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# The Economic Benefits of Reducing Violent Crime

A Case Study of 8 American Cities

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Robert J. Shapiro and Kevin A. Hassett

June 2012



Center for American Progress



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## Fast facts on the economic benefits of reducing violent crime

Reducing current rates of murder, rape, assault, and robbery would produce a wide range of savings and other benefits for Americans as individuals, property owners, and taxpayers. In 2010 these four main types of violent crime cost Americans more than \$42 billion in direct costs, including the associated costs of police, courts and correctional institutions, out-of-pocket-medical expenses borne by victims, and lost earnings by both victims and perpetrators who are arrested and convicted. These costs totaled \$137 per American in 2010, the last year for which complete data are available.

Violent crimes also inflict other, more intangible costs, including the pain and suffering of victims, a reduced quality of life for everyone, and lower investment levels and property values. While these intangible costs are difficult to measure with precision, analysts agree that they greatly exceed the direct costs. Here are the fast facts enumerating the economic benefits of reducing violent crime:

- Across five cities with the necessary data for our analysis, we found that a 10 percent reduction in homicides should lead to a 0.83 percent increase in housing values the following year, and a 25 percent reduction in homicides should produce a 2.1 percent increase in housing prices over the next year. Applying these results to all residential housing in the metropolitan areas of our sample of eight American cities, we find that:
- A 10 percent reduction in homicides should increase the value of residential real estate by \$4.4 billion in the Boston metropolitan area, \$3.2 billion in Philadelphia, \$2.9 billion in Seattle, \$2.4 billion in Dallas, \$2.2 billion in the Chicago area, \$800 million in Milwaukee, and \$600 million in Jacksonville. At current property tax rates, the increase in housing values associated with a 10 percent reduction in homicides would substantially expand revenues from property taxes in all eight cities.
- A 25 percent reduction in homicides should be followed by increases in metropolitan area housing values totaling \$11 billion in the Boston area, \$8 billion in Philadelphia, \$7.25 billion in Seattle,

\$6 billion in Dallas, \$5.5 billion in the Chicago area, \$2 billion in Milwaukee, and \$1.5 billion in Jacksonville. At their current property tax rates, these increases in housing values would substantially expand the revenues from property taxes in all eight cities.

- The other, direct annual costs of violent crime in the eight cities total \$3.7 billion per year, ranging from \$89 million per year in Seattle and \$198 million in Boston to \$752 million per year in Houston, \$736 million in Philadelphia, and \$1.1 billion in Chicago. These direct costs average \$320 per person per year across the eight cities, ranging from \$144 in Seattle and \$246 in Jacksonville to about \$390 in Milwaukee and Chicago, and \$472 in Philadelphia.
- The value of the more intangible pain and suffering borne by the victims of these violent crimes totals some \$13.9 billion per year across the eight cities, ranging from \$216 million per year in Seattle and \$734 million in Boston, to nearly \$3 billion per year in Philadelphia and \$4.2 billion in Chicago. These annual, intangible costs average more than \$1,200 per person across the eight cities, ranging from \$350 per person per year in Seattle and nearly \$980 in Jacksonville, to \$1,486 per person per year in both Chicago and Milwaukee, and more than \$1,900 in Philadelphia.

Successful efforts to reduce violent crime can generate significant savings for municipal budgets and large benefits for residents, apart from increases in their housing values. On the next page we list the economic savings the eight cities in our study would reap by reducing violent crime by 10 percent and by 25 percent.

### *Boston*

- A 10 percent reduction could save \$5 million per year, reduce direct costs to victims by more than \$7 million per year, and avert more than \$73 million in annual intangible costs to victims—reducing the total government costs by an average of \$145 per resident per year.
- A 25 percent reduction could save more than \$12 million per year, reduce the direct costs borne by victims by some \$18 million per year, and avert more than \$180 million in annual intangible costs—reducing total government costs by the equivalent of more than \$360 per resident per year.
- This 25 percent savings could enable a mix of boosting city spending on housing and community development by up to 14.4 percent or reducing property taxes by up to 0.8 percent.

### *Chicago*

- A 10 percent reduction could save \$24 million per year, reduce the direct costs to victims by nearly \$43 million per year, and avert more than \$420 million in annual, intangible costs to victims—reducing total government costs by an average of \$187 per resident per year.
- A 25 percent reduction could save \$59 million per year, reduce the direct costs to victims by more than \$107 million per year, and avert more than \$1 billion in annual intangible costs—reducing total government costs by the equivalent of nearly \$470 per resident per year.
- This 25 percent savings could enable a mix of reducing all local taxes by up to 2.5 percent or increasing city spending on community services by up to 66 percent.

### *Dallas*

- A 10 percent reduction could save \$7 million per year, reduce the direct costs to victims by nearly \$15 million per year, and avert more than \$140 million in annual, intangible costs to victims—reducing total government costs by an average of \$138 per resident per year.
- A 25 percent reduction could save \$19 million per year, reduce the direct costs to victims by more than \$36 million per year, and avert more than \$360 million in annual intangible costs—reducing total government costs by the equivalent of more than \$450 per resident per year.
- This 25 percent savings could enable a mix of reducing property taxes by up to 4.3 percent or increasing the parks and recreation budget by up to 29 percent.

### *Houston*

- A 10 percent reduction could save \$17 million per year, reduce the direct costs to victims by nearly \$27 million per year, and avert more than \$265 million in annual, intangible costs to victims—reducing total government costs by an average of nearly \$150 per resident per year.
- A 25 percent reduction could save more than \$43 million per year, reduce direct costs to victims by \$67 million per year, and avert more than \$660 million in annual intangible costs—reducing total government costs by the equivalent of more than \$370 per resident per year.
- This 25 percent savings could fund a mix of doubling city spending on health and human services or cutting property taxes by up to 5 percent.

Continued on next page

### *Jacksonville*

- A 10 percent reduction could save \$4 million per year, reduce the direct costs to victims by nearly \$8 million per year, and avert more than \$80 million in annual, intangible costs to victims—reducing total government costs by an average of \$122 per resident per year.
- A 25 percent reduction could save nearly \$12 million per year, reduce the direct costs to victims by nearly \$20 million per year, and avert more than \$200 million in annual intangible costs—reducing total government costs by the equivalent of more than \$305 per resident per year.
- This 25 percent savings could enable a mix of cutting its property taxes by up to 2 percent or increasing local spending on economic development by up to 26 percent.

### *Milwaukee*

- A 10 percent reduction could save nearly \$5 million per year, reduce the direct costs to victims by more than \$9 million per year, and avert some \$90 million in annual, intangible costs to victims—reducing total government costs by an average of nearly \$190 per resident per year.
- A 25 percent reduction could save more than \$12 million per year, reduce the direct costs to victims by some \$23 million per year, and avert \$225 million in annual intangible costs—reducing total government costs in Milwaukee by the equivalent of nearly \$470 per resident per year.
- This 25 percent savings could enable a mix of cutting property taxes by up to 4 percent or increasing spending on housing and community development by up to 71 percent.

### *Philadelphia*

- A 10 percent reduction could save more than \$17 million per year, reduce the direct costs to victims by nearly \$30 million per year, and avert nearly \$300 million in annual, intangible costs to victims—reducing total government costs by an average of nearly \$240 per resident per year.
- A 25 percent reduction could save more than \$43 million per year, reduce the direct costs to victims by nearly \$75 million per year, and avert some \$742 million in annual intangible costs—reducing total government costs by the equivalent of more than \$595 per resident per year.
- This 25 percent savings could enable a mix of cutting local property taxes by up to 11 percent or doubling spending on homeless and housing assistance.

### *Seattle*

- A 10 percent reduction could save more than \$2 million per year, reduce the direct costs to victims by more than \$2 million per year, and avert nearly \$22 million in annual, intangible costs to victims—reducing total government costs by an average of nearly \$50 per resident per year.
- A 25 percent reduction would save the city budget \$6 million per year, reduce the direct costs to victims by more than \$5 million per year, and avert some \$54 million in annual intangible costs—reducing total costs in Seattle by the equivalent of \$123 per resident per year.
- This 25 percent savings could enable a mix of cutting property taxes by up to 2.4 percent and increasing city spending on neighborhoods and development by up to 5.4 percent.

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# Introduction and summary

Violent crimes are costly. Murders, rapes, assaults, and robberies impose concrete economic costs on the victims who survive as well as the families of those who lose their lives, in the loss of earnings and their physical and emotional tolls. Violent crimes also impose large costs on communities through lower property values, higher insurance premiums, and reduced investment in high-crime areas. In addition, violent crimes impose significant costs on taxpayers, who bear the financial burden of maintaining the police personnel and operations, courts, jails, and prisons directed toward these crimes and their perpetrators.

Fortunately, the incidence of violent crimes in the United States has fallen sharply over the last 20 years. From 1960 to 1990 the rates of these crimes rose sharply as did their attendant costs. Over that period murder rates nearly doubled, rates of rape and robbery increased fourfold, and the rate of assault quintupled. Since the early 1990s, however, rates of most violent crimes have been cut nearly in half. (see Figure 1)

Yet rates of most violent crimes in the United States remain high compared to the 1950s and 1960s and to other advanced societies today. The U.S. murder rate, for example, has fallen to a 50-year low, but that rate is still nearly three times the level in Canada and more than four times the level in the United Kingdom.<sup>1</sup> Among all

**FIGURE 1**

## The good news: Falling crime rates

Violent crime in the United States, offenses per 100,000 population, 1960-2010

### Use of weapons and guns in violent crimes, 2010

Violent crime	Percent committed with weapons	Percent committed with handguns
Homicide	94%	67%
Robbery	58%	41%
Aggravated assault	73%	20%

Source: Federal Bureau of Investigation, Uniform Crime Report, Crime in the United States, 2010 (Department of Justice, 2011).

Source: FBI, Uniform Crime Reports as prepared by the National Archive of Criminal Justice Data, <http://www.ucrdatatool.gov/Search/Crime/State/StateCrime.cfm>

of the world's developed countries, the United States today, on a per capita basis, ranks second in murders, fourth in rapes, and sixth in robberies.

The Bureau of Justice Statistics reports that the majority of all violent crimes involve the use of weapons, and in two-thirds of all homicides and 41 percent of all robberies, the weapon is a handgun. (see Table 1)

**TABLE 1**  
**Most violent crimes involve weapons**

Use of weapons and guns in violent crimes, 2010

<b>Violent crime</b>	<b>Percent committed with weapons</b>	<b>Percent committed with handguns</b>
<b>Homicide</b>	94%	67%
<b>Robbery</b>	58%	41%
<b>Aggravated assault</b>	73%	20%

Source: Federal Bureau of Investigation, *Uniform Crime Report, Crime in the United States, 2010* (Department of Justice, 2011).

Moreover, from 2005 to 2010 the nationwide incidence of homicides declined by 12.5 percent, the number of robberies decreased by nearly 9 percent, and the number of aggravated assaults declined by 7 percent. The share of crimes committed with guns in all three categories, however, remained constant.

By most measures, violent crime continues to impose significant costs on Americans and their communities. The costs borne by the American public for this level of criminal activity are significant. Medical care for assault victims, for example, costs an estimated \$4.3 billion per year.<sup>2</sup> We spend \$74 billion per year on incarcerating 2.3 million criminals, including some 930,000 violent criminals.<sup>3</sup>

Moreover, the costs of the pain and suffering borne by the victims of violent crimes is several times greater than the more direct costs of those crimes. As a result, successful efforts to reduce violent crime can produce substantial economic benefits for individuals, communities, and taxpayers.

This report presents the findings and conclusions of a yearlong project to examine and analyze the costs of violent crimes in a sample of eight major American cities and estimate the savings and other benefits that would accompany significant

reductions in those crimes. This analysis draws on data pinpointing the incidence and location of murders, rapes, assaults, and robberies. The data were provided by the police departments of Boston, Chicago, Dallas, Houston, Jacksonville, Milwaukee, Philadelphia, and Seattle.

We examined a broad range of both direct and intangible costs associated with those violent crimes based on their incidence in each of the eight cities in 2010. The direct costs reported here are those borne by the residents and city governments of the eight cities, although additional costs are also borne by state and federal governments and the taxpayers who finance them. Finally, we calculated the benefits to those residents associated with substantial reductions in violent crime, including the impact on residential home values and a variety of savings to the city governments.

In today's tight fiscal and economic environment, the mayors and city councils of every city—along with state and the federal governments—are searching for ways to reduce their spending and expand their revenues. The common challenge is to achieve sustainable fiscal conditions without hobbling government's ability to provide the vital goods and services that most Americans expect, all without burdening businesses and families with onerous new taxes. This analysis provides another way available to many American municipalities: Secure budget savings, higher revenues, and personal income and wealth gains by reducing violent crime rates.

To calculate the extent of those savings and benefits, we analyze a broad range of direct costs associated with the violent crime in the eight cities sampled here. These direct costs start with local spending on policing, prosecuting, and incarcerating the perpetrators of those crimes. These costs also encompass out-of-pocket medical expenses borne by surviving victims of violent crime as well as the income those victims must forgo as a result of the crimes. These costs also include the lost incomes that would otherwise be earned by the perpetrators of violent crimes had they not been apprehended—as distasteful as it is to calculate the foregone income of rapists or armed robbers who are arrested, convicted, and incarcerated. These direct, annual costs range from \$90 million per year in Seattle to around \$200 million per year in Boston, Jacksonville, and Milwaukee, to more than \$700 million in Philadelphia and nearly \$1.1 billion for Chicago.

This report also examines certain intangible costs associated with violent crime, including the pain and suffering of the surviving victims of violent crime and the costs to the families of murder victims. Across the eight cities examined here, the

total annual costs of violent crimes, including these intangible costs as well as the more direct ones, range from more than \$300 million per year in Seattle to more than \$900 million in Boston, to some \$3.7 billion per year in Philadelphia and \$5.3 billion for Chicago.

Based on this analysis we also estimate the budgetary savings that each of the eight cities should expect to achieve if their rates of violent crime declined by either 10 percent or 25 percent. These savings include lower expenditures on law enforcement and the justice system, as well as the additional revenues that each city could expect to collect from applying local taxes to the income earned by those who otherwise would have been victims or perpetrators of those crimes.

All told, the estimated savings for municipal budgets from a 25 percent reduction in violent crime range from \$6 million per year in Seattle to \$12 million per year in Boston and Milwaukee, to \$42 million per year in Philadelphia and \$59 million for Chicago. We also estimate the value of other benefits associated with reduced rates of violent crime, including lower out-of-pocket medical costs for those who otherwise would have been victims as well as their averted pain and suffering.

The largest economic benefits, however, arise from the impact of lower rates of violent crime on the housing values in the cities sampled here. To estimate this effect, we use data covering several years on the incidence of violent crimes by zip code in each city and changes in housing values in the same zip codes over the same period. Five of the eight cities were able to provide data by zip code covering at least six years. Our analysis of those data found that a reduced incidence of murders in a particular zip code is followed by a predictable and significant increase in housing values in the same zip code in the next year.

On average, a reduction in a given year of one homicide in a zip code causes a 1.5 percent increase in housing values in that same zip code the following year. We applied these findings to available data on the value of the housing stock in the metropolitan areas of all eight cities. The estimated increases in the value of the housing stock for the eight cities and their immediate metropolitan areas, following a 10 percent reduction in homicides, range from \$600 million in Jacksonville and the surrounding area to \$800 million in the Milwaukee area, to \$3.2 billion in Philadelphia and the surrounding suburbs, and \$4.4 billion in the Boston area. Unfortunately, inconsistent reporting of other types of violent crime—rapes, assaults, and robberies—preclude a reliable analysis of the impact on housing values of changes in the incidence of those crimes.

## Methods to reduce violent crime

A full analysis of the ways communities reduce crime is beyond the scope of this report, but it is important to note that many strategies for reducing violent crime entail budgetary costs as well. We do not attempt to calculate those costs. Nevertheless, readers should be aware that scholars have conducted extensive research to identify which crime control and prevention strategies contributed most to the reductions in violent crimes in recent decades.

Problem-oriented policing is an evidence-based intervention for reducing violence.<sup>4</sup> An evaluation of the “pulling levers” strategy—policing that “focuses criminal justice and social service attention on a small number of chronically offending gang members”—found a 43 percent decline in assaultive gun violence events and a 66 percent reduction in gang-related homicides after the intervention.<sup>5</sup>

An economic analysis of underground gun markets in Chicago suggests that intervening in networks of black-market gun brokers may also offer promise in reducing illegal access to guns.<sup>6</sup> Police stings of gun dealers engaged in illegal gun sales were associated with a subsequent reduction in the supply of new guns to criminals in some but not all cities.<sup>7</sup>

Many empirical studies, for example, have examined which strategies have been most cost effective.<sup>8</sup> A 1997 meta-analysis commissioned by the U.S. Department of Justice identified a range of practices that have proved successful with various kinds of offenders. Family therapy and parent-training efforts have been quite effective for at-risk pre-adolescents while vocational training has worked well for certain groups of older, male ex-offenders. Additional police patrols also reduced the incidence of serious offenses in high-crime hotspots.<sup>9</sup>

Similarly, a 1998 RAND Corporation study analyzed the cost effectiveness of several approaches in California. It found that \$1 million expended on graduation incentives reduced the number of yearly serious crimes by 258.<sup>10</sup> By contrast, \$1 million for parent training led to 157 fewer crimes, \$1 million on supervising delinquents led to 72 fewer serious crimes, and \$1 million devoted to three-strike laws led to just 60 fewer serious offenses.<sup>11</sup>

As a crime-prevention strategy, longer and more certain prison sentences seem to reduce property crimes, but not violent crimes.<sup>12</sup> Yet incarceration does make it much easier to build up DNA databases and recent research has found that criminals included in DNA databases are less likely to commit new crimes as well as more likely to be apprehended when they do so.<sup>13</sup> According to one analysis a 50 percent increase in the size of the average DNA database could produce a 13.5 percent reduction in murders, a 27.2 percent reduction in rapes, and a 12.2 percent reduction in aggravated results.

Many social and economic policies designed for other purposes may also reduce the incidence of serious crimes. Programs to encourage young people to remain in school, for example, have proved to be one of the most cost-effective crime-reduction strategies.<sup>14</sup> Similarly, community-development efforts to increase business investment in at-risk neighborhoods have also been shown to reduce crime rates.<sup>15</sup> Finally, demographics play a role. Male youth are the population group most prone to commit serious crimes so as their share of the population grew with the initial baby boom and then fell with the subsequent baby bust, crime rates also increased and then subsided.<sup>16</sup>



# The consequences of falling crime rates on real estate values, city budgets, and local residents

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## Housing values

First, we will examine and analyze how a reduction in the incidence of violent crimes in a city affects the value of housing in that city. To undertake this analysis we collected data on the incidence of violent crimes by geographic area for eight cities:

- Boston
- Chicago
- Dallas
- Houston
- Jacksonville
- Milwaukee
- Philadelphia
- Seattle

These cities provided data covering varying periods of time from 2000 on, ranging from 6 to 11 years. Police departments in five of the cities were able to provide complete data by zip code covering a sufficiently long period for statistical analysis—Chicago, Houston, Jacksonville, Milwaukee, and Philadelphia.

We also collected data on the value of residential real estate in each city by zip code for the same time periods covered by the crime data. We used those two datasets to analyze the consequences of the actual changes in violent crime rates on actual housing values, using so called dynamic panel regression models in conjunction with Granger causality testing. (See Appendix A, Table A-2, on page 54 for a detailed description of this methodology.) This analysis shows that, on average, a reduction in homicides of one incident in a zip code during a given year causes a 1.52 percent increase in home prices in that zip code the following year.

The impact on real estate values of lower rates of other violent crimes, however, is more difficult to establish. Our analysis did not establish a statistically significant relationship. In fact, it found that falling rates of violent crimes other than homicides were followed by falling housing prices, though not to a statistically significant degree. We discount these results, however, because they likely reflect persistent problems with these types of crime data. Unlike murders, other violent crimes are sharply underreported. According to the Justice Department National Crime Victimization Surveys, on average only 45 percent of rapes and 59 percent of assaults are reported to police.

Moreover, the rates at which those crimes are reported may shift from year to year in no stable relationship to the rates at which those crimes actually occur. Since this analysis depends on changes in crime rates in small geographic areas (zip codes), these random variations preclude reliable results.

The results from homicides are reliable, however, and the economic consequences of reduced rates of homicides can be very large. Here, we were able to roughly estimate the metropolitan statistical area-wide impact for seven of the eight sample cities (all but Houston). We estimate, for example, that a 10 percent reduction in homicides could increase the value of the housing stock of the Boston area by \$4.4 billion in the following year. (see Table 5 on page 17)

Similarly, a 10 percent drop in homicides could increase the value of the housing stock by \$3.2 billion in the Philadelphia metropolitan area, by \$2.9 billion in the Seattle area, by \$2.4 billion in the Dallas area, by \$2.2 billion in the Chicago metropolitan area, by \$800 million in and around Milwaukee, and by \$600 million in the Jacksonville area. A 10 percent reduction in homicides, therefore, should generate large revenue gains from the property taxes applied to those values.

The housing stock data, however, cover metropolitan areas, which in each case encompass city and suburban jurisdictions with different property tax rates. Therefore, we cannot estimate the precise dimensions of these additional property tax revenues for the eight sampled cities.

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## City budgets and their residents

Next, we analyzed other benefits and savings for individuals, communities, and municipal budgets that come from reductions in violent crimes, using data on violent crimes from all eight cities examined in this report. This analysis begins with an accounting of the direct costs of violent crime:

- The medical costs borne by surviving victims of violent crime
- Municipal spending on police
- Courts and corrections
- The foregone productivity of murder victims, victims of other violent crimes while they recover, and of criminals while they remain in jail or prison

Across the eight cities, these direct costs arising from the four types of violent crimes total nearly \$3.7 billion per year. These direct costs are equivalent to an average of \$320 per resident per year for the eight cities, ranging from \$144 per resident per year in Seattle to \$472 per resident per year in Philadelphia. (see Table 2)

**TABLE 2**  
**The direct costs of violent crimes**

Estimated direct costs of violent crimes by city 2010 (\$ millions)

City	Victims	Justice system	Productivity losses (criminals)	Total	Cost per resident
<b>Boston</b>	\$72	\$102	\$24	<b>\$198</b>	<b>\$308</b>
<b>Chicago</b>	\$426	\$547	\$132	<b>\$1,104</b>	<b>\$390</b>
<b>Dallas</b>	\$145	\$175	\$43	<b>\$363</b>	<b>\$278</b>
<b>Houston</b>	\$268	\$393	\$91	<b>\$752</b>	<b>\$330</b>
<b>Jacksonville</b>	\$78	\$100	\$24	<b>\$202</b>	<b>\$246</b>
<b>Milwaukee</b>	\$92	\$115	\$27	<b>\$235</b>	<b>\$388</b>
<b>Philadelphia</b>	\$299	\$351	\$86	<b>\$736</b>	<b>\$472</b>
<b>Seattle</b>	\$21	\$56	\$12	<b>\$89</b>	<b>\$144</b>

Source: Authors' calculations; Federal Bureau of Investigation Uniform Crime Reports, Department of Justice National Crime Victimization Survey, 2006-2010, Department of Justice Bureau of Justice Statistics Criminal Justice Expenditure and Employment, and Department of Justice Bureau of Justice Statistics National Judicial Reporting Program.

Given these costs reducing the incidence of violent crime should produce substantial benefits. The direct savings for city governments associated with a 10 percent reduction in these four violent crimes would include commensurate reductions in spending on law enforcement, courts and corrections, and additional revenues from taxing the earnings of both would-be victims and would-be perpetrators of crimes that would not occur under this scenario.

A 10 percent decline in violent crime should produce direct savings to the governments of the eight cities ranging from \$2 million per year in Seattle to \$24 million per year in Chicago. Similarly, a 25 percent reduction in violent crime—half of the nationwide decline seen from 1990 to 2010 for rape, robbery, and assault—would mean annual savings for the eight city governments ranging from \$6 million per year in Seattle to \$59 million per year in Chicago.

Across all eight cities a 10 percent reduction in violent crime rates would produce combined direct savings of \$82 million per year for the eight city governments, while a 25 percent reduction would produce \$204 million. (see Table 3)

**TABLE 3**  
**Savings from reduced violent crime**

Estimated budget costs from violent crime and budget savings from 10 percent and 25 percent reductions in those crimes, by city, 2010 (\$ millions)

City	Budgetary costs			Annual budget savings from reducing violent crimes	
	Police, courts and corrections	Tax revenue	Total	10 Percent reduction	25 Percent reduction
<b>Boston</b>	\$102	\$6.8	<b>\$109</b>	\$11	\$27
<b>Chicago</b>	\$547	\$18.2	<b>\$565</b>	\$56	\$141
<b>Dallas</b>	\$175	\$5.6	<b>\$180</b>	\$18	\$45
<b>Houston</b>	\$393	\$10.8	<b>\$404</b>	\$40	\$101
<b>Jacksonville</b>	\$100	\$4.1	<b>\$104</b>	\$10	\$26
<b>Milwaukee</b>	\$115	\$2.9	<b>\$118</b>	\$12	\$30
<b>Philadelphia</b>	\$351	\$33.3	<b>\$384</b>	\$38	\$96
<b>Seattle</b>	\$56	\$1.1	<b>\$57</b>	\$6	\$14

Source: U.S. Census Bureau (2010), authors' calculations. Estimates of revenues losses assume one-to-one relationship between growth in the incomes of city residents and growth in the city's total tax revenues.

Such reductions in violent crime could release or create new resources for other municipal purposes. A 25 percent reduction would save the city of Boston, for example, sufficient funds and generate sufficient additional revenues to either fund a 1 percent cut in that city's property taxes, increase city spending on health and human services by 6.8 percent, or boost spending on housing and community development by 14.4 percent. Similarly, a 25 percent drop in Houston's violent-crime rates would generate sufficient additional resources to double that city's budget for health and human services or fund a 5.1 percent cut in property taxes.

Researchers also have studied and estimated the less tangible, indirect costs arising from violent crime, especially the pain, suffering, and diminished quality of life that surviving victims of violent crime experience as well as effects on the families of murder victims. Unlike the more tangible, direct costs of violent crimes, there are no objective measures for these genuine losses. But scholars have developed a variety of methods to estimate the value of the pain, suffering, and reduced quality of life of people who are raped, violently assaulted, or robbed.

All of these approaches find that these intangible costs exceed the direct costs by an order of three to four. Nationwide, these intangible costs come to an estimated \$156 billion per year. For the eight cities examined here, these intangible costs are estimated to total nearly \$14 billion per year, ranging from \$216 million per year in Seattle to \$4.2 billion per year in Chicago

Therefore, a 10 percent or 25 percent reduction in violent crime should proportionately reduce those indirect, intangible costs. A 25 percent reduction would save potential victims of violent crimes in Milwaukee, for example, pain, suffering, and diminished quality of life valued at \$225 million per year, while a similar decline in violent crimes in Dallas would be worth \$361 million in intangible benefits for those who otherwise would have been victims of violent crimes. (see Table 4 on next page)

TABLE 4

**Direct and indirect costs of violent crimes**

Estimated direct and indirect costs of violent crimes, by city, 2010 (\$ millions)

City	Direct costs				Intangible and total costs	
	Victim	Justice system	Criminal	Total direct	Intangible	Total direct and intangible
<b>Boston</b>	\$72	\$102	\$24	<b>\$198</b>	\$734	<b>\$932</b>
<b>Chicago</b>	\$426	\$547	\$132	<b>\$1,104</b>	\$4,206	<b>\$5,310</b>
<b>Dallas</b>	\$145	\$175	\$43	<b>\$363</b>	\$1,444	<b>\$1,807</b>
<b>Houston</b>	\$268	\$393	\$91	<b>\$752</b>	\$2,655	<b>\$3,407</b>
<b>Jacksonville</b>	\$78	\$100	\$24	<b>\$202</b>	\$802	<b>\$1,004</b>
<b>Milwaukee</b>	\$92	\$115	\$27	<b>\$235</b>	\$900	<b>\$1,135</b>
<b>Philadelphia</b>	\$299	\$351	\$86	<b>\$736</b>	\$2,970	<b>\$3,705</b>
<b>Seattle</b>	\$21	\$56	\$12	<b>\$89</b>	\$216	<b>\$305</b>

Source: FBI, "Uniform Crime Reports," as prepared by the National Archive of Criminal Justice Data, available at <http://www.ucrdatatool.gov/Search/Crime/State/StateCrime.cfm>; Kathryn E. McCollister, Michael T. French, and Hai Fang, "The Cost of Crime to Society: New Crime-Specific Estimates for Policy and Program Evaluation," Drug and Alcohol Dependence 108 (1-2) (2010): 98–109.

We now turn to more detailed analyses of the consequences of falling violent crime rates on real estate values, city budgets, and local residents.

# The impact of lower rates of violent crime on real estate values

The analysis in this section is based on data provided by the police departments of five cities on the incidence of violent crimes by geographic location, and data on residential home sales in those cities by zip code from DataQuick. As we will demonstrate, changes in homicide rates in particular across those five cities had clear and significant effects on the value of homes in the same areas. Homicides obviously exact an incalculable toll on the victims and significant costs on their families. But costs also are borne by everyone who lives nearby through the impact on property prices. Moreover, our analysis found that successful efforts to reduce homicides would generate substantial benefits not only for those who otherwise would be victims but also for the area as a whole.

These findings have important implications for policymakers because the equity that people hold in their homes accounts for much of Americans' wealth. Increases in home values driven by the exogenous factor of a falling homicide rate translate directly into increases in the wealth and financial security of the families who own those homes. Such increases in housing values also can lead to substantially higher local government revenues when property tax assessments catch up with the underlying increase in home values.

## Data and methodology

This analysis focused on the five cities of Chicago, Houston, Jacksonville, Milwaukee, and Philadelphia, covering at most the 11 years between 2000 and 2011. The police departments in these cities provided violent crime data by zip code. We obtained median and mean residential property prices by zip code for the same cities tract from DataQuick, a public-records database company. DataQuick compiles real estate data from public sources such as county assessors' offices and county recorders' offices and provides estimates of prices for new, existing, attached, and detached home-sale transactions.<sup>17</sup>

The crime data we collected covered reports of homicides, rapes, robberies, and aggravated assaults, covering all of these crimes and attempted crimes regardless of whether arrests or convictions were

ever made. These crime data were not reported in a uniform format across police departments. Each department provided a list of every reported violent crime by some geographic identification over the longest period available from 2000 to 2011.

Philadelphia, Milwaukee, and Jacksonville all provided the point location of each reported crime. We also engaged Spatial Insights, Inc., a geographic information services company, to "reverse geocode" these point locations to zip codes. Houston and Chicago provided street addresses, which we mapped onto zip codes using the "Geocode+Maps," software from GeoLytics, Inc., with a success rate of 99 percent.

[Continued on next page](#)

The data from different cities covered varying periods: 11 years (Jacksonville, 2001–2011), 10 years (Chicago, 2001–2010), nine years (Houston, 2000–2008), and six years (Milwaukee, 2005–2010, and Philadelphia, 2004–2009). As expected, the relative prevalence of these crimes is fairly uniform across the cities, with homicides being least common, followed by rapes, and aggravated assaults and robberies occurring much more frequently.

Our empirical method applied the standard “Granger Causality” statistical regression test to identify any causal relationship between changes in these violent crimes and changes in residential property prices.

In addition to the proposition that lower crime rates lead to higher property values, we also consider the possibility that higher residential property prices lead to reductions in violent crimes, and that violent crime rates and property prices are correlated with some other, third factor. We also recognize that there may be significant “multicollinearity” between the different types of violent crimes, so we group the crimes into the two variables of homicides and nonhomicides.

A more detailed description of our methodology and the summary statistics from the regression analysis is provided in Appendix A, Tables A-1 and A-2, on pages 52 and 54.

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## Results

Our main specification focused on the relationship between changes in violent-crime rates and changes in housing prices by zip code across five cities—Chicago, Houston, Jacksonville, Milwaukee, and Philadelphia. The Granger causality analysis found, first, the wholly unremarkable finding that, by zip code, housing prices in any one year affect housing prices in the following year to a statistically significant degree. (see Table A2 in Appendix A on page 54) In technical terms, changes in median residential property prices in an area in one year have a positive coefficient and are statistically significant in explaining the change in median residential property prices in that area in the following year.

More important, the causality test found that changes in the incidence of murders in a zip code in one year affect or explain, to a statistically significant degree, changes in residential property prices in the following year. Fewer murders in one year, therefore, “Granger cause” higher residential property prices the next year, and higher numbers of murders “Granger cause” lower residential property prices the following year.

More specifically, a reduction in homicides of one in a zip code Granger causes a 1.52 percent increase in home prices in that same zip code the following year. This relationship is symmetrical: Each additional homicide in a zip code, compared to the year before, is associated with a 1.52 percent reduction in home property values in the following year. This large of an effect from changes in homicide levels is not unexpected, given that the average number of homicides per zip code, per year across the cities sampled is only 5.51 per year.

These results are not affected by the underlying facts that through most of this period, murders were generally declining and housing prices were generally rising. The regression analysis takes account of these underlying facts and isolates and analyzes rates of changes in each of the variables across hundreds of observations by zip code and year.

The impact of falling rates of violent crimes other than homicides, however, is much more difficult to determine. Indeed, the regression analysis initially found the *opposite* effect from homicides. Falling rates of nonhomicide were associated with small declines in housing prices, or, since the relationship is symmetrical, rising nonhomicide crime rates were accompanied by slight increases in housing prices. These results, however, were *not* statistically significant.

In fact, these results likely reflect a recurring, underlying problem with nonhomicide crime data. The murder rate is widely considered the most reliable measure of violent crime. This is because virtually all murders are reported to the police. By contrast, a significant share of all rapes, robberies, and assault are not reported. Comparing “deaths from assault” (homicides) as reported by the Center for Disease Control with FBI reports of murder and non-negligent manslaughter, we find that more than 92 percent of all murders are reported to police.<sup>18</sup> But National Crime Victimization Surveys report that, on average, 45 percent of rapes, 59 percent of assaults, and 62 percent of robberies are reported to police. In addition, the rates at which these other violent crimes are reported vary from year to year, so that changes in their reported rates may not reflect changes in their actual incidence.

Therefore, an observed increase in these crimes may reflect shifts in reporting patterns rather than actual changes in crime rates. This effect may be very large in a small geographic area such as a zip code. When the police increase their presence in an area (such as a zip code), reported crimes may rise even when the actual incidence of those crimes is unchanged or even falls. Changes in the numbers of reported robberies, rapes, and aggravated assaults in a zip code may also be associated with increases in urban density when, for example, new businesses arrive and new residences are built in an area. Such a development could result, at once, in higher reported crime rates and higher property values, both reflecting the third variable of accelerated development. Along with many other researchers on the impact of crime, we therefore focus this analysis on homicides.

The technical specifications and results of the Granger causality analysis are provided in Appendix A at page 51.

In addition, Appendix B beginning on page 55 provides the results of six tests of the robustness of our main results. The tests demonstrate that the basic findings on the impact of changes in homicide rates are not affected by alternate specifications. In particular, we tested the sensitivity of our results to an increased number of lags, the inclusion of squared terms, the use of average rather than median property-price data, one-step estimation rather than two-step estimation, the inclusion of differing depths of lags, and an uncollapsed instrument matrix. These results confirm the impact of changes in homicide rates on changes in housing prices in zip code-size areas.

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### Impact of homicides on the value of the housing stock across a city or metropolitan area

Although our analysis was conducted at the zip-code level, we can use the results to estimate the impact of changes in homicide rates on the value of the overall housing stock of a city or metropolitan area. These estimates assume that the effect of reductions in homicide rates does not vary based on the absolute number of homicides in an area, and that people are as likely to move between cities or metropolitan areas in response to changes in homicide rates in their neighborhoods as they are to move within the same city or metropolitan area.

Using these assumptions we can estimate how much the value of the housing stock in the five cities examined here would be expected to rise in response to specified reductions in the homicide rates in those cities. These estimates should be accurate for the cities examined in this study, since they are all cities with accessible suburbs or nearby metropolitan areas that can provide potential new residents, and therefore increased demand for housing in areas with falling homicide rates.

As noted earlier, by combining the average number of homicides in those cities with our regression results, we find that a 10 percent reduction in homicides corresponds to a 0.83 percent increase in residential property values and prices the following year. A 25 percent reduction in homicides in these cities could push housing prices up by nearly 2.1 percent. This calculation allows us to estimate the overall gain in residential property values that could accompany a 10 percent reduction in homicides at the citywide or metropolitan areawide level. Moreover, we can extend this analysis to cover other cities considered here, so long as the relevant data on housing stock is available.

This analysis draws on total market value estimates for metropolitan areas from the Zillow Real Estate Market Reports of December 2010.<sup>19</sup> Since market value estimates for 2011 are not available, we estimate the effect on total residential property values in 2011 if the cities or their metropolitan areas had reduced homicides by 10 percent in 2010. These are high-end estimates that provide a rough measure of the wealth gains that could accompany a 10 percent reduction in homicide rates. Houston is omitted from this analysis because Zillow does not provide an estimate of total housing-market value in that city’s metropolitan area. Therefore, these estimates cover the other seven cities.

This analysis shows that a 10 percent reduction in homicides could increase the value of the residential housing stock by \$4.4 billion in the Boston metropolitan area, by \$2.4 billion in the Dallas metropolitan area, by \$2.2 billion in the Chicago metropolitan area, and by \$600 million in the Jacksonville metropolitan area. Similarly, a 10 percent reduction in homicides would boost the total value of all residential housing by \$3.2 billion across the Philadelphia metropolitan area, by \$2.9 billion in the Seattle metropolitan area, and by \$800 million in the Milwaukee metropolitan area. (see Table 5)

**TABLE 5**  
**Housing values rise as homicides decline**

Estimated impact of a 10 percent reduction in homicides in 2010 on total residential housing values in 2011, by metropolitan area (\$ billions)

Metropolitan area	Value of all housing, 2010	Increase in value of all housing, 2011
Boston	\$532,000,000,000	\$4,400,000,000
Chicago	\$266,000,000,000	\$2,200,000,000
Dallas	\$294,000,000,000	\$2,400,000,000
Jacksonville	\$75,000,000,000	\$600,000,000
Milwaukee	\$99,000,000,000	\$800,000,000
Philadelphia	\$391,000,000,000	\$3,200,000,000
Seattle	\$349,000,000,000	\$2,900,000,000

Source: Zillow Real Estate Market Reports of December 2011; authors’ calculations.

The large gains in the value of a city's housing stock associated with a 10 percent decline in homicides suggest that a successful effort to reduce violent crime could generate large revenue gains from the property taxes applied to those higher home values. Unfortunately, data constraints preclude our estimating those revenue gains with confidence because housing stock data cover metropolitan areas, and in each case, these metropolitan areas encompass city and suburban jurisdictions with varying property tax rates.

# Estimating other direct savings and intangible benefits of reducing violent crime

Economists, political scientists, and sociologists have examined the various costs that violent criminals impose on their victims and communities. We have reviewed this research to establish the best-available methodologies for estimating those various costs and consequently calculated the savings and benefits that should follow from reductions in the incidence of those crimes.

We estimate that a 10 percent reduction in violent crimes nationwide would generate direct and indirect saving of \$20 billion per year. Similarly, a 25 percent reduction in those crime rates would generate benefits estimated at \$50 billion per year.

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## The various costs associated with violent crimes

Most analysts distinguish between the direct or tangible costs of crimes and their indirect or intangible costs. The direct costs include, first, the value of property destroyed or damaged in the course of violent crimes, surviving victims' medical expenses and lost earnings from crime-related injuries, the productivity losses for those victims associated with the aftermath of these crimes over both the short and long term, and the productivity losses for murder victims based on their expected earnings for the remainder of their working lives.

The direct costs also include the expenditures by cities, counties, and states to apprehend, prosecute, and incarcerate the perpetrators of these crimes. Other direct costs include various types of private spending undertaken to avoid crime, including expenditures for home security systems, car alarms, security guards, and other security services. Finally, there are the economic losses entailed in moving accused or convicted people from a city's labor force to its jails and prisons and sacrificing the productivity and other benefits associated with their working, paying taxes, and buying goods and services. These last costs may seem problematic to some readers, because criminals are not commonly thought of as potentially

productive members of a community. Yet most criminals do work when they are not incarcerated, and we use the minimum wage to estimate these earnings.

To calculate these direct costs of crime, we use what researchers commonly call the “cost-of-illness” approach, which disaggregates these direct costs into the separate elements listed above.

While the direct costs of crime are significant, as are the associated direct savings from reducing such crime, the estimated value of the indirect and more intangible costs of violent crimes is much larger. These indirect costs focus on phenomena that have no universally accepted measure of their values, especially the pain, suffering, and reduced quality of life that result from being a surviving victim or potential victim of violent crime. Researchers have developed various ways of estimating these intangible costs using a “hedonic model,” a “contingent valuation” approach, a jury-award method, or some combination of these approaches. We examine each of these approaches in detail in this section of the report.

### The “cost-of-illness” approach to calculating the direct costs of violent crime

The “cost-of-illness” approach was first developed by public health experts to measure both the direct and intangible economic costs of illnesses and diseases. Its application to crime begins by identifying all of the distinct losses or costs associated with a crime and then estimating the value of each element. Most of such analyses of crime rely on FBI Uniform Crime Reports and the Department of Justice National Crime Victimization Surveys. The FBI Uniform Crime Report provides estimates of the incidences of a wide range of criminal activities based on reports of known offenses and arrests from various American law enforcement agencies. These crime incidence statistics cover eight serious or “Part 1” offenses, including four offenses classified as violent crimes (murder, rape, robbery, and aggravated assault) and four others classified as property crimes (burglary, larceny-theft, motor vehicle theft, and arson).<sup>20</sup>

The Department of Justice National Crime Victimization Surveys collect information on the victims of those crimes, including their out-of-pocket costs for medical treatment, property losses, and lost earnings. These data are drawn from a national sample of 42,000 U.S. households covering 76,000 individuals. The Bureau of Justice Statistics uses these data for an annual publication presenting a variety of

statistics on rapes and sexual assaults, robberies, aggravated assaults, burglaries, larceny-thefts, and motor vehicle thefts.

Using these data the Bureau of Justice Statistics published one of the first comprehensive studies of the costs of crime in 1984.<sup>21</sup> That study calculated that the direct victim-related costs of crime in 1981 nationwide totaled \$22.9 billion (2010 dollars). The bureau's follow up study 10 years later found that direct victim-related costs grew to \$27.4 billion (2010 dollars) from 1981 to 1991. These reports were important early contributions to the research on the costs of crime.

To estimate the direct costs of violent crimes in the United States today using this approach, we begin by updating the calculation of the direct economic costs borne by the victims of violent crime. Based on National Crime Victimization Surveys data for 2006–2010, we estimate the average out-of-pocket medical costs, property losses, and lost earnings of victims of rape, robbery, and assault over that five-year period.<sup>22</sup> This analysis shows, unsurprisingly, that victims of aggravated assault incur the largest average medical costs (\$1,969) and highest total average costs (\$2,133), and victims of completed robberies incur the largest average property losses (\$1,263). (see Table 6)

**TABLE 6**  
**The direct costs of violent crime excluding murder**

Average out-of-pocket costs for victims of rape, robbery and assault based on estimates from the national crime victimization survey, 2006-2010 (\$2010)

Crime	Medical	Property	Lost earnings	Total
<b>Rape/Sexual Assault</b>	<b>\$201</b>	<b>\$28</b>	<b>\$17</b>	<b>\$246</b>
<b>Rape</b>	\$314	\$41	\$24	\$379
<i>Completed Rape</i>	\$510	\$41	\$45	\$596
<i>Attempted Rape</i>	\$151	\$40	\$3	\$195
Sexual Assault	\$50	\$8	\$5	\$63
<b>Robbery</b>	<b>\$244</b>	<b>\$927</b>	<b>\$67</b>	<b>\$1,238</b>
<i>Completed</i>	\$122	\$1,263	\$59	\$1,444
<i>Attempted</i>	\$535	\$107	\$87	\$729
<b>Assault</b>	<b>\$128</b>	<b>\$10</b>	<b>\$51</b>	<b>\$188</b>
<b>Aggravated Assault</b>	\$526	\$8	\$61	\$596
<i>Completed</i>	\$1,969	\$14	\$150	\$2,133
<i>Attempted</i>	\$0	\$6	\$18	\$24
<b>Simple Assault</b>	\$25	\$10	\$48	\$82

Source: U.S. Department of Justice, National Crime Victimization Survey, (2006-2010).

Using a similar approach we also estimate the direct victim-related costs of the fourth violent crime: murder. This calculation assumes no out-of-pocket medical costs or property losses so the victim's lost earnings over a lifetime constitute the only victim-related costs of the crime. To estimate the value of those earnings, we use data on the average age of murder victims from the National Vital Statistics System and data on average income by age reported by the U.S. Census Bureau's Current Population Survey. We apply a discount value of 3 percent to derive the net present value of the lifetime earnings of murder victims, which we estimate to average \$925,000. Using this figure, the results in Table 3, and the incidence of violent crimes, we estimate that violent crimes nationwide in 2010 imposed direct costs on victims totaling \$14.6 billion. (see Table 7)

TABLE 7

### The total direct cost of violent crimes

Victim-related costs from violent crimes including murder, nationwide, 2010

Crime	Direct costs per-offense	Offenses in 2010	Total direct costs
Murder	\$924,562	14,748	\$13,635 million
Rape	\$379	84,767	\$32 million
Robbery	\$1,238	367,832	\$455 million
Aggravated Assault	\$596	\$778,901	\$464 million
<b>Total</b>	--	<b>\$1,246,248</b>	<b>\$14,587 million</b>

Source: FBI Uniform Crime Reports (2010); Department of Justice National Crime Victimization Survey, and authors calculations

Calculating the costs of violent crime for the criminal justice system is more complex because the data on these costs are not usually disaggregated by types of crime. To estimate the law enforcement, judicial, and correctional costs of violent crimes, we start with total U.S. expenditures for police protection, judicial and legal services, and corrections in 2007, reported by the Bureau of Justice Statistics.<sup>23</sup> We then adjust the 2007 data to 2010 dollars.<sup>24</sup> Next, we use FBI Uniform Crime Report arrest data to calculate arrests for violent crimes as a share of all arrests.

In 2010 murders accounted for 0.1 percent of all arrests, rapes accounted for 0.15 percent, robberies accounted for 0.9 percent, and aggravated assaults accounted for 3.1 percent. We apply these shares to the data on the aggregate costs of police and the judicial system. By this approach, we can estimate that the policing of

violent crimes cost \$4.6 billion in 2010, and the adjudication of those accused of violent crimes cost \$2.2 billion.

These estimates, however, are very conservative. Police departments and courts give much higher priority to violent crimes. Therefore it is very likely that the share of police and judicial resources devoted to these crimes substantially exceeds their share of all crimes.

The corrections costs for violent crimes are also difficult to measure. Some studies estimate correctional costs per offense by multiplying the average cost per inmate for all U.S. jails and prisons by the number of inmates incarcerated for each offense, and dividing that result by the number of total offenses committed each year. But this approach assumes that the number and distribution of violent criminal offenses committed each year remains constant, which is not the case.

For a more accurate estimate, then, we start with data from the Bureau of Justice Statistics on the number of inmates incarcerated in jails and prisons in 2010, and total correctional costs at federal, state, and local levels. On this basis we calculate that the cost of incarceration per inmate in 2010 was \$33,400.<sup>25</sup> Next we multiply the number of 2010 convictions for each of the four violent crimes by the average sentence for each crime, the percentage of each sentence actually served, and the estimated annual cost per inmate.<sup>26</sup> Using this approach we estimate that the correctional costs for the four violent crimes nationwide totaled \$15.4 billion in 2010.

The costs of the criminal justice system for violent crimes in 2010, therefore, totaled \$22.2 billion: \$4.6 billion (policing) + \$2.2 billion (courts) + \$15.4 billion (corrections).

Other direct costs of these crimes involve the economic losses from the foregone productivity or economic output of those convicted of violent crimes. To estimate these costs we start with data on the pre-arrest personal incomes of convicted felons based on a 2002 national survey of inmates.<sup>27</sup> These data suggest that convicted criminals earn about 40 percent of the U.S. average personal income. Using the approach adopted above to calculate correctional costs, we can estimate the lost income attributable to criminals for each type of violent crime based on the average income of convicted felons, the average age at sentencing for each type of violent crime, and the average sentence served for each violent crime. We estimate that in 2010 violent crimes nationwide cost the U.S. economy some \$5.4 billion in income, which those convicted would otherwise have produced.

Based on these calculations, the direct costs of violent crimes in 2010 totaled \$42.2 billion nationwide: \$14.6 billion (victim-related costs) + \$22.2 billion (police, courts, and correctional costs) + \$5.4 billion (lost work product of criminals). This is equivalent to a cost of \$137 for every person in the United States.

Therefore, a 10 percent reduction in violent crimes nationwide would save Americans nearly \$1.5 billion in victim-related costs and \$2.2 billion in law enforcement and judicial costs while increasing economic output by \$540 million. Similarly, a 25 percent reduction in these crimes would save Americans \$3.6 billion in victim-related losses and nearly \$5.6 billion in law enforcement and judicial spending while increasing the economy's output by nearly \$1.4 billion annually.

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## Estimating the intangible costs of violent crime

### The hedonic model approach for estimating these intangible costs

The academic literature on the costs of crimes includes extensive analysis of indirect or intangible costs, notably the pain, suffering, and diminished quality of life experienced by victims of violent crimes. This literature includes numerous studies that apply so-called hedonic models drawn from housing markets. Hedonic models are designed to reveal people's underlying preferences about the characteristics or attributes of a good, and then use those findings to estimate its value. In a housing market the value of a property can be estimated based on the number of bedrooms and bathrooms, the size of the lot, the location and characteristics of the neighborhood, and so on.

Cost-of-crime studies that use hedonic pricing assume that people reveal their preferences about crime levels when they purchase their homes, based on crime levels in that area. These studies apply econometric models that control for other variables that influence housing prices in order to isolate the monetary value that homebuyers place on reduced risk of crime.

The first study to adopt a hedonic model approach to estimate the intangible costs of crime used a sample of single-family home sales in Rochester, New York, in 1971.<sup>28</sup> After controlling for the characteristics of the properties and neighborhoods as well as other variables, the author found that an increase in per capita

property crime of 4.5 percent was associated with 3 percent lower home values. Using these findings the author estimated that the social and personal costs of a property crime in Rochester in 1971 averaged about \$2,880 (in 2010 dollars).

A broader study from 1999 analyzed the relationship between crime rates and urban flight for 127 American cities from 1970 to 1993.<sup>29</sup> Applying a hedonic model to FBI data on rapes, robberies, aggravated assaults, burglaries, larcenies, and auto thefts, the authors concluded that a 10 percent increase in those crimes led to a 1 percent decline in a city's population, and that those population losses were associated with identifiable reductions in housing prices. Finally, a 2010 study focused on housing prices and crime rates in Miami-Dade County, Florida, from 1999 to 2007 and found that a 1 percent increase in violent crime per acre reduced housing prices by about 0.25 percent.<sup>30</sup>

A key strength of this approach is that it relies on market data, which generally provide the most reliable information on the true value of goods. The challenge lies in identifying all the factors other than crime that influence housing prices so the relationship between crime and housing prices can be isolated. This is particularly difficult for factors such as poverty, which may be correlated with both crime and low real estate values.

Critics also note that an observed correlation between changes in crime rates and changes in housing prices may represent a causal relationship that runs from crime to housing prices and not in the other direction. Our own analysis of this relationship avoids the pitfalls of hedonic modeling by using the Granger Causality regression, which explicitly tests for and establishes the direction of the effect. In addition, this approach is often unable to distinguish the costs of different types of crimes, because rates for the various kinds of crimes tend to rise and fall together.

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### The contingent-valuation approach to estimating intangible costs

In the absence of market data on a public good such as reduced crime or clean air, some economists rely instead on surveys that measure how much people say they would be willing to pay for those public goods. This approach is called “contingent valuation,” because the willingness-to-pay values reported in those surveys are contingent on the conditions presented in the survey. Contingent valuation analysis was first used in environmental economics, but it is now commonly applied to crime.

A 2001 analysis, for example, used a 1998 survey of more than 1,200 people to estimate how much people would be willing to pay to reduce gun violence by 30 percent.<sup>31</sup> The study estimated a willingness-to-pay value of \$24.5 billion, or about \$1.2 million per gunshot injury. A 2004 analysis similarly surveyed 1,300 adults to estimate how much Americans would be willing to pay for a 10 percent reduction in murders, rapes, robberies, assaults, and burglaries.<sup>32</sup> Based on the survey the authors reported that the total personal and social costs of these crimes are between 1.5 times and 10 times greater than had been found previously—a result that they attributed to their capturing a range of intangible as well as direct costs.

Here, too, many economists question the reliability of this approach. The responses from the surveys sometimes contradict basic economic axioms, especially in the environmental area, when respondents say that they would be willing to pay the same or similar amounts to reduce water pollution by widely different amounts.<sup>33</sup> Another criticism is that contingent valuation suffers from “hypothetical bias” because survey respondents have no actual stake in the result.

Finally, some analysts argue that the surveys do not measure people’s actual economic preferences but rather their general approval or disapproval about a public good such as reduced gun violence or cleaner air. So respondents may derive a sense of satisfaction from expressing their (theoretical) willingness to pay a high price for less crime or cleaner air, but in practice they might strongly oppose a new tax for the same purpose.

Despite these criticisms the application of contingent valuation analysis to crime has certain advantages. In contrast to its use in the environmental area, respondents generally express a willingness to pay more for greater reductions in crime. On balance, a panel of experts recently concluded that a contingent valuation approach can produce estimates that provide a credible starting point for assessing the value of greater public safety, even though it may overstate people’s actual willingness to pay for it.<sup>34</sup>

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### The jury-award approach to estimating intangible costs

This approach also applies people’s stated views on the intangibles costs of crime but in a less hypothetical way. This approach relies on data from jury awards in civil suits that compensate victims of violent crimes for pain and suffering. A 1988

study used jury awards to estimate these costs for victims of 10 types of crimes, including rape, robbery, and assault.<sup>35</sup> This study also introduced other intangible costs unexamined by previous researchers, including the costs to victims' mental health and anxieties related to perceived "risks of death."

A subsequent study published by the U.S. Department of Justice's National Institute of Justice also used jury awards to estimate the costs arising from the pain and suffering of rape, robbery, and assault victims.<sup>36</sup> This study also estimated a variety of costs associated with murders, which other researchers usually had left unexamined, including the pain and suffering of third parties, medical costs, and lost productivity.<sup>37</sup>

While the jury award approach provided a new way of capturing the intangible costs of crimes, it also raised certain concerns. For instance, since litigation is often costly the cases that are pursued civilly may involve unusually violent and injurious acts, creating an upward bias in the cost estimates.<sup>38</sup> In addition, some analysts argue that jury awards are inappropriate because they represent *ex-post* or "willingness-to-accept" estimates of the cost of crime rather than *ex-ante* or "willingness-to-pay" estimates derived, in principle, from contingent valuation surveys. Researchers have found that willingness-to-accept values are typically two to three times larger than comparable willingness-to-pay values,<sup>39</sup> which critics point to as support for the view that jury awards incorporate an upward bias.

In the end we find that the most credible estimates of the intangible costs were derived from a very large and recent study that used a modified jury compensation approach to calculate per-offense pain and suffering estimates for violent crime, entitled, "The Cost of Crime to Society: New Crime-Specific Estimates for Policy and Program Evaluation."<sup>40</sup> The authors based their pain and suffering estimates on Jury Verdict Research (2004), which provides data on jury verdicts for individual injuries such as gunshot wounds, knife wounds, and rape-related injuries, based on their level of severity.<sup>41</sup> The authors then used 2007 data gathered by the Bureau of Justice Statistics on the probability that each offense leads to various injuries, to estimate pain and suffering costs for individual offenses. Moreover, as shown in Table 9 on page 32, the aggregate estimates of direct and intangible costs found by the "Cost of Crime to Society," a study sponsored by the National Institute on Drug Abuse and the National Institutes of Health,<sup>42</sup> are very close to those derived in a leading contingent valuation analysis that is also included in Table 9.<sup>43</sup>

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## The limitations of all crime-related cost estimates

The data used in all of these analyses of crime and their costs have certain limitations. Estimates of the income losses suffered by victims of violent crimes, for example, generally assume that those victims are broadly representative of the whole population. In fact, data from the National Crime Victim Survey suggest that victims of rape, robbery, and assault have lower-than-average annual incomes: 35 percent of the victims of violent crimes between 2006 and 2010 lived in households with incomes of less than \$20,000, compared to 20 percent of all American households.<sup>44</sup> Similarly, data from municipal police departments suggest that 70 percent to 80 percent of homicide victims in large cities have criminal records.<sup>45</sup> This suggests that the lifetime earnings losses attributed to murder victims may be overstated.

At the same time other factors suggest that most estimates of the costs of crime are understated. Most notably, crime is notoriously underreported. Data from the National Crime Victim Survey indicate that less than 60 percent of all violent crimes are reported to the police: these respondents report that only 45 percent of rapes, 59 percent of assaults, and 62 percent of robberies are reported to the police. If those data are correct, then the estimates of the costs to victims of violent crime in most of the current research including this study are substantially understated.

Between the various data issues and the approaches for estimating costs, researchers have produced a wide range of estimates. The estimates of the direct or tangible costs of one murder, for example, range from \$1.3 million to \$1.5 million, while the estimates for the indirect or intangible costs of one murder range from \$2.9 million to more than \$8.5 million. Similarly, the estimates of the direct costs of a rape or sexual assault vary from \$7,642 to \$41,774, and the estimated indirect or intangible costs range from \$94,115 to \$200,746. As noted above, we find that the per-offense estimates derived by the “Cost of Crime to Society” study, on balance, are the most reliable available. (See Table 8 for a breakdown of these intangible cost estimates by four key researchers.)

TABLE 8

**Estimates of Costs of Violent Crime**

Survey of recent research on the direct and intangible costs of violent crimes, per-offense (in 2010 dollars)

Crime	Cohen (1988)	Miller et al (1996)	Cohen et al (2004)	McCollister et al (2010)
<b>Murder</b>	<b>N/A</b>	<b>\$4,425,284</b>	<b>\$9,098,564</b>	<b>\$9,844,715</b>
Direct Costs	N/A	\$1,543,022	N/A	\$1,294,771
Intangible Costs	N/A	\$2,882,263	N/A	\$8,549,945
<b>Rape &amp; Sexual Assault</b>	<b>\$103,471</b>	<b>\$130,477</b>	<b>\$222,305</b>	<b>\$242,521</b>
Direct Costs	\$9,357	\$7,642	N/A	\$41,774
Intangible Costs	\$94,115	\$122,836	N/A	\$200,746
<b>Robbery</b>	<b>\$25,522</b>	<b>\$12,059</b>	<b>\$217,615</b>	<b>\$26,711</b>
Direct Costs	\$2,258	\$3,457	N/A	\$21,672
Intangible Costs	\$23,265	\$8,602	N/A	\$5,040
<b>Assault</b>	<b>\$24,375</b>	<b>\$14,114</b>	<b>\$65,660</b>	<b>\$33,394</b>
Direct Costs	\$855	\$2,344	N/A	\$19,787
Intangible Costs	\$23,520	\$11,770	N/A	\$13,607

Sources: Mark A. Cohen, "Pain, Suffering, and Jury Awards: A Study of the Cost of Crime to Victims," *Law & Society Review* 22 (3) (1988): 537–556. Ted R. Miller, Mark A. Cohen, and Brian Wierseman, "Victim Costs and Consequences: A New Look" (Washington, : National Institute of Justice Research Report, U.S. Department of Justice, 1996). Mark A. Cohen and others, "Willingness-To-Pay for Crime Control Programs," *Criminology* 42 (1) (2004): 89–109. Kathryn E. McCollister, Michael T. French, and Hai Fang, "The Cost of Crime to Society: New Crime-Specific Estimates for Policy and Program Evaluation," *Drug and Alcohol Dependence* 108 (1-2) (2010): 98–109. The estimates from Cohen and others (2004) are adjusted by a factor of 1.35 for hypothetical bias. The McCollister and others (2010) estimates do not include intangible costs associated with a sense of enhanced risk of homicide.



# The costs of violent crimes for eight U.S. cities and the benefits and savings from reducing those crimes

Earlier in this report we provided the details behind our estimate that violent crimes across the United States cost Americans nearly \$200 billion per year, including \$46 billion in direct costs and nearly \$156 billion in indirect, intangible costs. (see Table 4 on page 12) To estimate those intangible or indirect costs, we rely, as noted, on the recent “Cost of Crime to Society” study conducted by Kathleen McCollister, Michael French, and Hai Fang, which draws on jury award data to estimate the value of the pain and suffering arising from injuries from gunshot wounds, knife wounds, and physical assaults.<sup>46</sup>

Based on these data the authors calculated the average pain and suffering costs for each type of violent crime. We adjusted their figures to 2010 dollars. While jury awards may introduce an upward bias, we suspect that the substantial underreporting of most types of violent crimes introduces a larger downward bias. While we consider these estimates to be the most reliable available, we are confident that the actual, total costs of all violent crimes, direct and intangible, are probably even higher than those reported here.

The direct economic costs of those violent crimes cover the medical, property, and work- or productivity-related costs borne by surviving victims and by victims of homicide; the costs of policing, courts, and correctional facilities for those who commit violent crimes; and the value of the work or productivity-related losses of those arrested for violent crimes. For the eight cities examined in this report, those direct costs come to nearly \$3.7 billion per year, ranging from an estimated \$89 million per year in Seattle to more than \$1.1 billion per year in Chicago. On a per-resident basis, these direct annual costs range from \$144 per resident of Seattle to \$472 per resident of Philadelphia.<sup>47</sup> (see Table 9 on next page)

TABLE 9

## The multibillion dollar cost of violent crime

Estimated direct costs of violent crime, by city, 2010 (\$ millions)\*

City	Victim costs	Law enforcement and justice system costs				Criminal productivity costs	Total costs	Cost per resident
		Federal	State	Local	Total			
<b>Boston</b>	\$72	\$12	\$48	\$42	\$102	\$24	\$198	\$308
<b>Chicago</b>	\$426	\$64	\$265	\$218	\$547	\$132	\$1,104	\$390
<b>Dallas</b>	\$145	\$20	\$86	\$69	\$175	\$43	\$363	\$278
<b>Houston</b>	\$268	\$47	\$187	\$159	\$393	\$91	\$752	\$330
<b>Jacksonville</b>	\$78	\$12	\$47	\$40	\$100	\$24	\$202	\$246
<b>Milwaukee</b>	\$92	\$14	\$55	\$46	\$115	\$27	\$235	\$388
<b>Philadelphia</b>	\$299	\$41	\$171	\$139	\$351	\$86	\$736	\$472
<b>Seattle</b>	\$21	\$7	\$26	\$23	\$56	\$12	\$89	\$144
<b>Total</b>	<b>\$1,401</b>	<b>\$217</b>	<b>\$885</b>	<b>\$786</b>	<b>\$1,839</b>	<b>\$439</b>	<b>\$3,679</b>	<b>\$320 (ave)</b>

\*The criminal justice system cost estimates presented here are distributed among federal, state, and local governments based on national data on the distribution of those costs, as reported by the Bureau of Justice Statistics, and the incidence of violent crime in each jurisdiction. The actual costs borne by each of our eight cities may differ from those presented here based on how those costs are distributed between state and local governments.

Source: Authors' calculations. The estimates of justice system costs by level of government are based on data from the Bureau of Justice Statistics.

While Table 9 includes the total law enforcement and justice system costs for violent crimes at each level of government, we also disaggregate those costs into three components: police protection, the judicial system, and corrections. These data show that correctional-system operations account for nearly 72 percent of the total costs, ranging from \$38 million per year for Seattle to \$397 million per year for Chicago. Of the remaining justice-system expenditures, police operations for the eight cities account for an average of about 19 percent, and the judicial system accounts for the remaining 9 percent. (see Table 10)

The annual intangible or indirect costs per resident for the pain and suffering of the victims of violent crimes, on average, are nearly four times greater than the annual direct costs of those crimes per resident. These intangible costs for the eight cities total nearly \$14 billion per year, ranging from \$216 million per year in Seattle to \$4.2 billion per year in Chicago. On a per-resident basis, these annual intangible costs average \$1,202 per crime and range from an estimated \$350 for Seattle to \$1,905 for Philadelphia.

The large differences among the eight cities in both intangible and direct costs per resident reflect differences in both total violent crime rates and the rates of different types of violent crime. In particular, there are significant differences in murder

TABLE 10

## The costs of protecting against violent crime

Law enforcement and justice system expenditures on violent crimes, by city, 2010 (\$ millions)

City	Police protection	Judicial system	Corrections	Total
Boston	\$21	\$10	\$71	\$102
Chicago	\$101	\$49	\$397	\$547
Dallas	\$31	\$15	\$129	\$175
Houston	\$80	\$38	\$275	\$393
Jacksonville	\$20	\$10	\$70	\$100
Milwaukee	\$22	\$11	\$83	\$115
Philadelphia	\$64	\$31	\$256	\$351
Seattle	\$13	\$6	\$38	\$56
<b>Total</b>	<b>\$352</b>	<b>\$170</b>	<b>\$1,319</b>	<b>\$1,839</b>

Source: Tracey Kyckelhahn, "Justice Expenditures and Employment, 1982-2007" (Washington: Bureau of Justice Statistics, 2011).

TABLE 11

## The cost of violent crime per resident in eight U.S. cities

Annual intangible costs of violent crimes, by city, total and per resident, direct costs per resident, and total costs per-resident, 2010

City	Intangible costs (\$ millions)	Intangible costs per resident	Direct costs, per resident	Total costs per resident
Boston	\$734	\$1,142	\$308	\$1,447
Chicago	\$4,206	\$1,486	\$390	\$1,874
Dallas	\$1,444	\$1,106	\$278	\$1,383
Houston	\$2,655	\$1,165	\$330	\$1,494
Jacksonville	\$802	\$977	\$246	\$1,221
Milwaukee	\$900	\$1,486	\$388	\$1,873
Philadelphia	\$2,970	\$1,905	\$472	\$2,378
Seattle	\$216	\$350	\$144	\$492
<b>Total/Average</b>	<b>\$13,920</b>	<b>\$1,202</b>	<b>\$320</b>	<b>\$1,520</b>

Source: Authors' calculations.

rates across the eight cities, and the direct and indirect costs per resident are much higher for murders than for the other violent crimes. The total annual costs of violent crimes per resident in the eight cities average \$1,520, ranging from \$492 per resident per year in Seattle to \$2,378 per resident per year in Philadelphia. (see Table 11 on previous page)

Based on these cost calculations, a 10 percent reduction in violent crimes would generate estimated direct savings or benefits totaling \$368 million per year for all eight cities, ranging from \$9 million per year for Seattle to \$110 million for Chicago. The total annual savings and benefits, direct and indirect, from a 10 percent reduction in violent crime for all eight cities come to nearly \$1.8 billion, ranging from \$30 million in Seattle to \$531 million in Chicago.

A 25 percent reduction in violent crime in these eight cities would generate direct savings or benefits totaling \$921 million per year, ranging from an estimated \$22 million in annual benefits in Seattle to \$276 million in annual benefits for Chicago. A 25 percent reduction in violent crime would generate total benefits and savings, direct and indirect, of nearly \$4.5 billion per year for all eight cities, ranging from \$76 million in Seattle to more than \$1.3 billion in Chicago. (see Table 12)

TABLE 12

### Total costs of violent crime and total savings and benefits

Annual direct and indirect costs of violent crimes and annual direct savings and total benefits from reducing those crimes by 10 percent and 25 percent, by city, 2010 (\$ millions)

City	Costs			10% Crime Reduction		25% Crime Reduction	
	Direct	Intangible	Total	Direct Savings	All Benefits	Direct Savings	All Benefits
<b>Boston</b>	\$198	\$734	\$932	\$20	\$93	\$50	\$233
<b>Chicago</b>	\$1,104	\$4,206	\$5,310	\$110	\$531	\$276	\$1,327
<b>Dallas</b>	\$363	\$1,444	\$1,807	\$36	\$181	\$91	\$452
<b>Houston</b>	\$752	\$2,655	\$3,407	\$75	\$341	\$188	\$852
<b>Jacksonville</b>	\$202	\$802	\$1,004	\$20	\$100	\$51	\$251
<b>Milwaukee</b>	\$235	\$900	\$1,135	\$24	\$114	\$59	\$284
<b>Philadelphia</b>	\$736	\$2,970	\$3,705	\$74	\$371	\$184	\$926
<b>Seattle</b>	\$89	\$216	\$305	\$9	\$30	\$22	\$76
<b>Total</b>	<b>\$3,679</b>	<b>\$13,927</b>	<b>\$17,605</b>	<b>\$368</b>	<b>\$1,761</b>	<b>\$921</b>	<b>\$4,481</b>

Source: FBI Uniform Crime Reports (2010); McCollister et al (2010); authors' calculations.

These estimates of the benefits of lower violent-crime rates are conservative because they do not include a range of secondary benefits associated with reduced crime. Cities known to be safer places often experience increased tourism, which can generate substantial gains for businesses located there and for city governments that collect revenues on those gains. As we have established, falling crime rates also are associated with higher residential and commercial property values, which enrich households and businesses and generate higher property tax revenues for city governments.

In addition, falling crime rates generally result in lower insurance rates and payments, further supporting businesses and households.<sup>48</sup> Finally, falling violent crime rates can improve a city's general economic and business environment, leading to higher overall levels of investment and population gains.

Some of the direct savings from reducing violent crime will accrue directly to municipal budgets. To calculate the benefits for the budgets in the eight cities, we focus first on costs that come directly from those budgets. These estimates are provided in Table 9 on page 32, using local law enforcement and justice-system costs. These local budgetary costs for violent crimes come to \$786 million per year for all eight cities, ranging from \$23 million in Seattle to \$218 million in Chicago. Once again, these estimates are conservative. They are based on local law enforcement and justice system costs divided by violent crimes' share of all crimes, when violent crimes usually claim a disproportionate share of such spending.

The direct budgetary costs of violent crimes and corresponding budgetary benefits from reducing those crimes also include tax revenues on the income of victims who would have been able to work in the days following a crime and on foregone income by those convicted of violent crimes. To estimate the magnitude of these additional revenues from reducing violent crime, we analyzed U.S. Census Bureau data on the share of total household income that each city collects in local taxes. These implicit tax rates average 4.3 percent and range from 3 percent in Dallas and Houston to 8.6 percent in Philadelphia.

Next, we sum the foregone income of the victims of crimes and the criminals, using the methodology described earlier. This foregone income totals \$1.84 billion per year for the eight cities, ranging from \$33 million for Seattle to \$557 million for Chicago. We multiply this foregone income by the implicit tax rate for each city to

TABLE 13

**The municipal costs of violent crime**

Annual municipal revenue effects of violent crime from foregone income, by city, 2010 (\$ millions)

City	Victim-Related Costs	Criminal Productivity Costs	Total Foregone Income	Local Taxes as % of Household Income	Foregone Tax Revenues
Boston	\$72	\$24	\$96	7.0%	\$7
Chicago	\$426	\$132	\$557	3.3%	\$18
Dallas	\$145	\$43	\$188	3.0%	\$6
Houston	\$268	\$91	\$359	3.0%	\$11
Jacksonville	\$78	\$24	\$103	4.0%	\$4
Milwaukee	\$92	\$27	\$120	2.5%	\$3
Philadelphia	\$299	\$86	\$385	8.6%	\$33
Seattle	\$21	\$12	\$33	3.3%	\$1
<b>Total</b>	<b>\$1,401</b>	<b>\$439</b>	<b>\$1,841</b>	<b>4.3% (ave)</b>	<b>\$83</b>

Source: U.S. Census Bureau, Federal, State and Local Governments, Government Finances, U.S. Census Bureau, 2010 American Community Survey, and authors' calculations.

estimate the revenues foregone as a result of violent crime.<sup>49</sup> Our estimates of these foregone local revenues total \$83 million per year for the eight cities, ranging from \$1 million for Seattle to \$33 million for Philadelphia. (see Table 13)

The total municipal budgetary effects from reducing violent crime in the eight cities by 10 percent and 25 percent are calculated by summing those foregone revenues and the budgetary savings from lower local police, judicial, and correctional system spending. The municipal budget savings from a 10 percent reduction in violent crimes total \$82 million per year for the eight cities, ranging from \$2 million per year in Seattle to \$24 million per year in Chicago. The local budget savings from a 25 percent reduction in violent crime total \$205 million per year for all eight cities, ranging from \$6 million per year in Seattle to \$59 million per year in Chicago. (see Table 14)

TABLE 14

**Annual municipal cost and savings from reducing violent crime**

Local budgetary costs of violent crime and local budgetary savings from 10 percent and 25 percent reductions in those crimes, by city, 2010 (\$ millions)

City	Foregone Tax Revenues	Police & Justice System Spending	Total Revenue & Spending Costs	Saving: 10% Reduction in Violent Crime	Saving: 25% Reduction in Violent Crime
<b>Boston</b>	\$7	\$42	\$49	\$5	\$12
<b>Chicago</b>	\$18	\$218	\$236	\$24	\$59
<b>Dallas</b>	\$6	\$69	\$75	\$8	\$19
<b>Houston</b>	\$11	\$159	\$170	\$17	\$43
<b>Jacksonville</b>	\$4	\$40	\$44	\$4	\$11
<b>Milwaukee</b>	\$3	\$46	\$49	\$5	\$12
<b>Philadelphia</b>	\$33	\$139	\$172	\$17	\$43
<b>Seattle</b>	\$1	\$23	\$24	\$2	\$6
<b>Total</b>	<b>\$83</b>	<b>\$736</b>	<b>\$819</b>	<b>\$82</b>	<b>\$205</b>

Source: Authors' calculations.



# Alternative uses of the municipal savings from reducing violent crime

Finally, we present in graphical form alternative uses of the direct annual budget savings from reducing violent crime in each of the eight cities by 25 percent, as well as our earlier findings on the annual direct costs of those crimes to local budgets and examples of what the annual savings from the reductions in those crimes could be used for at the city level. (see next page)

As noted earlier, our criminal justice system cost estimates are distributed among federal, state, and local governments based on national data on the distribution of those costs as reported by the Bureau of Justice Statistics. The actual costs borne by each of our eight cities may differ from those presented here based on how costs are distributed between state and local governments. Some of the projected savings presented here, therefore, would accrue to state governments as well as city governments. Here we attribute those estimated savings to the local level to illustrate the budgetary impact of achieving reductions in violent crime of 10 percent or 25 percent.

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## Boston

In 2010 the Boston Police Department received reports of 73 murders, 256 rapes, 1,926 robberies, and 3,564 aggravated assaults. Boston experienced twice as many violent crimes per capita as the nation as a whole and the second-highest rate of aggravated assaults of the eight cities. These violent crimes cost the city \$198 million in 2010 or \$308 per resident.

A 25 percent reduction in these violent crimes would generate an estimated \$12.1 million in annual savings for the Boston city budget, including \$10 million in local justice-system savings and \$2 million in additional tax revenue. These extra savings would be enough for the city to consider a mix of boosting city spending on housing and community development by up to 14.4 percent or reducing property taxes by up to nearly 1 percent. (see Figure 2)

**FIGURE 2**  
**How Boston benefits from reducing violent crime**

The costs and potential budget savings (\$ millions)



Source: Authors' calculations.

## Chicago

In 2010 Chicago had a reported 432 murders, 1,262 rapes, 14,213 robberies, and 13,757 aggravated assaults for a total of 29,664 violent crimes. The city's violent-crime rate was more than 2.5 times the national average and these crimes cost the city more than \$1.1 billion in 2010, or nearly \$400 per resident.

A 25 percent reduction in violent crime in Chicago would generate an estimated \$59 million in direct cost savings to the Chicago city budget, including \$54 million in law enforcement and justice-system savings and \$5 million in increased revenues. These savings would enable Chicago to consider a mix of reducing all local taxes by up to 2.5 percent or increasing city spending on community services by up to 66 percent. (see Figure 3)

**FIGURE 3**  
**How Chicago benefits from reducing violent crime**

The costs and potential budget savings (\$ millions)



Source: Authors' calculations.

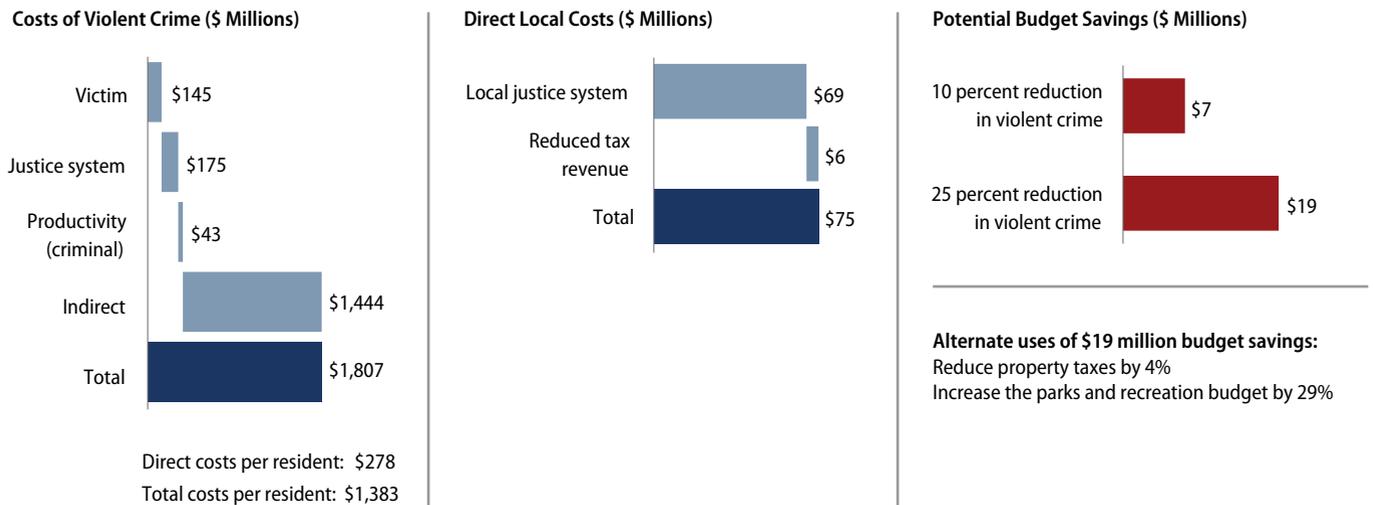
## Dallas

Dallas law enforcement received reports of 148 murders, 505 rapes, 4,487 robberies, and 4,021 aggravated assaults in 2010 for a total of 9,161 violent crimes. While Dallas was one of the safer cities in our sample of cities, it nevertheless sustained an estimated \$363 million in direct costs from violent crimes, equivalent to \$278 per resident.

Reducing violent crime in Dallas by 25 percent would generate \$18.7 million for the Dallas city budget, including \$17.2 million in law enforcement and justice-system savings and \$1.4 million in increased revenues. These savings would enable Dallas to consider a mix of reducing property taxes by up to 4.3 percent or increasing the parks and recreation budget by up to 29 percent. (see Figure 4)

**FIGURE 4**  
**How Dallas benefits from reducing violent crime**

The costs and potential budget savings (\$ millions)



Source: Authors' calculations.

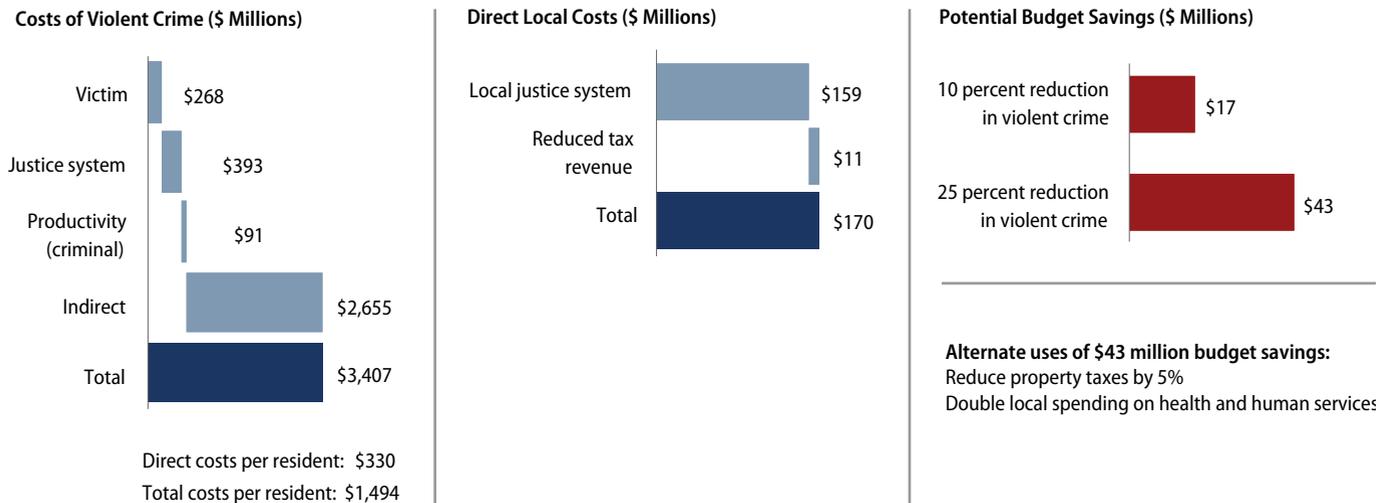
## Houston

Houston law enforcement in 2010 received reports of 269 murders, 712 rapes, 9,449 robberies, and 12,061 aggravated assaults, a total of 22,491 violent crimes. While these crimes represented less than 3 percent of all arrests in Houston that year, they cost the city \$752 million or \$330 per resident.

A 25 percent reduction in violent crime would generate \$43 million in savings for the Houston city budget, including \$40 million in law enforcement and justice-system savings and \$3 million in tax revenues. These savings could enable the city to consider a mix of doubling city spending on health and human services or cutting property taxes by 5 percent. (see Figure 5)

**FIGURE 5**  
**How Houston benefits from reducing violent crime**

The costs and potential budget savings (\$ millions)



Source: Authors' calculations.

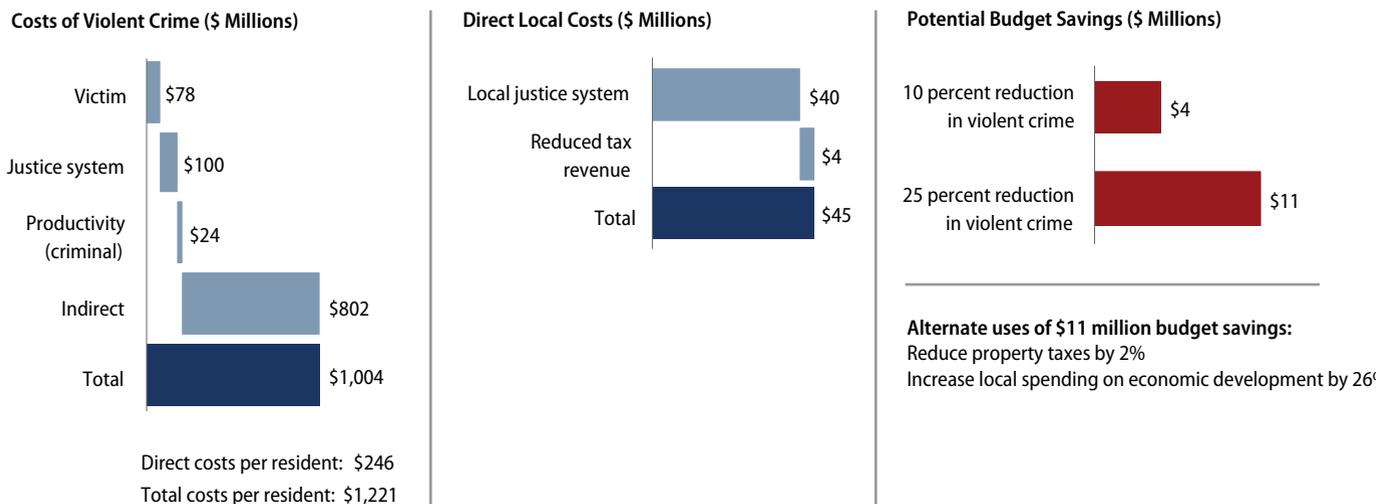
## Jacksonville

The Jacksonville Police Department received reports of 80 murders, 316 rapes, 1,693 robberies, and 3,380 aggravated assaults in 2010, a total of 5,469 violent crimes. Jacksonville was the second safest of the eight cities based on violent crimes per capita. Nevertheless, these crimes cost Jacksonville and its citizens more than \$200 million in 2010 or \$246 per resident.

A 25 percent reduction in these violent crimes would generate an estimated \$11.1 million in city budget savings, which would enable Jacksonville to consider a mix of cutting its property taxes by up to 2 percent or increasing local spending on economic development by up to 26 percent. (see Figure 6)

**FIGURE 6**  
**How Jacksonville benefits from reducing violent crime**

The costs and potential budget savings (\$ millions)



Source: Authors' calculations.

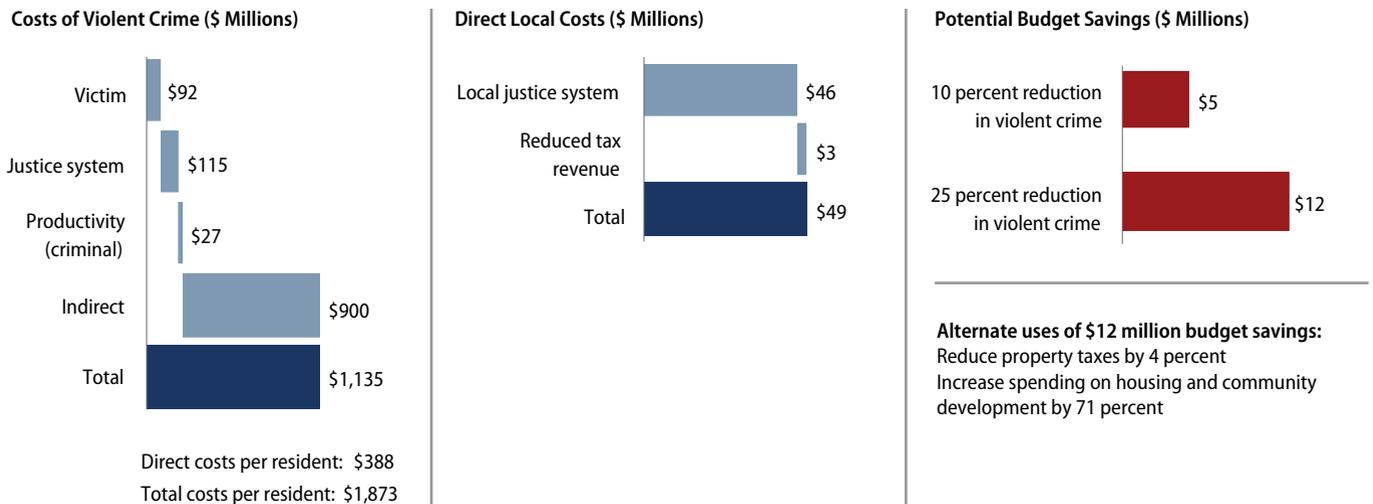
## Milwaukee

In 2010 Milwaukee law enforcement received reports of 94 murders, 197 rapes, 2,932 robberies, and 3,106 aggravated assaults, a total of 6,329 violent crimes. Milwaukee has one of the highest rates of violent crime of the eight cities, with more than one reported violent crime for every 100 residents. Even though violent crimes accounted for less than 4 percent of all arrests in Milwaukee, they cost the city \$235 million or \$388 per resident.

If Milwaukee reduced violent crime by 25 percent, the city government would save \$12.3 million, which could enable the city to consider a mix of cutting property taxes by up to 4 percent or increasing spending on housing and community development by up to 71 percent. (see Figure 7)

**FIGURE 7**  
**How Milwaukee benefits from reducing violent crime**

The costs and potential budget savings (\$ millions)



Source: Authors' calculations.

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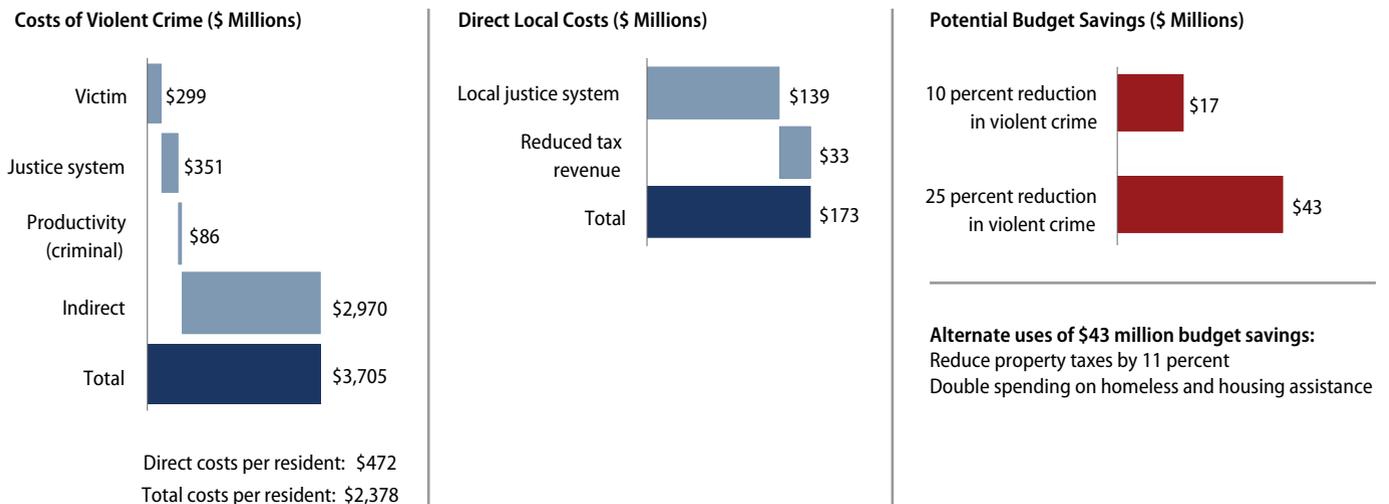
## Philadelphia

Philadelphia law enforcement received reports in 2010 of 306 murders, 945 rapes, 8,363 robberies, and 8,921 aggravated assaults, a total of 18,535 violent crimes. The violent-crime rate in Philadelphia is three times the national average. The direct costs of these violent crimes in Philadelphia totaled \$736 million in 2010 or \$472 per resident.

Reducing these crimes by 25 percent would generate \$43 million for the Philadelphia city budget, including \$35 million in law enforcement and justice system savings and \$8 million in new revenues. This revenue would enable the city to consider a mix of a cut in local property taxes of up to 11 percent or up to a doubling of spending on homeless and housing assistance. (see Figure 8)

**FIGURE 8**  
**How Philadelphia benefits from reducing violent crime**

The costs and potential budget savings (\$ millions)



Source: Authors' calculations.

## Seattle

Seattle police in 2010 recorded 19 murders, 96 rapes, 1,429 robberies, and 1,971 aggravated assaults. Seattle had the lowest crime rates of the eight cities. Nevertheless, violent crime cost Seattle \$89 million in 2010 or \$144 per resident.

Reducing violent crime by 25 percent would produce savings for the Seattle city budget of \$14.4 million, which could enable the city to consider a mix of up to a 2.4 percent cut in property taxes or an increase in city spending on neighborhoods and development of up to 5.4 percent. (see Figure 9)

**FIGURE 9**  
**How Seattle benefits from reducing violent crime**

The costs and potential budget savings (\$ millions)



Source: Authors' calculations.

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# Appendix A

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## Methodology to test the impact of changes in violent crime rates on housing values

To isolate any causal relationship between violent crimes and property prices, we use the Granger causality test, a widely employed statistical regression method developed by Nobel Laureate Clive Granger. Granger's key insight in developing this method is that time series data on two related variables allow one to test for a statistical causal relationship between those data. Stated in technical terms, recursive substitution of a dynamic system can reduce it to a bivariate system, so long as the data include many lags of the dependent variable in the regression. Using this method, a time series X can be said to Granger-cause a time series Y if the lagged values of X provide statistically significant information about future values of Y in a regression that also includes lagged values of Y as independent variables.<sup>50</sup>

The main regression equation for this analysis is:

$$\Delta(\log(\text{Median Residential Property Prices}_{it})) = \beta_1 \cdot \Delta(\log(\text{Median Residential Property Prices}_{i(t-1)})) + \beta_2 \cdot \Delta(\text{Homicides}_{i(t-1)}) + \beta_3 \cdot \Delta(\text{NonHomicides}_{i(t-1)}) + \gamma_i + \Delta \varepsilon_{it}$$

The dependent variable is the log differences of residential property price for geographic area  $i$  at time  $t$ :  $\Delta(\log(\text{Median Residential Property Prices}_{it}))$ . The independent variables are the lagged value of the dependent variable and the lagged values of  $\Delta(\log(\text{Homicides}_{it}))$  and  $\Delta(\log(\text{NonHomicides}_{it}))$ , the differenced number of homicides and nonhomicide violent crimes. Time-specific fixed effects are captured by  $\gamma_i$ , although they are dropped in the table.<sup>51</sup> (See Table A-1 on next page)

TABLE A-1  
**Summary Statistics at Zip Code or Census Tract Level**

BOSTON, 2006-2007 (40 Observations)				
Variable	Mean	Std. dev.	Min	Max
Homicide	2.68	4.54	0	19
Nonhomicide	269.80	240.34	11	916
Rapes	9.75	9.15	0	33
Aggravated assault	165.85	158.04	11	583
Robbery	94.20	76.60	0	300
Median property value	\$499,611	\$387,261	\$235,000	\$2,600,000
Mean property value	\$601,214	\$428,991	\$246,995	\$2,600,000
CHICAGO, 2001-2010 (560 Observations)				
Variable	Mean	Std. dev.	Min	Max
Homicide	9.07	10.61	0	44
Nonhomicide	646.92	602.39	12	2322
Rapes	31.23	28.47	0	124
Aggravated assault	326.32	331.73	4	1438
Robbery	289.38	251.11	5	1010
Median property value	\$220,117	\$92,541	\$57,500	\$647,500
Mean property value	\$250,919	\$110,998	\$71,676	\$796,811
HOUSTON, 2000-2008 (868 Observations)				
Variable	Mean	Std. dev.	Min	Max
Homicide	3.06	3.46	0	26
Nonhomicide	242.98	222.98	1	1365
Rapes	8.47	7.94	0	50
Aggravated assault	125.38	115.58	0	567
Robbery	109.13	110.42	0	823
Median property value	\$148,797	\$86,220	\$43,146	\$745,520
Mean property value	\$171,216	\$111,823	\$48,838	\$788,328

JACKSONVILLE, 2001-2011 (308 Observations)				
Variable	Mean	Std. dev.	Min	Max
Homicide	3.23	3.92	0	25
Nonhomicide	193.35	179.27	9	930
Rapes	7.39	6.13	0	36
Aggravated assault	108.81	111.32	4	607
Robbery	77.16	67.76	0	322
Median property value	\$133,501	\$52,386	\$40,000	\$334,900
Mean property value	\$153,938	\$59,816	\$50,752	\$316,542
MILWAUKEE, 2005-2010 (166 Observations)				
Variable	Mean	Std. dev.	Min	Max
Homicide	3.31	4.79	0	31
Nonhomicide	233.11	245.09	1	981
Rapes	6.80	7.29	0	25
Aggravated assault	108.39	121.87	0	569
Robbery	117.93	119.90	0	425
Median property value	\$135,271	\$51,099	\$38,000	\$291,750
Mean property value	\$153,577	\$84,798	\$57,368	\$864,970
PHILADELPHIA, 2004-2009 (276 Observations)				
Variable	Mean	Std. dev.	Min	Max
Homicide	10.74	9.93	0	54
Nonhomicide	494.01	434.01	12	2207
Rapes	22.92	20.69	0	110
Aggravated assault	233.83	206.70	6	1045
Robbery	237.26	208.10	5	1052
Median property value	\$154,846	\$97,884	\$35,900	\$450,000
Mean property value	\$179,738	\$128,137	\$41,855	\$740,840
SEATTLE, 2000-2007 (976 Observations)				
Variable	Mean	Std. dev.	Min	Max
Homicide	0.23	0.60	0	6
Nonhomicide	32.32	40.02	0	390
Rapes	1.09	1.56	0	13
Aggravated assault	18.32	21.96	0	196
Robbery	12.90	17.99	0	181
Median property value	\$339,846	\$126,941	\$129,840	\$1,100,000
Mean property value	\$376,827	\$157,568	\$131,110	\$1,271,009

Source: Authors' calculations.

TABLE A-2  
Results of Granger causality regression analysis

Variables	Specification 1 <sup>48</sup>	Specification 2 <sup>49</sup>
	$\Delta(\log(\text{MedProp}_{it}))$	$\Delta(\log(\text{MedProp}_{it}))$
$\Delta(\log(\text{MedProp}_{it-1}))$	0.737*** (0.0947)	0.649*** (0.113)
$\Delta\text{Homicides}_{t-1}$	-0.0160** (0.00650)	-0.0168** (0.00673)
$\Delta\text{NonHomicides}_{t-1}$	0.000446*** (0.000167)	0.000766*** (0.000179)
Observations	2,739	2,740
Number of geographic areas	396	396
Number of instruments	35	31
AR(1)	0	0
AR(2)	0.222	0.253
Hansen	0.214	0

\*\* p < 0.05; \*\*\* p < 0.01; Standard errors in parentheses

Source: Authors' calculations.

The results for Specification 1 are derived from data for Chicago, Jacksonville, Houston, Milwaukee and Philadelphia. We excluded the data from Boston from our main regression specification because Boston could only provide two years of crime data by zip code. We also excluded data from Seattle from the initial regression because Seattle could only provide crime data by census tract. Census tracts cover smaller areas than zip codes, increasing the impact of changes in crime rates relative to the zip code-based analysis for the other cities. Specification 2, however, includes the crime and property value data from Boston and Seattle as well as the five original cities. These results produce a small, statistically significant positive effect from reductions in nonhomicide crime rates. We do not consider those results to be as reliable, however, given the data constraints for Boston and Seattle.

# Appendix B

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## Testing the robustness of the impact of violent crime on housing prices

### Robustness test 1: One lag and two lags of independent variables

As the first check for the robustness of our results, we compare the results with one lag of the independent variables included to the results with two lags of the independent variables. Our main regression is listed again in column (1) of Table B-1. Column (2) includes a second lag of changes of median residential property prices, homicides, and nonhomicides. The magnitude of all coefficients increase under this specification, however their significance declines.

Still, the Wald test shows joint statistical significance at the 10 percent level, and just above the 5 percent level, for homicides. Nonhomicides are less significant, but still so at the 10 percent level. We chose to only include one lag in our main specification since we have a short unbalanced panel and the overall sample size is degraded sharply with the inclusion of additional lags.

Additionally, since we expect the second lag of differences is correlated with the third lag of levels, we can only include lags four deep and greater in our instrument matrix. Finally, with the second lags included, the AR(2) test for autocorrelation barely rejects the null hypothesis of no autocorrelation in levels under the two-lag specification. (see Table B-1)

TABLE B-1

## Test of robustness—one lag and two lags of independent variables

Variables	Specification 1	Specification 2 <sup>50</sup>
	$\Delta(\log(\text{MedProp}_{it}))$	$\Delta(\log(\text{MedProp}_{it}))$
$\Delta(\log(\text{MedProp}_{i(t-1)}))$	0.737*** (0.0947)	1.0004*** (0.218)
$\Delta(\log(\text{MedProp}_{i(t-2)}))$		-0.0632** (0.210)
$\Delta(\text{Homicides}_{i(t-1)})$	-0.0152** (0.00684)	-0.0151* (0.0868)
$\Delta(\text{Homicides}_{i(t-2)})$		-0.0247** (0.0114)
$\Delta(\text{NonHomicides}_{i(t-1)})$	0.000260 (0.000192)	0.000235 (0.000425)
$\Delta(\text{NonHomicides}_{i(t-2)})$		0.000820** (0.000379)
Observations	1,911	1,657
Number of geographic areas	254	253
Number of instruments	35	31
AR(1)	0	0.004
AR(2)	0.214	0.067
Hansen	0.256	0.759
Wald Test (homicides)	N/A	0.0541
Wald Test (non-homicides)		0.0878

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ ; Robust standard errors in parentheses

Source: Authors' calculations.

## Robustness test 2: Quadratic effects

For our second test of robustness, we test for quadratic effects (Table B-2, below). Again, our main regression specification is in column (1). In column (2) we include a regression where differences of the squares of the crime variables are added as explanatory variables. The results show that the coefficients for these terms are small and the coefficients are insignificant. We conclude that quadratic effects have only little influence on our results. (see Table B-2)

**TABLE B-2**  
**Test of robustness—quadratic effects**

Variables	Specification 1	Specification 2 <sup>51</sup>
	$\Delta(\log(\text{MedProp}_{it}))$	$\Delta(\log(\text{MedProp}_{it}))$
$\Delta(\log(\text{MedProp}_{it(t-1)}))$	0.737*** (0.0947)	0.894*** (0.076)
$\Delta(\text{Homicides}_{it(t-1)})$	-0.0152** (0.00684)	-0.0298** (0.0223)
$\Delta(\text{Homicides}_{it(t-1)})^2$		0.000695 (0.000465)
$\Delta(\text{NonHomicides}_{it(t-1)})$	0.000260 (0.000192)	0.000445 (0.0003918)
$\Delta(\text{NonHomicides}_{it(t-1)})^2$		-1.79e-07 (1.35e-07)
Number of geographic areas	1,911	1,911
Number of instruments	254	254
AR(1)	35	51
AR(2)	0	0
Hansen	0.214	0.163

\* p < 0.1; \*\* p < 0.05; \*\*\* p < 0.01; Standard errors in parentheses

Source: Authors' calculations.

### Robustness test 3: Average versus median residential property price

The third robustness test we conduct compares the use of median residential property price data and average residential property price data, which were also available from DataQuick. Because DataQuick does not take steps to compare repeat transactions of similar homes, there is a chance that outliers exist in the dataset that they used to calculate average prices by geographic area. Since we have no means to measure the existence of outliers, we chose to use the median prices that they report rather than the mean prices since medians are relatively invariant to outliers. In Table B-3, below, we include in column (2), a regression with mean residential property prices. (see Table B-3)

**TABLE B-3**  
**Test of robustness—median and average property price data**

Variables	Specification 1	Specification 2 <sup>52</sup>
	$\Delta(\log(\text{MedProp}_{it}))$	$\Delta(\log(\text{MedProp}_{it}))$
$\Delta(\log(\text{MedProp}_{it(t-1)}))$	0.737*** (0.0947)	0.591*** (0.112)
$\Delta(\text{Homicides}_{(t-1)})$	-0.0152** (0.00684)	-0.0122** (0.00566)
$\Delta(\text{NonHomicides}_{(t-1)})$	0.000260 (0.000192)	0.000236 (0.000170)
Number of geographic areas	1,911	1,909
Number of instruments	254	396
AR(1)	35	35
AR(2)	0	0.001
Hansen	0.214	0.253

\* p < 0.1; \*\* p < 0.05; \*\*\* p < 0.01; Standard errors in parentheses

Source: Authors' calculations.

## Robustness test 4: One-step and two-step estimators

The two-step estimator is preferable to the one-step estimator in that it is robust to panel autocorrelation and heteroskedasticity, but the standard errors are biased downwards and so researchers have historically provided both one-step and two-step results. In our main specification, however, we resolve the downward bias by employing the Windmeijer (2005) finite-sample correction. We only include one-step results as a robustness check for the sake of convention, and they can be seen in column (2) of Table B-4, below.

**TABLE B-4**  
**One-step and two-step estimators**

Variables	Specification 1	Specification 2 <sup>52</sup>
	$\Delta(\log(\text{MedProp}_{it}))$	$\Delta(\log(\text{MedProp}_{it}))$
$\Delta(\log(\text{MedProp}_{it(t-1)}))$	0.737*** (0.0947)	0.740*** (0.0860)
$\Delta(\text{Homicides}_{(t-1)})$	-0.0152** (0.00684)	-0.0212** (0.00614)
$\Delta(\text{NonHomicides}_{(t-1)})$	0.000260 (0.000192)	0.000459*** (0.000196)
Number of geographic areas	1,911	1,911
Number of instruments	254	254
AR(1)	35	35
AR(2)	0	0.001
Hansen	0.214	0.189

\* p < 0.1; \*\* p < 0.05; \*\*\* p < 0.01; Standard errors in parentheses

Source: Authors' calculations.

## Robustness test 5: Depth of lags in the instrument matrix

Our fifth robustness check tests the sensitivity of our results to different depths of lags in the instrument matrix. Our main specification includes all lags greater than three deep, and is reported in column (1) of Table B-5 below. Column (2) reports a specification with all lags greater than four deep and the results are roughly similar. Column (3), however, includes all lags greater than two deep and shows quite a large difference. We attribute this to overidentification that occurs under this specification, which can be seen by examining the p-value of the Hansen test, which only barely rejects the null hypothesis of no overidentification. (see Table B-5)

**TABLE B-5**  
**One-step and two-step estimators**

Variables	Specification 1	Specification 2 <sup>53</sup>	Specification 3 <sup>54</sup>
	$\Delta(\log(\text{MedProp}_{it}))$	$\Delta(\log(\text{MedProp}_{it}))$	$\Delta(\log(\text{MedProp}_{it}))$
$\Delta(\log(\text{MedProp}_{i(t-1)}))$	0.737*** (0.0947)	0.791*** (0.114)	0.718*** (0.0769)
$\Delta(\text{Homicides}_{(t-1)})$	-0.0152** (0.00684)	-0.0127** (0.007349)	-0.00346** (0.00166)
$\Delta(\text{NonHomicides}_{(t-1)})$	0.000260 (0.000192)	0.000223 (0.000202)	0.000057 (0.0000683)
Number of zip	1,911	1,911	1,911
Number of instruments	254	254	254
AR(1)	35	32	38
AR(2)	0	0	0
Hansen	0.214	0.210	0.286

\* p < 0.1; \*\* p < 0.05; \*\*\* p < 0.01; Standard errors in parentheses

Source: Authors' calculations.

## Robustness test 6: Collapsed and uncollapsed instrument matrix

Our final robustness check compares a collapsed instrument matrix to one that is not collapsed. Our main specification, collapsed, is presented in column (1) of Table B-6 below. Column (2) displays the results when the instrument matrix is left uncollapsed. When uncollapsed the number of instruments explodes, going from 35 to 141. Correspondingly, the Hansen test indicates that the model is strongly overidentified. The coefficients and significance levels remain roughly similar, except on the lagged dependent variable for which the magnitude of the coefficient drops considerably. (see Table B-6)

**TABLE B-6**  
**Collapsed and uncollapsed instrument matrix**

Variables	Specification 1	Specification 2 <sup>55</sup>
	$\Delta(\log(\text{MedProp}_{it}))$	$\Delta(\log(\text{MedProp}_{it}))$
$\Delta(\log(\text{MedProp}_{it-1}))$	0.737*** (0.0947)	0.485*** (0.128)
$\Delta(\text{Homicides}_{t-1})$	-0.0152** (0.00684)	-0.0138** (0.00430)
$\Delta(\text{NonHomicides}_{t-1})$	0.000260 (0.000192)	0.000362*** (0.000135)
Number of geographic areas	1,911	1,911
Number of instruments	254	254
AR(1)	35	141
AR(2)	0	0.001
Hansen	0.214	0.224

\* p < 0.1; \*\* p < 0.05; \*\*\* p < 0.01; Standard errors in parentheses

Source: Authors' calculations.

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## Endnotes

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- 49 We assume here a one-to-one relationship between growth in local economic activity and growth in local tax revenues, based on extensive evidence on the sensitivity of local sales, business, and income taxes to local economic growth. See: Jesse Edgerton, Andrew F. Haughwout, and Rae Rosen, "Revenue Implications of New York City's Tax System," *Current Issues in Economics and Finance: Second District Highlights* 10 (4) (2004): 1–7.

- 50 In this case, Granger-causality testing is being performed with panel data, which can lead to panel bias if conducted using a standard OLS model. This occurs because the lagged dependent variable is endogenous to the error term. In other words, if in period one, a geographic area experiences a negative shock to the dependent variable that is not explicitly modeled, then the error term will soak up the entire shock and the fixed effect for that geographic area will appear lower in every period. In period two, the lagged dependent variable and the fixed effect will both be lower, and so there is a positive correlation between a regressor and the error, and the model is inconsistent. To account for this issue, we explore the Granger causality between violent crime and property prices using the Arellano-Bond (1991) two-step linear generalized method of moments estimator, which was designed for dynamic panel analysis where there are few time periods but many individuals, or in our case, geographic areas. We implement the Arellano-Bond estimator using the STATA program `xtabond2`, developed by David Roodman and described in Roodman (2006). See: Manuel Arellano and Stephen Bond, "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies* 58 (2) (1991): 277–297; David Roodman, "How to Do `xtabond2`: An Introduction to 'Difference' and 'System' GMM in Stata." Working Paper 103 (Center for Global Development, 2006), available at <http://repec.org/nasug2006/howtodoxtabond2.cgdev.pdf>.
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- 52 `xtabond2 logMedPriceR L(1/1).logMedPriceR L(1/1).homicides L(1/1).nonHomicides yr*, gmmstyle(homicides nonHomicides logMedPriceR, lag(3 .) c) ivstyle(yr*) two nolevelq nocons robust small`
- 53 `xtabond2 logMedPriceR L(1/1).logMedPriceR L(1/1).homicides L(1/1).nonHomicides yr*, gmmstyle(homicides nonHomicides logMedPriceR, lag(3 .) c) ivstyle(yr*) two orth nolevelq nocons robust small`
- 54 `xtabond2 logMedPriceR L(1/2).logMedPriceR L(1/2).homicides L(1/2).nonHomicides yr*, gmmstyle(homicides nonHomicides logMedPriceR, lag(4 .) c) ivstyle(yr*) two nolevelq nocons robust small`
- 55 `xtabond2 logMedPriceR L(1/1).logMedPriceR L(1/1).homicides L(1/1).homicidesSq L(1/1).nonHomicidesSq yr*, gmmstyle(homicides nonHomicides logMedPriceR homicidesSq nonHomicidesSq, lag(3 .) c) ivstyle(yr*) two nolevelq nocons robust small`
- 56 `xtabond2 logAvgPriceR L(1/1).logAvgPriceR L(1/1).homicides L(1/1).nonHomicides yr*, gmmstyle(homicides nonHomicides logAvgPriceR, lag(3 .) c) ivstyle(yr*) two nolevelq nocons robust small`
- 57 `xtabond2 logMedPriceR L(1/1).logMedPriceR L(1/1).homicides L(1/1).nonHomicides yr*, gmmstyle(homicides nonHomicides logMedPriceR, lag(4 .) c) ivstyle(yr*) two nolevelq nocons robust small`
- 58 `xtabond2 logMedPriceR L(1/1).logMedPriceR L(1/1).homicides L(1/1).nonHomicides yr*, gmmstyle(homicides nonHomicides logMedPriceR, lag(2 .) c) ivstyle(yr*) two nolevelq nocons robust small`
- 59 `xtabond2 logMedPriceR L(1/1).logMedPriceR L(1/1).homicides L(1/1).nonHomicides yr*, gmmstyle(homicides nonHomicides logMedPriceR, lag(3 .) c) ivstyle(yr*) two nolevelq nocons robust small`



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- Eliminating or redesigning misguided spending programs and tax expenditures, focused on priority areas such as health care, energy, and education
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- Building a foundation for smarter decision-making by enhancing transparency and performance measurement and evaluation

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what works