicide), $21,000–$26,000 (rape and sexual assault), $2400–$3200 (robbery), $9100–$11,600 (aggravated assault), $1500–$1700 (burglary), $1100–$1400 (larceny/theft), and $900–$1100 (motor vehicle theft).

Results of this study are somewhat different from marginal costs estimates in the field. Fowles and Nyström (2012) found the marginal cost for law enforcement services for one reported Part 1 property crime (excluding arson) in 2010 was $880 and $4509 for a Part 1 violent crime in Utah. This study finds the average variable costs in Utah for law enforcement services for one, UCR-reported Part 1 property crime (excluding arson) are approximately $1000 to $1500 and a Part 1 violent crime is $10,000 to $13,700.

Of course, there are some limitations in our approach that merit discussion. A set of sensitivity analyses demonstrate robustness in our 10th and 90th percentile estimates. However, there are some changes in results that help to understand how the estimation procedure works. We find that reducing the time spent on one crime type, aggravated assaults in urban areas, reduces not only the cost per unit of this crime type, but also changes the costs of other crime types. This is unlike a change in a parameter on expenditure, which reduces costs across all crime types similarly. Given the large differences in time spent on robberies and assaults in urban compared to rural studies, and that we only have one of each, our results suggest there is a great need to improve information on resources expended by crime type across jurisdictions. We also stress the need for researchers to use the ranges in this study for violent crimes in particular, rather than mean point estimates.

In terms of freeing up law enforcement resources, there are a couple of ways to think about how these findings play out in practice. First, the results of this study indicate that from the perspective of law enforcement resources, preventing one reported robbery is preferable to preventing 2 reported burglaries. Second, the average labor inputs to produce crime-responding services for an average crime would
allow law enforcement to transfer hours to other services for the benefit of society. In order to understand the scale of labor hours transferred, consider the median hourly wage (BLS, 2012a) plus fringe (62.2%), employer taxes (7.65%), and capital overhead (68.2%) of law enforcement in 2010 was $120.

Findings of this study suggest avoiding one, reported motor vehicle theft would allow law enforcement to transfer approximately $960 of labor and equipment/supplies, or equivalently, about 1 working day of one sworn and 0.5 day of one non-sworn law enforcement personnel (using wage, fringe, and taxes) to dispatch officers, conduct interviews, complete paperwork, identify the vehicle, conduct any arrests, among other activities. In addition, approximately $100 worth of equipment/supplies, such as police vehicles, gasoline, etc. Of course, these are only the benefits through the law enforcement phase of the criminal justice system, but a BCA analyst will also want to include benefits via the judicial/legal system, institutional corrections, and community supervision systems, and more importantly, the pecuniary and non-pecuniary impacts to victims and society.19

The main contribution of this study is to generate state-level, crime-specific, average variable cost estimates for policing services for each Part 1 crime. While there is a movement toward encouraging evidence-based policing (e.g., Braga & Weisburd, 2006), there remains insufficient evidence on the law enforcement-specific costs of different crime types to support decisionmaking by policymakers and practitioners across the country. One study compared the effect sizes of various crime control methods to their net benefits and came to surprisingly different conclusions – there was a shockingly low correlation between effect size and net benefits, providing further evidence that a more nuanced and complete understanding of the benefits associated with crime reduction is essential to making smart

19 Heaton (2010) provides a useful summary of methodological approaches and findings for the total costs to victims by Part 1 crime type in the studies of Cohen and Piquero (2009), McCollister et al. (2010), and Cohen et al. (2004). Adjusting to 2010 dollars, the average tangible and intangible benefit to society of avoiding one crime is $9355,225 (homicide), $235,650 (rape), $72,769 (robbery), $94,359 (aggravated assault), $14,165 (burglary), $2314 (larceny), and $9820 (motor vehicle theft). As an example of the scale of costs of crime for judicial/legal services, Hunt et al. (2016) find the national average costs per reported crime is: $22,000–$44,000 (homicide), $2000–$5000 (rape and sexual assault), $600–$1300 (robbery), $800–$2100 (aggravated assault), $200–$600 (burglary), $300–$600 (larceny/theft), and $200–$400 (motor vehicle theft). Due to concerns about the rising costs of prisons and overcrowding, there appears to be a substantial number of studies examining the marginal cost per person for corrections. One study estimated the costs per unit to 40 states by collecting operating costs and inmate population size through a survey and found the cost per inmate-year in 2010 dollars was $31,286 on average (Henrichson & Delaney, 2012). The last element of the criminal justice system costs is community supervision, or probation and parole costs, which are sometimes included with corrections. An estimate of the average total cost per person-year in community supervision, in 2010 dollars, based on survey responses from 33 states was approximately $1350 per probationer to $2900 for a parolee (Pew Center on the States, 2009).
Estimates of law enforcement costs by crime type for benefit-cost analyses

Estimates of law enforcement costs by crime type for benefit-cost analyses (Marsh et al., 2008). Previous estimates tend to group crime types together to generate unit cost of violent crime or property crime, for example, or do not differentiate by the phase of the criminal justice system (e.g., law enforcement, courts, corrections). However, researchers may identify an impact of their program on specific crime types, e.g., aggravated assaults or motor vehicle theft, and using the general categories may lead to over- or underestimates of the benefit of crime reduction because it is likely that the resources used for different crime types varies. Furthermore, recent estimates in the literature focus on the specific jurisdictions of Washington state (Aos et al., 2006) and Vermont (Schlueter et al., 2014), yet we might expect differences in productivity and cost minimization strategies across jurisdictions and thus costs per unit of crime.

While greater costs per unit are not necessarily an indication of waste, lower spending is also not necessarily a sign of efficiency; changes in environment and criminal justice demands can change spending. It is beyond the scope of this study to test the determinants of cost per unit of law enforcement services, but results of this study suggest it could be a productive pursuit. There is a substantial amount of variation in the costs per unit within and across crime types and jurisdictions. Furthermore, in the data used to calculate costs, we observe variation in socio-economic factors such as urban density, expenditure per capita on law enforcement, population levels, and income tax rates. These and other factors could be important in understanding why crime costs more in some jurisdictions than others.

Another potential avenue for future research would be to estimate the cost of Part 2 crimes, such as simple assault. We did not include Part 2 crimes because the data available are only for arrests, not reported crime. Furthermore, since Part 2 crimes tend to be less reliably enforced and reported (Gove et al., 1985), future research would need to focus on a theoretically grounded and empirically reliable measure of law enforcement production quantity.20

Supplementary material

To view supplementary material for this article, please visit https://doi.org/10.1017/bca.2018.19.

20 In addition, there would need to be consideration of how to include federal law enforcement costs. Most cases that go through the federal jurisdiction are not Part 1 incidents; in fewer than 4% of federal cases, the most serious offense is a Part 1 violent or property offense (Motivans, 2015). So the federal cost implications may be important to include in Part 2 crime costs. However, there are jurisdictional complications in estimating the federal cost implications of local or state policies impacting crime that would need to be properly worked out.
References


FBI. 2013b. “Uniform Crime Reporting Program Data: County-Level Detailed Arrest and Offense Data, 2012.”


