The cost of crime to society: New crime-specific estimates for policy and program evaluation

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ABSTRACT

Estimating the cost to society of individual crimes is essential to the economic evaluation of many social programs, such as substance abuse treatment and community policing. A review of the crime-costing literature reveals multiple sources, including published articles and government reports, which collectively represent the alternative approaches for estimating the economic losses associated with criminal activity. Many of these sources are based upon data that are more than 10 years old, indicating a need for updated figures. This study presents a comprehensive methodology for calculating the cost to society of various criminal acts. Tangible and intangible losses are estimated using the most current data available. The selected approach, which incorporates both the cost-of-illness and the jury compensation methods, yields cost estimates for more than a dozen major crime categories, including several categories not found in previous studies. Updated crime cost estimates can help government agencies and other organizations execute more prudent policy evaluations, particularly benefit–cost analyses of substance abuse treatment or other interventions that reduce crime.

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1. Introduction

Crime generates substantial costs to society at individual, community, and national levels. In the United States, more than 23 million criminal offenses were committed in 2007, resulting in approximately $15 billion in economic losses to the victims and $179 billion in government expenditures on police protection, judicial and legal activities, and corrections (U.S. Department of Justice, 2004a, 2007a, 2008). Programs that directly or indirectly prevent crime can therefore generate substantial economic benefits by reducing crime-related costs incurred by victims, communities, and the criminal justice system.

Substance abuse treatment is one example of an intervention that not only has the potential to improve individual lives through recovery from addiction but also may generate significant economic benefits to society by reducing addiction-related crime. Numerous studies have documented the strong relationship between substance use and crime, and although causality between the two has not been conclusively established, U.S. statistics show that more than 50% of state and federal inmates used drugs in the month prior to committing the offense for which they were incarcerated and that more than a quarter of all offenders were using drugs at the time of their offense (U.S. Department of Justice, Bureau of Justice Statistics, 2006; Miller et al., 2006). Most substance abuse treatment evaluations use standard assessment instruments such as the Addiction Severity Index (ASI) (McLellan et al., 1992) and Global Appraisal of Individual Needs (GAIN) (Dennis et al., 2006), which include measures of criminal activity or legal problems. Economists can therefore use these criminal activity measures to estimate the dollar benefits of substance abuse interventions if they have access to current and reliable unit cost estimates for individual crimes. Many of the crime cost estimates currently available to analysts are more than 10 years old and were generated from even older data (e.g., Rajkumar and French, 1997; Cohen, 1988; Cohen et al., 1994; Miller et al., 1996).

As presented in numerous prior studies, the cost of crime to society can be divided into four fundamental components:

Victim costs: Direct economic losses suffered by crime victims, including medical care costs, lost earnings, and property loss/damage.

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Criminal justice system costs: Local, state, and federal government funds spent on police protection, legal and adjudication services, and corrections programs, including incarceration.

Crime career costs: Opportunity costs associated with the criminal's choice to engage in illegal rather than legal and productive activities.

Intangible costs: Indirect losses suffered by crime victims, including pain and suffering, decreased quality of life, and psychological distress.

Measuring losses across these four components provides an estimate of the economic cost of individual crimes. The broad societal perspective is appropriate for economic analysis and program evaluation because more narrow perspectives (e.g., crime victim, criminal justice agency, community organization) apply to specific stakeholders or agendas. For comparability with previous research, this study uses established methods while incorporating the most current sources of crime and cost data to produce an expanded list of unit cost estimates for 13 criminal offenses, including several crime categories not found in previous studies. These new crime cost estimates are necessary inputs for full economic evaluations of addiction treatment, neighborhood policing, welfare reform programs, and any other programs or interventions with a crime prevention component.

2. Literature review

Previous studies estimating the economic impact of criminal activity vary greatly in their perspective, methods, measures, and data sources. The literature includes peer-reviewed publications, as well as unpublished manuscripts and government reports.

2.1. Government reports

Many government agencies are responsible for collecting criminal activity data as well as estimating the cost of crime. For example, the U.S. Department of Justice (DOJ) collects large amounts of criminal activity data for analysis and reporting. The Bureau of Justice Statistics (BJS), a quantitative research component within the DOJ, publishes an annual report entitled "Criminal Victimization in the United States" based on its National Criminal Victimization Survey (NCVS). While this report can serve as an important data source for quantifying criminal activities across various offense categories, it does not independently estimate the total cost of crime. Specifically, the DOJ calculates direct victim costs, but does not address the three other key components of the societal cost of crime.

Over the last two decades, the U.S. Department of Health and Human Services (DHHS) has sponsored a series of reports entitled "The Economic Costs to Society of Alcohol and Drug Abuse and Mental Illness." Although relatively recent versions of the report calculate all four components of the societal cost of crime (Harwood et al., 1998; Rice et al., 1990), these calculations only consider data for those crimes committed by alcohol/drug abusers and the mentally ill and are not apportioned across individual criminal offenses. Despite a comprehensive methodology, therefore, the report's cost estimates are not disaggregated and are limited to a specific subset of the overall U.S. population.

2.2. Crime-costing methods

A variety of scientific studies have been instrumental in developing and refining crime-costing methods. These studies have implemented various techniques to estimate costs, including the numerical crime-ranking method (Roth, 1978; Schrager and Short, 1980; Evans, 1981; Phillips and Votey, 1981; Byers, 1993), the property-value method (Thaler, 1978; Gray and Joelson, 1979;

Rizzo, 1979; Hellman and Fox, 1984; Little, 1988; Buck et al., 1991, 1993), the quality-of-life method (Dolan et al., 2005; Nichols and Zeckhauser, 1975; Rosser and Kind, 1978; Rice et al., 1989; French and Mauskopf, 1992; Miller et al., 1993; French et al., 1996; Viscusi and Aldy, 2003), the willingness-to-pay (WTP) approach (Cohen et al., 2004; Ludwig and Cook, 2001; Viscusi and Zeckhauser, 2003; Baron and Maxwell, 1996), the life satisfaction approach (Frey et al., 2009), market-based modeling (Bartley, 2000), and a life-course model (Macmillan, 2000). Others have examined the aggregate burden of crime (Anderson, 1999), the cost of alcohol and other drug-related crime (Miller et al., 2006), or the cost of crime within components or for various sectors of the economy (Miller et al., 2007, 2001; Corso et al., 2008; Wright and Litaker, 1996; Luna et al., 2001; Cohen and Miller, 1998; Miller and Cohen, 1997). Cohen (2005) and Czabanski (2008) provide a detailed review of the different methodologies for estimating the cost of crime.

2.3. Unit cost studies

Only a handful of studies have estimated the societal cost of crime for specific criminal offenses. This research provides a statistical framework as well as a context for interpreting the crime cost estimates reported in the present study. Selected results of these studies are summarized in Table 1 across the 13 offense categories featured in the current study (all estimates have been converted to 2008 U.S. dollars for comparison purposes) and discussed below. This table provides benchmark data and facilitates the interpretation of our crime cost estimates within the range of previously estimated costs for specific criminal offenses.

Aos et al. (2001) estimated the costs and benefits of crime prevention programs and developed unit costs for six types of crime using data from the state of Washington and methods advanced by Miller et al. (1996). Offense categories included murder/manslaughter, rape/sex offenses, robbery, aggravated assault, felony property crimes, and drug offenses. Notable in this study is the detailed data available from Washington's criminal justice system (CJS). Aos et al. measured the cost of crime across 14 resource categories in the Washington criminal justice system (adult and juvenile). Washington CJS estimates were supplemented with victim cost information from Miller et al. (1996). Total costs (first reported in 2000 U.S. dollars) were $4.4 million per act of murder/manslaughter, $219,286 per robbery, $369,739 per rape/sexual assault, $105,545 per aggravated assault, $22,739 per property offense, and $28,121 per drug offense.

With his "jury compensation approach," Cohen (1988) demonstrated how to estimate a monetary value for pain, suffering, and fear in personal injury cases by combining victim injury data with jury awards. Based on research by Viscusi (1983), Cohen set the value of a statistical life at $2 million. A monetary value for the risk of death in each crime category was then calculated by multiplying the value of a statistical life by corresponding Federal Bureau of Investigation (FBI)-reported crime-related death rates. Cost estimates (first reported in 1985 U.S. dollars) included $97,962 per rape/sexual assault, $23,025 per aggravated assault, $24,168 per robbery, $344 per larceny/theft, $6006 per motor vehicle theft, and $2575 per household burglary.

This jury compensation approach for calculating intangible victim costs was later combined with direct victim cost data from 1987 to 1990 to estimate more broadly the per-offense cost of crime across four crime categories (rape, assault, robbery, and arson). Estimates from Miller et al. (1993) (first reported in 1989 U.S. dollars) were $4.1 million for a murder, $80,403 for a rape/sexual assault, $24,987 for an aggravated assault, $33,036 for a robbery, and $41,900 for an act of arson.

Besides unit cost estimates, Miller et al. (1996) calculated an aggregated societal cost of crime for all criminal activity in the

Table 1
Summary of unit crime cost estimates reported in the literature (2008 dollars).

Type of crime	Aos et al. (2001)[a]	Cohen (1988)[b]	Cohen et al. (2004)[c]	Miller et al. (1993)[d]	Miller et al. (1996)[e]	Rajkumar and French (1997)[f]	*Present Study*[g]
Murder	$4,423,614		$11,350,687	$4,144,677	$4,380,559		$8,982,907
Rape/sexual assault	$369,739	$97,962	$286,277	$80,403	$124,419		$240,776
Assault	$105,545	$23,025	$84,555	$24,987.	$21,451	$76,829	$107,020
Robbery	$219,286	$24,168	$280,237	$33,036	$18,591	$33,143	$42,310
Arson				$41,900	$53,629		$21,103
Larceny/theft		$344			$529	$1,104	$3,532
Motor vehicle theft		$6,006			$5,720	$1,723	$10,772
Household burglary		$2,575	$30,197		$2,145	$1,974	$6,462
Embezzlement							$5,480
Fraud							$5,032
Stolen property	$22,739					$151	$7,974
Forgery and counterfeiting						$833	$5,265
Vandalism							$4,860

Note: all unit costs expressed in 2008 dollars. Unit cost values were inflated using the Bureau of Labor Statistics inflation calculator based on the consumer price index (CPI). U.S. Department of Labor (2008), http://www.bls.gov/data/inflation_calculator.htm.

[a] Estimates combine Washington state and local governmental operating costs paid by taxpayers (originally reported in 2000 dollars) and costs incurred by crime victims from Miller et al. (1996) (reported in 1995 dollars). Values reflect present value cost of each offense used to calculate the benefits of adult community-based substance abuse treatment. Cost per assault is for aggravated assault.

[b] Original estimates in 1985 dollars. Jury compensation approach to estimate the monetary value for pain, suffering, and fear in personal injury cases.

[c] Original crime cost estimates in 2000 dollars. Estimated using contingent valuation method (willingness-to-pay).

[d] Original estimates in 1989 dollars. Victim costs of violent crime and resulting injuries.

[e] Original estimates in 1993 dollars. Estimates reflect victim losses including medical and mental health care spending, tangible losses, and reduced quality of life. Excludes adjudication and sanctioning.

[f] Original crime cost estimates reported in 1992 dollars. Estimated using a combination of cost-of-illness and jury compensation approaches. Cost of assault is for aggravated assault.

[g] Unit cost estimates from the present study as reported in Table 5. Cost of assault is for aggravated assault.

United States (first reported in 1993 U.S. dollars). Using predominantly NCVS data, victim losses due to crimes against individuals and households were estimated at $450 billion ($1800 per resident) per year from 1987 to 1990. These losses included $18 billion in medical and mental health care spending, $87 billion in other tangible costs, and $345 billion in pain, suffering, and reduced quality of life. Rape had the highest annual victim costs of all offense categories at $127 billion per year ($124,419 per offense). Per-offense crime cost estimates were also presented for murder ($4.4 million), aggravated assault ($21,451), robbery ($18,591), arson ($53,629), larceny/theft ($529), motor vehicle theft ($5720), and burglary ($2145). These estimates excluded crime career costs and included only police and fire services in criminal justice system costs, leaving out major elements such as legal, adjudication, and corrections costs.

A recent study (Cohen et al., 2004) attempted to portray more fully the social costs of crime using a willingness-to-pay approach based on contingent valuation methods. Data collected from more than 1000 residents revealed that the average household was willing to pay $100–$150 per year for programs that would reduce burglary, serious assault, armed robbery, rape/sexual assault, and murder by 10% in its neighborhood. Based on the amounts respondents were willing to pay to prevent each individual type of crime (first reported in 2000 U.S. dollars), murder was found to be the most costly crime at $11.4 million per offense. Per-offense costs were also estimated for rape/sexual assault ($286,277), armed robbery ($280,237), serious assault ($84,555), and burglary ($30,197).

Rajkumar and French (1997) estimated the per-offense societal cost of crime across a broad list of offense categories and demonstrated the utility of these cost estimates in conducting benefit–cost analyses (BCA). They mapped out a two-pronged methodology that employed the cost-of-illness and jury compensation approaches to estimate the tangible and intangible components of the total cost of crime using data from the NCVS and UCR. The study found aggravated assault to be the most costly crime category (murder was not included among the crime categories), with a total societal cost of $76,829 per offense (first reported in 1992 U.S. dollars). The cost

per offense for the other categories ranged from $32 for drug law violations to $33,143 for robbery. The authors applied their cost estimates to outcome data from the Treatment Outcome Prospective Study (TOPS) to illustrate the potential economic benefits of drug abuse treatment. The total value of reductions in criminal activity (from baseline to the one-year follow-up) ranged from $34.54 million to $52.83 million.

Along with the unit cost estimates summarized in Table 1, the studies described above provide a foundation for developing new estimates of the per-offense cost of criminal activity to society. As demonstrated by this literature review, research on the unit costs of crime is scattered and inconsistent. Moreover, values are missing for some offenses, and many of the available estimates are now out of date. The current study largely replicates the approach of Rajkumar and French (1997) and builds upon work by Cohen, Miller, and Harwood to update unit cost estimates of the societal cost of crime.

3. Data

The availability of quality data sources plays a fundamental role in developing and implementing a comprehensive estimation strategy. Table 2 presents the list of offense categories, definitions, and data sources for the 13 crimes examined in this study. Data on most high-profile crime categories are available from the NCVS. Using a stratified, multi-stage cluster sample of U.S. residents aged 12 or older, the NCVS covers crimes against individuals and households, regardless of whether those crimes were reported to law enforcement. The current study employs NCVS data on the counts and nature of victimizations for the following offense categories: rape/sexual assault, robbery, aggravated assault, household burglary, motor vehicle theft, and larceny/theft.

The FBI's Uniform Crime Reports (UCR) and National Incident-Based Reporting System (NIBRS) were used to obtain count data for additional crime categories. The UCR is a city, county, and state law enforcement program that provides a nationwide summary of criminal activity based on the submission of statistics by law

Table 2
Criminal offense categories, definitions, and sources of data.

Offense	Definition	Data source
Murder	The killing of one human being by another, through either a willful act (nonnegligent manslaughter) or negligence (negligent manslaughter).	UCR (2007) and NIBRS (2001)
Rape/sexual assault	Forced sexual intercourse (vaginal, anal, or oral penetration) involving psychological coercion and physical force, as well as attacks or attempted attacks generally involving unwanted sexual contact between victim and offender.	NCVS (2006)
Aggravated assault	Attack or attempted attack with a weapon, regardless of whether or not an injury occurred, and attack without a weapon when serious injury results.	NCVS (2006)
Robbery	Completed or attempted theft, directly from an individual, of property or cash by force or threat of force, with or without a weapon, and with or without injury.	NCVS (2006)
Arson	The unlawful and intentional damage, or attempt to damage, any personal property by fire or incendiary device.	FEMA and NFIRS (2007)
Larceny/theft	Completed or attempted theft of property or cash without personal contact, including theft or attempted theft of property or cash directly from the victim without force or threat of force, purse snatching, and pocket picking.	NCVS (2006)
Motor vehicle theft	Stealing or unauthorized seizure of a motor vehicle, including attempted thefts.	NCVS (2006)
Household burglary	Unlawful/forcible entry or attempted entry into a residence, usually involving theft.	NCVS (2006)
Embezzlement	The unlawful misappropriation for profit of money, property, or some other article of value entrusted to the care, custody, or control of the offender.	UCR (2007) and NIBRS (2001)
Fraud	The intentional perversion of the truth for the purpose of inducing another person or entity to part with something of value or to surrender a legal right.	UCR (2007) and NIBRS (2001)
Stolen property	The reception, purchase, retail, possession, concealment, or transportation of any property with the knowledge that it has been unlawfully taken.	UCR (2007) and NIBRS (2001)
Forgery and counterfeiting	The unauthorized altering, copying, or imitation of an article with the intent to deceive or defraud by passing off the copy as the original or the selling, buying, or possession of an altered, copied, or imitated article with the intent to deceive or defraud.	UCR (2007) and NIBRS (2001)
Vandalism	The willful destruction or damage of real or personal property without the consent of the owner or the individual in custody or control of it.	UCR (2007) and NIBRS (2001)

Notes: Criminal offense categories and descriptions come from the following government sources: The National Crime Victimization Survey (NCVS); Uniform Crime Reports (UCR); National Incident-Based Reporting System (NIBRS); Federal Emergency Management Agency (FEMA); and National Fire Incident Reporting System (NFIRS).

enforcement agencies throughout the country. The NIBRS – a by-product of local, state, and federal automated records systems – collects data on each crime occurrence. The list of offenses used in the current study from both the UCR and NIBRS includes murder, forgery and counterfeiting, fraud, embezzlement, stolen property offenses, and vandalism.

Finally, the Federal Emergency Management Agency (FEMA) and the U.S. Fire Administration (USFA) recently issued a report entitled "Arson in the United States" that presents data combined from the National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's annual survey, "Fire Loss in the United States 1995–2004." The reported frequency of arson acts, as well as cost estimates for property loss associated with these offenses, was used in the present study.

The NCVS, UCR, and NIBRS also collect data on a number of other offenses. These include simple assault, carrying/possessing weapons, prostitution and commercialized vice, sex offenses, drug violations, gambling, offenses against family and children, driving under the influence of alcohol (DUI), liquor law violations, public drunkenness, disorderly conduct, vagrancy, suspicion, curfew and loitering law violations, and being a runaway. To reliably estimate the number of offenses for some of these crime categories is nearly impossible. For example, "simple assault" encompasses any attempted or completed physical contact with malicious intent and occurs far too often to be accurately reported by any state or federal data collection effort. Some of the other offenses occur with great frequency and have relatively minor tangible and intangible costs, thus generating a relatively small contribution to the total societal cost of crime. On the other hand, the cost per offense can be quite significant for DUI and prostitution, particularly if a DUI crash involves a death(s) or if prostitution contributes to the spread of costly diseases such as HIV/AIDS. Although we did not attempt to calculate unit cost estimates for these offenses in the present study, some work has been done in this area. For example, Miller et al. (1996) derived unit cost estimates for drunk driving (with

and without injury), but these estimates are reported as "tentative" given that they were based on a study conducted in the 1960s. More recent work has estimated the costs of alcohol-involved traffic crashes (Zaloshnja and Miller, in press; Blincoe et al., 2002). Identification of appropriate and current data, and the application of rigorous methods to estimate the unit cost of DUI, prostitution, and other potentially costly offenses should be explored in future crime cost studies.

Estimates for government crime prevention and prosecution expenditures were taken from the BJS report "Justice Expenditure and Employment, 2005." Data collected from the Census Bureau's Annual Government Finance Survey and Annual Survey of Public Employment provide national estimates of government expenditures for police protection, all judicial services (including prosecution, courts, and public defense), and corrections.

Two BJS reports, "Prisoners in 2006" and "Profile of Jail Inmates, 2002," were used to estimate the number of sentenced prisoners by offense type. The former uses an annual survey of inmates in state and federal correctional facilities to provide counts of prisoners, probationers, and parolees by convicted offense. The latter reports the number of jail inmates by offense type as compiled from a nationally representative sample of more than 400 local-jurisdiction jails.

The Current Population Survey (CPS), a monthly survey of about 50,000 households administered by the Bureau of the Census for the Bureau of Labor Statistics (BLS), includes labor force characteristics of the U.S. population (e.g., employment and unemployment rates, mean annual earnings), which were used for estimating victim mortality costs. Life tables from the National Vital Statistics System of the National Center for Health Statistics were used to estimate the mean present value of lifetime earnings. The 2008 Federal minimum wage (obtained through the BLS website) was used to estimate the productivity loss associated with a perpetrator of a given crime who was later incarcerated (crime career cost). The 2008 Consumer Price Index (CPI) from the BLS, a monthly data

source indicating changes in the prices paid by urban consumers for a representative basket of goods and services, was used to adjust all financial data to 2008 dollars.

Medical expenses and lost earnings for various injuries featured in Miller et al. (1996) were obtained from Miller et al. (2007), Corso et al. (2008), and through personal correspondence with the authors. Multivariate regression models using data collected by Jury Verdict Research® (JVR) were employed to convert these costs into pain-and-suffering estimates for various predatory crimes.

4. Methods

The analysis follows a two-pronged approach that employs cost-of-illness and jury compensation methods to estimate both the tangible and intangible costs of crime (Rajkumar and French, 1997). The cost-of-illness approach estimates the tangible costs of crime, including lost productivity for the perpetrator and short-term medical expenses, lost earnings, and property damage/loss for the victim.

Measuring the intangible costs of crime requires a different approach. As described earlier, Cohen's jury compensation method uses jury award data from personal injury trials to measure the equivalent dollar value of the pain and suffering and psychological distress suffered by the victim of a criminal offense. In short, intangible costs are based on the difference between the jury's total award and the direct economic loss to the victim. These costs include the medical expenses and lost earnings incurred by the victim, which are determined during the trial and acknowledged by the jury when deciding on the appropriate compensatory award. Multivariate regression models predict the proportion of these costs that can be attributed to pain and suffering in a jury award. By matching the types of injuries covered by jury awards with the types of injuries incurred by crime victims, this approach permits the calculation of intangible costs of individual crimes. For greater detail on the jury compensation method generally and the application of intangible costs specifically, refer to Cohen (1988), Cohen (2005), Miller et al. (1993), or Miller et al. (1996).

The first step in calculating unit or per-offense costs is determining the annual number of offenses that occurred in each crime category. Almost all crime cost data are aggregated and must be re-assigned to types of crime based on the ratio of crime-specific offenses to total offenses for all crimes. The 13 offense categories used in the present study were rape/sexual assault, robbery, aggravated assault, household burglary, motor vehicle theft, larceny/theft, murder, arson, forgery and counterfeiting, fraud, embezzlement, stolen property offenses, and vandalism. For the first six crime categories, the most current NCVS tables (U.S. Department of Justice, Bureau of Justice Statistics, 2007c) provided the number of offenses per category. UCR (U.S. Department of Justice, FBI, 2008) and USFA (Federal Emergency Management Agency, 2007) publications supplied information on the number of reported murders and arson acts.

Offense totals for the last five crime categories were calculated using a combination of UCR tables (U.S. Department of Justice, FBI, 2008) and raw data from the NIBRS (U.S. Department of Justice, FBI, 2004b). NIBRS collects the actual number of incidents reported for these crime categories whereas the UCR offers only documented arrests aggregated from various nationwide law enforcement agencies. Because a relatively small number of states have implemented the NIBRS program, these figures underestimate the number of offenses that have occurred nationwide. Consequently, an adjustment factor, calculated by dividing the number of NIBRS-reported incidents by the number of NIBRS-reported arrests, was applied to UCR's nationwide arrest data. Using this *incident-to-arrest ratio*, estimates were calculated for the total number of offenses for each of the last five crime categories.

4.1. Tangible costs

4.1.1. Victim costs. The DOJ collects data on medical expenses, cash losses, property theft or damage, and lost earnings because of injury and other victimization-related consequences for six crime categories (rape/sexual assault, robbery, aggravated assault, household burglary, motor vehicle theft, and larceny/theft). Arson-related damages are available from USFA (Federal Emergency Management Agency, 2007). These aggregate cost data were divided by the number of offenses in each respective crime category to derive per-offense direct victim costs. Other crime categories measured in the current study typically involve very little direct economic loss to the victim (and no agency collects victim cost data for these categories). For the mental health component of victim loss we relied on estimates of post-victimization counseling and related services from Cohen and Miller (1998) (inflated to 2008 dollars; U.S. Department of Labor, 2008b).

The risk-of-homicide component of victim cost is calculated by multiplying the probability that a certain type of offense will lead to a homicide by the mean present value of lifetime earnings for individuals of various ages (i.e., a proxy for the value of the homicide victim's life). Risk of homicide is not explicitly measured in all crime cost studies, but is clearly an important component to the full cost of crime. Because homicide rates and present discounted value of lifetime earnings differ significantly for males and females, gender-specific risk-of-homicide costs were developed and weighted based on rate of occurrence to create the total per-offense risk-of-homicide cost.

UCR data (U.S. Department of Justice, FBI, 2008) listing the number of homicides by known offense type was used to calculate the probability of homicide by crime category. According to the FBI, any homicide resulting from unspecified crime-related circumstances (e.g., a homicide resulting from a sexual assault but reported simply as a homicide) is classified as an aggravated assault. We apportioned homicides with unknown circumstances (about 63% of male homicide victims and 42% of female homicide victims) to the various crime categories proportionate to the distribution of homicides with known circumstances. The probability of homicide for each crime category was then calculated as the ratio of the number of homicide victims within a given crime category to the total number of homicide victims.

Calculating the mean present value of lifetime earnings involved several demographic and economic variables that vary by age and gender: (1) the percentage of the population classified as "employed" and the percentage classified as "not in the labor force" (U.S. Department of Labor, 2008a), (2) the mean annual earnings of the employed population inflated to 2008 dollars (Max et al., 2004; U.S. Department of Labor, 2008b), and (3) the mean annual value of housekeeping services inflated to 2008 dollars (Max et al., 2004; U.S. Department of Labor, 2008b). The latter value is used as a proxy for the productivity cost of crime victims who are not in the labor force and for any non-labor market activities.

Mean annual earnings of the employed population were added to the mean annual value of housekeeping services for those not employed to derive an overall average value of productivity. Such calculations were performed for age and gender groups (incremented by five years for ages 1–80), as the average life expectancy for the United States is 77.2 years (U.S. Department of Health and Human Services, 2004).

Once these average annual productivity values were developed, a compounded present value formula with a 3% discount rate was used to estimate the value of a homicide victim's lifetime earnings potential. These figures were then averaged to provide the mean present value of lifetime earnings potential for each gender. Of course, these calculations implicitly assume that the average worker is representative of the average homicide victim, which may

not be the case. If the average homicide victim has lower (greater) earnings potential than the average worker, then these calculations will be biased upward (downward).

A risk-of-homicide cost was developed for each crime category by multiplying the probability of homicide for each type of crime by the mean present value of lifetime earnings for each gender. Adding the risk-of-homicide cost for each gender produced an overall per-offense risk-of-homicide cost for those crime categories known to have resulted in homicides.

4.1.2. Criminal justice system costs. The three elements of criminal justice system costs at the federal, state, and local levels are police protection costs, legal and adjudication costs, and corrections costs. Police protection costs were estimated under the assumption that police protection activities do not vary across specific crime categories since they are "pre-offense." It would be desirable to apportion total police protection costs to each of the crime categories, but information was not available to reliably derive these fractions. The overall government expenditures on police protection reported by BJS (U.S. Department of Justice, 2007a) was divided by the total number of offenses for all crime categories to derive an estimate of police protection costs per offense. Given our simplifying assumption about police protection activities, this figure is uniform across all crime categories in our study. Adjustments to police protection costs are considered in the sensitivity analysis described below and presented in Table 6.

Because legal and adjudication costs are incurred "post-offense," expenditures were assigned based on the percentage contribution of each crime category to the total number of arrests for all offense categories combined (U.S. Department of Justice, FBI, 2008). The apportioned legal and adjudication costs per category were then divided by the number of offenses within that crime category to calculate the per-offense legal and adjudication costs. While this approach is more accurate than the method described above for police protection costs, the estimates are representative of "typical" cases, as legal and adjudication costs can vary widely across cases and settings.

Federal, state, and local corrections costs were calculated using DOJ data on the number of inmates per offense type incarcerated at each level of jurisdiction (federal, state, and local) (U.S. Department of Justice, Bureau of Justice Statistics 1999, 2007b). Corrections expenditures for each jurisdiction level were determined by multiplying the proportion of inmates per offense type by total corrections costs. These figures were then divided by the number of offenses committed within each crime category to calculate per-offense corrections costs.

4.1.3. Crime career costs. Productivity losses associated with perpetrators of crimes were calculated using corrections data. Crime career costs is another component to total crime cost that has not always been explicitly measured in previous studies. Nevertheless, given that society is worse off if an individual chooses to engage in illegal activities as opposed to legal employment that contributes to Gross Domestic Product (GDP), these productivity losses should be included in the total social cost. This is a challenging component to estimate because of the lack of reliable information on the actual time spent engaged in criminal activity. As an alternative, we used DOJ data on the number of inmates serving multiple-year sentences by type of crime (U.S. Department of Justice, Bureau of Justice Statistics 1999, 2004a, 2007b). Person-years served were then converted into productivity losses by assuming that the earnings potential of the average perpetrator was equal to the U.S. minimum wage (U.S. Department of Labor, 2008c). For each crime category, person-years served were multiplied by a full year (2080 h) of lost productivity at the 2008 minimum wage rate ($6.55) to derive estimates of the per-offense productivity losses in

each crime category for each jurisdiction level (federal, state, and local).

4.2. Intangible costs

4.2.1. Pain-and-suffering costs. The jury compensation approach developed by Cohen (1988) was used to calculate per-offense pain-and-suffering estimates for the three crime categories with the greatest intangible costs (rape/sexual assault, robbery, and aggravated assault). Injury events for these three offense types were extracted from Miller et al. (1996) and included gunshot wounds, broken bones (in conjunction with internal injury), knife wounds, being knocked unconscious, bruises and/or cuts, rape-related injuries (rape itself is considered an injury type), and other injuries. Each injury type was further delineated by type of post-injury medical treatment received, including overnight hospital stays, home care, and other medical treatment.

Miller et al. (1996) provided injury counts by the type of medical treatment provided. These counts were converted into proportions of the total number of injuries by injury type. Miller et al. (1996) also included useful data on injury victims' medical expenses and lost earnings. These costs, which were reported by injury/offense type in accordance with the injury count data, were adjusted to 2008 dollars (U.S. Department of Labor, 2008b) and multiplied by the proportion of medical treatments per injury. The resulting estimates were then summed to calculate the average amount of medical expenditures and lost earnings by injury type for aggravated assault, rape/sexual assault, and robbery.

Jury Verdict Research (2004) provides "base injury verdicts" (BIVs) based on the value of medical expenditures and lost earnings. These overall jury awards are reported across all injury types except "broken bones/internal injury" and "all other injuries." BIVs for knife wounds were used for broken bones/internal injury while BIVs for "bruises, cuts, etc." were used for "all other injuries." Average pain-and-suffering costs per injury type were then calculated by subtracting the medical/earnings losses from the BIVs.

An NCVS report on violent crime (U.S. Department of Justice, Bureau of Justice Statistics, 2007c) listed the per-offense probability of an injury resulting from rape/sexual assault, aggravated assault, or robbery. The pain-and-suffering awards were apportioned based on these probabilities for each crime category. Summing these estimates across injuries yielded the total pain-and-suffering award per offense.

4.2.2. Corrected risk-of-homicide costs. Risk of death was calculated differently for tangible and intangible costs. As discussed in Rajkumar and French (1997), valuing a murder victim's life based on lost productivity (i.e., mean present value of expected lifetime earnings) covers only tangible costs and is inappropriately low for the elderly. To account for the intangible costs associated with a murder, a more comprehensive approach is necessary. Viscusi and Aldy's (2003) aggregate estimate for the mean value of a statistical life (VSL) was inflated to 2008 dollars (U.S. Department of Labor, 2008b) and included in our calculations. This estimate is essentially the same as the VSL estimated by Ludwig and Cook (2001) in their national survey of society's willingness-to-pay to prevent gun violence. The probability of homicide for each offense type was multiplied by this new cost of premature mortality estimate to produce corrected per-offense risk-of-homicide costs.

4.2.3. Total intangible cost. The sum of pain-and-suffering and corrected risk-of-homicide costs for rape/sexual assault, robbery, and aggravated assault represents the total intangible cost per offense. For all other offense categories that resulted in murder, the corrected risk-of-homicide cost alone represents the total intangible cost.

Table 3
Tangible per-offense costs (including crime victim, criminal justice system, and crime career costs) for different crimes in 2008 dollars.

Type of offense	Crime victim cost	Criminal justice system cost	Crime career cost	Total tangible cost
Murder[a]	$737,517	$392,352	$148,555	$1,278,424
Rape/sexual assault	$5,556	$26,479	$9,212	$41,247
Aggravated assault	$8,700	$8,641	$2,126	$19,537
Robbery	$3,299	$13,827	$4,272	$21,398
Motor vehicle theft	$6,114	$3,867	$553	$10,534
Arson	$11,452	$4,392	$584	$16,428
Household burglary	$1,362	$4,127	$681	$6,170
Larceny/theft	$480	$2,879	$163	$3,523
Stolen property[b]	N/A	$6,842	$1,132	$7,974
Vandalism[b]	N/A	$4,160	$701	$4,860
Forgery and counterfeiting[b]	N/A	$4,605	$660	$5,265
Embezzlement[b]	N/A	$4,820	$660	$5,480
Fraud[b]	N/A	$4,372	$660	$5,032

Note: Formulae used for the calculations were based on Rajkumar and French (1997). *Sources*: Cohen and Miller (1998), Federal Emergency Management Agency (2007), U.S. Department of Health and Human Services (2004), Max et al. (2004), U.S. Bureau of Labor Statistics (2008a), U.S. Census Bureau (2007), U.S. Department of Justice, Bureau of Justice Statistics (1999, 2001, 2004a, 2006, 2007a, 2007b, 2007c), and U.S. Department of Justice, FBI (2004b, 2008).
N/A: no available or not applicable.
[a] Crime victim cost for murder was calculated as the mean present value of lifetime earnings for a homicide victim.
[b] Because these are generally considered "victimless" crimes, they do not include crime victim costs.

4.3. Total crime cost

By combining the tangible and intangible cost estimates, a total per-offense societal cost of crime was calculated for each crime category. To avoid double counting for those categories with a corrected risk-of-homicide cost, the original risk-of-homicide cost was first removed from the tangible cost estimates. For those offenses with neither pain-and-suffering nor corrected risk-of-homicide costs, the total societal cost estimate is identical to the total tangible cost estimate. For interested readers, Excel spreadsheets with detailed formulae and calculations are available from the corresponding author.

4.4. Sensitivity analysis

The calculations summarized above are based on disparate data sources and numerous simplifying assumptions. Thus, we are not able to calculate conventional standard errors or confidence intervals for the point estimates. As an alternative approach to examining uncertainty in the estimates, we conduct sensitivity analyses focusing on three key sources of variation in the calculation of crime costs. First, we consider an alternative VSL for the calculation of risk-of-homicide costs. Cohen et al. (2004) conducted a national survey of U.S. residents asking respondents what they would be willing to pay for crime control programs. The

implied WTP to prevent a murder was estimated to be between $8.5 and $11 million (in 2000 dollars). Taking the mid-point of this range and inflating to 2008 dollars yields an implied VSL of $12,190,501—considerably higher than the estimate from Viscusi and Aldy (2003) that is used for the core analysis ($8.3 million in 2008 dollars).

The second source of variation we focused on was CJS costs for policing and legal/adjudication services. Both Cohen et al. (1994) and Aos (2003) estimated the costs of policing and legal processing for criminal offenses using state-specific and national data sources. Cohen et al. (1994) provide CJS costs for four crime types: murder, aggravated assault, robbery, and rape/sexual assault. Aos (2003) presents CJS costs in the state of Washington for a broader range of crimes including many property crimes. These estimates are based on work by Aos et al. (2001) and reflect the cost per reported crime based on the probabilities of arrest and conviction in Washington. Estimates from both of these studies were used in the sensitivity analysis.

As a third sensitivity test, we used estimates from recent studies conducted by Miller and co-workers (Corso et al., 2008; Miller et al., 2007) to re-analyze the medical costs and productivity losses associated with assaults, robberies, and rape/sexual assault. It is widely understood that the NCVS significantly underreports medical costs for crime victims because they only account for victims' (short-term) out-of-pocket medical expenses and do not capture

Table 4
Intangible per-offense costs (including pain-and-suffering and corrected risk-of-homicide costs) for different crimes in 2008 dollars.

Type of offense	Pain-and-suffering cost	Corrected risk-of-homicide cost	Total intangible cost
Murder[a]	$8,442,000	N/A	$8,442,000
Rape/sexual assault	$198,212	$1,430	$199,642
Aggravated assault	$13,435	$81,588	$95,023
Robbery	$4,976	$17,599	$22,575
Motor vehicle theft[b]	N/A	$262	$262
Arson[b]	N/A	$5,133	$5,133
Household burglary[b]	N/A	$321	$321
Larceny/theft[b]	N/A	$10	$10
Stolen property[c]	N/A	N/A	$0
Vandalism[c]	N/A	N/A	$0
Forgery and counterfeiting[c]	N/A	N/A	$0
Embezzlement[c]	N/A	N/A	$0
Fraud[c]	N/A	N/A	$0

Note: Formulae used for the calculations were based on Cohen (1988). *Sources*: Jury Verdict Research (2004), Miller (2004) and Viscusi and Aldy (2003).
N/A: not available or not applicable.
[a] Intangible cost for murder is equal to the mean value of a statistical life (Viscusi and Aldy, 2003) inflated to 2008 dollars.
[b] Intangible costs for arson, household burglary, motor vehicle theft, and larceny/theft are equal to the corrected risk-of-homicide cost only.
[c] Intangible costs for stolen property offenses, vandalism, forgery and counterfeiting, embezzlement, and fraud cannot be calculated using available sources.

long-term medical costs or insurance costs (Cohen, 2005). As an alternative to NCVS, we use medical costs and work loss associated with sexual assault from Miller et al. (2007). For assaults and robberies, medical costs were computed by combining treatment costs by place of treatment from Corso et al. (2008; and unpublished supporting tables) with NCVS data for 2000–2004 on the percentage of police-reported victimizations that were medically attended and the percentage treated by place of treatment (Miller et al., 2006 and personal correspondence with Dr. Miller). The results of the three sensitivity analyses are presented in Table 6 and discussed in the next section.

5. Results

Table 3 presents estimates for the per-offense tangible costs of crime in 2008 dollars across 13 offense types. The three main components of tangible costs are victim costs, criminal justice system costs, and crime career costs. Predatory crimes generated the highest per-offense cost to society with $1.28 million per murder, $41,247 per rape/sexual assault, $21,398 per robbery, and $19,537 per aggravated assault. The property crimes of motor vehicle theft, arson, household burglary, and larceny/theft generated per-offense tangible costs between $3523 and $16,428. The remaining crime categories, including stolen property offenses, vandalism, forgery and counterfeiting, embezzlement, and fraud, had per-offense tangible costs ranging between $4860 and $7974.

Table 4 presents estimates of intangible costs per offense in 2008 dollars. The two components of intangible costs are pain and suffering and the corrected risk of homicide. Four crime categories have pain-and-suffering costs: murder, rape/sexual assault, aggravated assault, and robbery. The pain-and-suffering cost associated with murder is simply the average value of a statistical life (Viscusi and Aldy, 2003) inflated to 2008 dollars (U.S. Department of Labor, 2008b). Because a risk-of-homicide cost is not applicable, this pain-and-suffering component represents the total intangible cost of murder ($8.4 million). Rape/sexual assault had the next highest per-offense intangible cost to society ($199,642), followed by aggravated assault ($95,023) and robbery ($22,575). The value of the pain and suffering associated with rape/sexual assault ($198,212) was more than 40 times greater than that associated with robbery ($4976). The corrected risk-of-homicide component for aggravated assault ($81,588) was more than four times that of robbery ($17,599). Crime categories with only a corrected risk-of-homicide cost (arson, household burglary, motor vehicle theft, and

Table 5
Total (tangible plus intangible) per-offense cost for different crimes in 2008 dollars.

Type of offense	Tangible cost	Intangible cost	Total cost[a]
Murder	$1,285,146	$8,442,000	$8,982,907
Rape/sexual assault	$41,252	$199,642	$240,776
Aggravated assault	$19,472	$95,023	$107,020
Robbery	$21,373	$22,575	$42,310
Arson	$16,429	$5,133	$21,103
Motor vehicle theft	$10,534	$262	$10,772
Stolen property	$7,974	N/A	$7,974
Household burglary	$6,169	$321	$6,462
Embezzlement	$5,480	N/A	$5,480
Forgery and counterfeiting	$5,265	N/A	$5,265
Fraud	$5,032	N/A	$5,032
Vandalism	$4,860	N/A	$4,860
Larceny/theft	$3,523	$10	$3,532

Sources: Tables 3 and 4, and unreported estimates.
N/A: not available or not applicable.
[a] Total per-offense cost calculated as the sum of tangible cost (excluding the uncorrected risk-of-homicide cost from crime victim cost, when applicable) and intangible cost.

larceny/theft) had significantly lower intangible costs ranging from $10 to $5133. The remaining categories had neither a pain-and-suffering component nor a corrected risk-of-homicide component and therefore had no measurable intangible costs.

Table 5 presents the total per-offense societal cost of crime across all offense categories. For murder, the total cost is the sum of tangible and intangible costs, excluding crime victim costs, which are already accounted for in the value of a statistical life used to estimate the intangible costs. For those crime categories with an associated risk of homicide, original risk-of-homicide costs (based on the mean present value of lifetime earnings) were first removed from the tangible costs reported in Table 3 to prevent double counting. The resulting estimates were then added to the intangible costs from Table 4 to produce total cost estimates. For crime categories without associated risk-of-homicide costs, the total cost of crime is equal to the tangible costs reported in Table 3.

Crime categories are ranked in Table 5 by magnitude of total societal cost. Not surprisingly, murder generates the greatest loss to society at nearly $9 million per offense. Rape/sexual assault follows murder with a total per-offense cost of $240,776. Aggravated assault generates a total per-offense societal cost of $107,020, and the average robbery leads to a societal burden of $42,310. It is worth noting the significance of intangible costs in determining the ranking of these offenses. Arson, motor vehicle theft, household

Table 6
Sensitivity analyses of total per-offense cost for different types of crimes.

Type of offense	Primary analysis[a]	SA1[b]	SA2[c]		SA3[d]
		VSL Cohen et al. (2004)	CJS Cohen et al. (1994)	CJS Aos (2003)	Medical and productivity losses Miller et al. (2007) and Corso et al. (2008)
Murder	$8,982,907	12,554,552 [40%]	8,989,832 [0.08%]	9,591,511 [6.8%]	
Rape/sexual assault	$240,776	241,381 [0.25%]	240,550 [−0.09%]	252,069 [4.7%]	244,126 [1.4%]
Aggravated assault	$107,020	141,538 [32%]	106,342 [−0.63%]	113,587 [6.1%]	115,365 [7.8%]
Robbery	$42,310	49,756 [18%]	43,594 [3%]	49,234 [16%]	49,481 [17%]
Motor vehicle theft	$10,772	10,883 [1%]		9,327 [−13%]	
Arson	$21,103	23,274 [10%]			
Household burglary	$6,462	6,598 [2%]		6,316 [−2.3%]	
Larceny/theft	$3,532	3,536 [0.12%]		1,912 [−46%]	
Stolen property offenses	$7,974				
Vandalism	$4,860				

Notes: All cost estimates presented in 2008 dollars. Bracketed values represent the percentage change from primary analysis.
[a] Total per-offense costs from Table 3.
[b] Sensitivity analysis 1 (SA1) changed the value of a statistical life (VSL) for the corrected risk-of-homicide cost calculations to $12.19 million based on Cohen et al. (2004) WTP per murder.
[c] Sensitivity analysis 2 (SA2) changed the criminal justice cost estimates to those reported in Cohen et al. (1994) and Aos (2003).
[d] Sensitivity analysis 3 (SA3) changed medical and productivity losses for the calculation of crime victim costs to values provided by Miller and co-workers (from Corso et al., 2008 and Miller et al., 2007 and personal correspondence with Dr. Miller).

burglary, and larceny/theft have total per-offense societal costs between $3532 and $21,103. With the exception of arson, these crimes have relatively minor intangible costs, so the estimates in Table 5 are very similar to the tangible costs alone in Table 3. Finally, stolen property offenses, vandalism, forgery and counterfeiting, embezzlement, and fraud have a total societal cost of less than $8000 per offense (resulting exclusively from tangible losses).

Table 6 presents the results from the sensitivity analyses of tangible crime costs (alternative estimates for medical costs, productivity losses, and criminal justice system costs) and intangible costs (alternative value of a statistical life for corrected risk-of-homicide calculations). As a point of reference, the second column in Table 4 lists the total per-offense costs from the primary analysis (also in Table 3). The first sensitivity analysis (SA1) recalculated the corrected risk of homicide used for estimating intangible crime costs by replacing the VSL from Viscusi and Aldy (2003) with the VSL estimated by Cohen et al. (2004). Using the latter value for all crimes involving a risk of death increased the total per-offense cost for murder to $12,554,552 (40% increase over the primary analysis), aggravated assault to $241,381 (32% increase), robbery to $49,756 (18% increase), and arson to $23,274 (10% increase). The impact on other crimes was very small (0.1–2%).

Columns 4 and 5 in Table 6 present the second sensitivity analysis (SA2) of criminal justice system costs. Cohen et al. (1994) calculated police investigation and court-related costs for murder, aggravated assault, rape/sexual assault, and robbery. Substituting Cohen et al.'s estimates for the original estimates in the tangible crime cost calculations had very little impact on total per-offense costs. Murder and robbery costs increased marginally (0.08% and 3%, respectively), while rape/sexual assault and aggravated assault decreased slightly (−0.09 and −0.63%, respectively). Aos et al. (2001) used data from the Washington State Auditor to estimate the CJS costs for a range of violent and property offenses. Based on this work, Aos (2003) reports CJS costs per crime based on the probabilities of arrest and conviction in Washington. Employing these values in the tangible crime cost calculations increased the total per-offense costs for murder, rape/sexual assault, robbery, and aggravated assault by 4–16%. The unit costs of property offenses decreased by 2–46%.

The final column in Table 6 presents the results of the third sensitivity analysis (SA3), whereby more recent medical and productivity loss data for sexual violence, assaults, and robberies are used (Corso et al., 2008; Miller et al., 2007). Employing these alternative estimates increased the per-offense cost of rape/sexual assault to $244,126 (1.4%), aggravated assault to $115,365 (7.8%), and robbery to $49,481 (17%).

6. Discussion

The costing methodology outlined in this paper has advantages over other approaches because it employs standardized techniques and provides a comprehensive perspective. Dividing estimates of the total cost of crime into tangible and intangible components incorporates a variety of perspectives (e.g., victim, criminal justice system, taxpayer, perpetrator). Another unique aspect of this study is the broad list of criminal offenses. An extensive list of crimes facilitates the use of these estimates in a wide variety of program evaluations and policy decisions.

Table 3 presents the tangible costs of crimes and provides a breakdown of these estimates by victim costs, criminal justice system costs, and crime career costs. This allows the reader to easily identify the most costly components of tangible costs for different crimes. Table 4 presents the intangible components of victim costs. The true societal impact of some crimes would be significantly underestimated if the intangible victim losses were not included in the analysis.

Table 5 provides the core findings of this investigation: the total societal cost of crime by type of offense. Notable in Table 5 is how the inclusion of intangible costs greatly increased the per-offense societal cost of rape/sexual assault, aggravated assault, and robbery (detailed in Table 4). Tangible costs represented only 12–47% of these three offense categories.

As discussed earlier, the range of unit cost estimates reported in the literature provides a broader context for interpreting the new crime cost estimates derived in this study (see Table 1). Previous estimates reflect a variety of methods and data sources, so direct comparison to our crime cost estimates is not straightforward. Nevertheless, it is interesting to observe the variation across these estimates and how the present cost estimates fit within the ranges. Some of the cells in Table 1 remain empty because not all of the crimes were valued in each study.

Our estimates for murder, rape/sexual assault, robbery, household burglary, and stolen property fall within the range of estimates for these offenses (all values were converted to 2008 dollars):

- Murder: $8,982,907 [range = $4,144,677–$11,350,687].
- Rape/sexual assault: $240,776 [range = $80,403–$369,739].
- Robbery: $42,310 [range = $18,591–$280,237].
- Household burglary: $6462 [range = $1974–$30,197].
- Stolen property: $7974 [range = $151–$22,739].

In contrast, our unit cost estimate for an act of arson ($21,103) is considerably lower than estimates reported in studies by Miller et al. (1993, 1996) ($41,900–$53,629), due mainly to differences in data availability and approach. At the other extreme, our unit cost estimates for aggravated assault, motor vehicle theft, and larceny/theft are higher than that of other studies: $107,020 [range = $21,451–$105,545] for assault (any type), $10,772 [range = $1723–$6006] for motor vehicle theft, and $3532 [$344–$1104] for larceny/theft. Overall, the sensitivity analyses presented in Table 6 suggest that our core estimates for most crimes (except for motor vehicle theft, household burglary, and larceny/theft) are somewhat conservative as all three sensitivity analyses led to per-offense cost estimates that were generally higher than those in Table 5.

6.1. Implications for public policy and future research

This study makes several important contributions to the crime-costing literature. As evidenced by Table 1, most previous studies addressed only a subset of the crimes we investigated and valued in the present study. Beyond better coverage, the present study provides estimates derived with a consistent set of methods and data, which enhances standardization and comparability. Finally, most unit cost estimates in the literature are based on data that are more than 10 years old. By updating these estimates with the most recently available data, the present study reveals contemporary trends and improves the salience of the numbers.

The research and policy value of these estimates is perhaps best demonstrated through a practical application. Federal, state, and local governments allocate a substantial amount of resources to programs that either directly or indirectly mitigate criminal activity. Because criminal activity is heterogeneous, these agencies need a way to normalize changes in criminal activity so that program benefits can be compared and scarce resources can be allocated accordingly. These unit cost estimates can be matched to the respective crimes that are avoided or reduced to calculate the total economic value of crime reductions. The economic benefit estimates can eventually be directly compared with the economic costs of the particular programs to determine which programs to fund, expand, or eliminate.

Many different types of crime prevention, ranging from strategic policing initiatives in large cities to school-based violence prevention programs in rural communities, could be evaluated in this way. Consider a residential aftercare program for parolees with substance use problems. Assume that the average aftercare participant committed 3 fewer robberies during the assessment period and 12 fewer acts of vandalism compared to an average parolee with substance use problems who did not attend the aftercare program. Based on the estimates in Table 5, this translates into an average savings for society of $185,250. Comparing these savings to the average cost per treatment episode in a therapeutic community aftercare program (about $20,000; French et al., 2008), the net economic benefit generated from treatment would amount to more than $160,000. The key message here is that even modest reductions in criminal activity can generate economic benefits that significantly outweigh the costs of treatment. Moreover, crime cost estimates have proven particularly useful for calculating the economic benefits of various treatment programs for criminally active individuals (French et al., 2002a, 2002b, 2002c, 2002d; Alexandre et al., 2002; Zarkin et al., 2000), and these findings have been welcomed and put to immediate use by policymakers.

6.2. Challenges and limitations

We confronted various conceptual and empirical challenges in conducting the present study. Perhaps the most significant challenge was the lack of uniformity between data sources. One goal of this study was to identify the most current and reliable data available on criminal activity, crime victims, perpetrators, and criminal justice system resources. Following the methods proposed in Rajkumar and French (1997), we selected many of the data sets used in previous crime-costing studies (with more current data) for the present analysis. Data on criminal activity was relatively easy to obtain from the NCVS and UCR. Information on victim losses and productivity losses, however, which was used to estimate other components of crime costs, had to be pieced together from several disparate sources (e.g., CPS, JVR, previously published articles). Ultimately, the availability and quality of data in all of these areas had the biggest impact on the precision of our estimates.

The present study is subject to several limitations, most of which are common to all crime-costing studies. First, the study uses national data from the United States and thus the crime cost estimates may not be generalizable to other countries. A second limitation is the difficulty of quantifying the actual number of offenses for crimes such as drug law violations and prostitution, and their consequent exclusion from the analysis. Given the high frequency of these offenses, the sporadic reporting by victims, and the difficulty in apprehending offenders, the actual number of crimes is surely much greater than the number of reported arrests. A related question is whether an average incident of these offenses has a significant impact on society. For example, the act of purchasing illegal substances transfers income from one member of society (drug user) to another (drug dealer). Absent any negative externalities (e.g., violence associated with drug dealing, transmission of a communicable disease), the net effect on society is negligible. A similar case could be made for prostitution. Indeed, ingesting illicit drugs or engaging in unsafe sexual activity could have a negative impact on society, but the link is indirect. For example, heavy or chronic drug users may consume a disproportionate amount of health services such as emergency department care, which is very costly (French et al., 2000). There is also evidence that heavy drug users are likely to commit crimes to support their addictions (Chaiken and Chaiken, 1990; Goldstein, 1985). Other crimes such as DUI may be more costly to society, particularly if a DUI-related traffic crash involves a death(s) or serious injury(s). We were not able to reliably measure

and incorporate these potential consequences in a crime cost estimate, but some previous studies have attempted to value crimes such as DUI, prostitution, and drug law violations (e.g., Miller et al., 1996; Zaloshnja and Miller, in press; Blincoe et al., 2002; Rajkumar and French, 1997; Aos et al., 2001). Future studies may be able to consider a broader list of crimes with better sources of criminal activity and cost data.

The exclusion of psychological injury from the estimates presented here constitutes another limitation of the present study. Although pain and suffering inherently involve some elements of psychological distress, these elements are not clearly defined and fail to provide a complete account of the psychological injury suffered by the crime victim. Other studies (Cohen, 1988; Miller et al., 1993, 1996) have estimated the value of psychological injury for crime victims, but updating these estimates would require more current information from victims regarding the long-term psychological impact of crime. Even some "minor" offenses such as theft may carry a psychological cost for the victim, but no previous studies have examined this possibility, and we were not able to locate any data that would allow us to assess the psychological costs to victims of property crimes.

Another debatable issue is whether property loss is legitimately part of the cost of crime to society. Some previous studies, including Rajkumar and French (1997), used the value of property damage exclusively in their crime-costing calculations, arguing that property loss is a transfer from one party to another, regardless of the means of this transfer (e.g., crime). In the present analysis, we take the position that certain costs are incurred by the property loss victim (e.g., search costs, replacement costs, inconvenience costs) in addition to the value of the property itself, and property loss estimates can serve as a proxy for these additional costs.

Another limitation is that we do not account for additional costs associated with sexual violence such as sexually transmitted infections (STIs), pregnancy, suicide, and substance abuse. Miller et al. (2007) estimated that these costs contribute an additional $16,600 (in 2005 dollars) to the total cost of a sexual assault. Other excluded costs are those associated with child abuse and neglect, which were estimated by Miller et al. (1996) to be $60,000 per victimization.

We recognize that the assumption that certain criminal justice system costs are uniform across criminal acts is tenuous. Without more detailed information on the criminal justice system process for each type of offense, however, it is difficult to precisely estimate the unique economic impact of specific crimes on the criminal justice system. Our decision to treat police protection costs as uniform across types of crimes was based on the assumption that these resources are allocated pre-offense. We decided to apportion legal, adjudication, and corrections costs using adjustments for the proportion of arrests per offense type to total arrests and the proportion of inmates per offense type to the total number of inmates (across all jurisdiction levels). This approach has obvious limitations. For police protection costs, we were not able to divide policing effort across crime prevention and other police activities such as traffic control and administrative duties. The estimated police protection cost per offense may therefore be overstated as not all policing resources are dedicated specifically to crime patrol/prevention. In addition, for legal and adjudication costs, we could have used the number of convictions as opposed to number of arrests, but we were unable to find any information on the total number of convictions for both federal and state courts (excluding civil courts) that were recorded by specific offenses. Current statistics report that approximately 68% of defendants in the 75 largest counties in the U.S. were convicted for their most serious arrest charge (U.S. Department of Justice, 2006). This suggests that our estimate of legal and adjudication costs per offense may be overstated. Crime career costs may also be inflated as our method for valuing lost productivity due to incarceration assumes prisoners

would be employed full-time if not incarcerated. Furthermore, we have no way of accounting for the opportunity cost of time spent engaging in illegal activities if not incarcerated. Aos et al. (2001) and Cohen et al. (1994) have made great strides in this area, which provide a foundation for future research to disentangle the various cost elements of the criminal justice system at both the state and national levels.

Another limitation with the crime cost estimates presented here is that they reflect the average cost per crime as opposed to the more policy relevant marginal cost. This distinction is relevant for the economic evaluation of crime prevention programs where analysts are interested in the cost savings associated with preventing the last crime or group of crimes instead of the cost resulting from a typical crime. For example, if a local crime prevention program avoids five additional robberies per month, how does this translate into cost savings for the jurisdiction? On this level, using the average cost per robbery could potentially overstate the marginal value of each additional criminal act avoided.

Finally, these crime cost estimates do not include a measure of the time, effort, and expenditures by households and communities to minimize the risk of being victims of crime. For example, costs associated with household security systems, security guards, badge-only access at workplaces, guard dogs, neighborhood watch programs, and time spent seeking travel routes perceived to be "safer" are not considered. Other costly crime-averting behaviors include choosing to pay higher property prices to live in neighborhoods with relatively low crime rates and avoiding leisure (i.e., tourism) trips to cities and neighborhoods with relatively high crime rates. These activities and expenditures contribute funds to the overall economy that might fruitfully be redirected. An opportunity cost resulting from the mere presence of crime must therefore be acknowledged.

7. Conclusion

This study presents the most current estimates of the societal cost of 13 individual criminal offenses, using the most recently available national crime statistics. Such estimates are crucial for evaluating the economic impact of programs that directly or indirectly reduce crime. The estimates are disaggregated to show not only the cost of specific components of crime (victim costs, criminal justice system costs, productivity losses) but also their tangible and intangible (pain/suffering and risk of death) elements. Because most of the crime-costing literature is more likely to include only tangible costs, one might infer that tangible cost estimates are more precise or reliable than intangible cost estimates. Yet this is not necessarily the case for all crimes due to data challenges, simplifying assumptions, and methodological limitations associated with tangible cost estimation. Similar issues pertain to intangible cost estimation as well. We therefore believe that tangible and intangible costs should be viewed together when assessing the cost of crime to society and that one should not be chosen at the expense of the other in terms of which is most reliable for a particular type of crime.

An important advantage of these new crime cost estimates is that they are not aligned with any particular program, population, or setting, which will permit future research to incorporate this information into any economic evaluation of a crime prevention program. Considering the challenges and limitations noted earlier, greater coverage, better data, and more advanced methods are needed to improve precision and perhaps to incorporate some of the excluded crimes. We encourage interested researchers to pursue this project using the detailed template provided in this study. Given the dynamic trends in criminal activity and victimization, re-estimation of the social cost of individual offenses can justifiably be conducted every five years.

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