

# Urban Crime\*

Brendan O’Flaherty<sup>†</sup>      Rajiv Sethi<sup>‡</sup>

July 17, 2014

## Abstract

We survey the literature on index crime, paying particular attention to spatial issues. We note the contrasting descriptive traditions of Lombroso (characteristics matter) and Beccaria (incentives matter); and the contrasting policy traditions of incapacitation (predict who will offend and keep them from doing it) and deterrence (uncover who offended and punish them). The economics of crime has several points of contact with the economics of space, since the commission of an index crime requires proximity between offenders and victims (or their property). We explore these linkages, as well as a range of other issues: the effects of certainty and severity of punishment on crime, the role of stereotypes in interactions between offenders, victims and law enforcement officers, and racial disparities in victimization, offending and incarceration. The economics of crime has made tremendous progress, but enormous variation across both time and space remains poorly understood, and many non-traditional explanations often neglected by economics need to be explored more systematically.

Keywords: Crime, Victimization, Offending, Monitoring, Enforcement

---

\*Written for the *Handbook of Urban and Regional Economics*, edited by Gilles Duranton, Vernon Henderson and William Strange. In addition to the editors, we thank Douglas Almond, Jeff Fagan, Ally Fedorov, Yiming He, John MacDonald, Robert McMillan, and Steven Raphael for comments on earlier versions, and Suxin Shen for research assistance.

<sup>†</sup>Department of Economics, Columbia University

<sup>‡</sup>Department of Economics, Barnard College, Columbia University and the Santa Fe Institute.

# 1 Introduction

Crimes are activities that governments have threatened to punish rather severely. This threat, in principle, is not contingent on whether any third party complains about the activity. If there is no government, or no prospect of punishment, there is no crime.

Across time and space, the kinds of activities that are crimes vary widely. Sodomy and blasphemy were once crimes in New York, and they are still crimes in many parts of the world. Married men in New York could once inflict violence on their wives with impunity, and continue to have that latitude elsewhere. Some activities that have modest external costs are crimes in most American cities—trading safe sex for money, or stealing a carton of cigarettes—while other activities with considerable external costs are not—sticking an umbrella in the closing door of a rush-hour subway train, running an unsafe fertilizer plant in Texas, or driving while sober and absent-mindedly killing a pedestrian, for instance.

Many activities that almost all governments proscribe are extremely noxious to society, and cities probably could not flourish unless they were somehow restrained. But threatening punishments credibly and carrying them out are also expensive, both to the government and to the people punished and their families. These two costs—those of the activities that are proscribed, and those of the punishments that make them crimes—are central to the economic analysis of crime.

Urban economists have focused on the so-called “index crimes” and so will this review. These are the acts in the FBI’s index of crime—murder, rape, robbery, assault, larceny, burglary, and motor vehicle theft.<sup>1</sup> These crimes require that the offender be near the victim or the victim’s property, and so have an inherently spatial component. For the most part, they are also *mala in se* and proscribed in almost all societies. The boundaries of these crimes, however, are not always well established, for instance in cases involving vehicular homicide, justifiable homicide, euthanasia, abortion, date-rape, and marital rape. We will look at crimes involving illicit drugs, too, since they are tied to the index crimes in many ways, both real and imaginary.

Our focus on index crimes is driven mainly by convenience, and by the way that law enforcement agencies are organized. But because these are probably the most serious crimes with a strong spatial component, the focus is probably not misplaced. White collar crimes like fraud and embezzlement transfer vastly more resources (Anderson, 1999), and cybercrimes are a rapidly growing problem, but where you live, whom you live with, and whether a police officer is standing outside your home probably exert little influence over whether you fall victim to these crimes. We will also largely omit terrorism. Terrorists commit index crimes,

---

<sup>1</sup>Following an act of Congress, arson has legally been considered an index crime since 1979, but the numbers are small and detection uncertain. We will disregard arson in this chapter.

but their preferences and the strategies that might deter them are different enough from those of more prosaic criminals that they deserve study in a separate place.<sup>2</sup>

If index crimes are committed, they have to be committed somewhere, and so both strategies for committing them and strategies for avoiding them must take location into account. Ultimately one of our main concerns is what makes particular times and places more dangerous than others, and our last two sections (Section 6 on times and 7 on places) are explicitly devoted to this question. As we show there, the economic literature on the timing and placement of crime is scant, with many important issues remaining unresolved. Most of this review can be seen as looking at various hypotheses for spatio-temporal disparities, even though the solid work on these hypotheses rarely develops far enough to say much about time and place. Perhaps locations are dangerous because of the reasonably stable characteristics of people who live or work close to them; thus Section 2 examines what we know about the relationship between criminogenic characteristics and crime. Perhaps locations are dangerous because of poor incentives nearby, either negative (not enough jobs) or positive (not enough cops); Sections 3 and 5 look at how incentives effect crime. Perhaps more complex interactions and the behavior of potential victims create danger, and Section 4 accordingly studies interaction structures.

In this review, we concentrate on the incidence of crime and the effectiveness of efforts to reduce it. We do not provide a systematic discussion of the welfare implications of crime and crime control policies. This is due both to space constraints and to the philosophical difficulty that attaches to the issue. How, for instance, do we assess the benefits that an offender derives from crime? If fear of punishment deters a would-be assailant, is his welfare loss a social cost? If not, then should the charges incurred by power companies compelled to reduce emissions also be excluded from any analysis of welfare? Coase (1960) famously observed that harmful actions have a reciprocal character—prevention of harm to one party by another is itself harmful to the party that is restrained. Thus the costs of abatement incurred by a polluting firm are generally treated as social costs, to be fully accounted for in any welfare analysis. But this principle is seldom invoked in the welfare analysis of criminal behavior. Such issues deserve careful scrutiny, but lie beyond the scope of the more modest exercise undertaken here.

---

<sup>2</sup>Unexpected terrorist attacks can lead to sudden and plausibly exogenous changes in police deployments, and this can be used to identify causal effects of police presence on index crime. We discuss this literature extensively below, but avoid a discussion of the causes and consequences of terrorism itself.

## 2 Criminogenic Characteristics

The common-sense, man-in-the-street reaction to crime is to observe that most of us don't go around murdering our spouses or molesting small children, and to ask what makes criminals different. If criminals commit crimes because of their individual characteristics, then the volume of crime is roughly proportional to the number of criminals. Crime goes up when the number of criminals goes up; down when the number of criminals goes down. Crime is high in places with a lot of criminals, low in places with few criminals. From this perspective, the objective of research should be to determine what makes criminals criminals, and the objective of policy should be to reduce the number of people with the characteristics that make them criminals, or at least to make sure they aren't in contact with potential victims.

This view of crime has a long history. Cesare Lombroso (1835-1909), who is often called the father of modern criminology, maintained that criminals were "atavistic," born different from other people, and could be distinguished by their physical features, many of them simian, like a sloping forehead, ears of unusual size, facial asymmetry, left-handedness, prognathism, and excessive arm length. Lombroso's views have largely been discredited, but the notion remains pervasive that some relatively permanent features, either genetic or acquired, predispose people to commit crimes.<sup>3</sup>

It is probably more useful to me personally to know whether the large stranger approaching me on a quiet street is likely to rob me than it is to know why car thefts declined in Chicago in the 1990s; thus the practical appeal for the general population of this line of research is immediate. The facts that only a small proportion of the population commits index crimes in any year and that crime commission is serially correlated suggest that something about people who commit crimes sets them apart from others, and makes it appropriate to talk about "criminals" rather than simply "people who commit crimes."<sup>4</sup>

This view of crime has policy implications. If the characteristics that incline people to commit crimes are known, then crime can be prevented either by eliminating those characteristics or by separating the people carrying those characteristics from potential victims. Prediction leads to prevention through incapacitation.

Government policies that are derived from this premise, however, face some thorny ethical issues. Some of these policies harm the people that are likely to commit crimes—sending

---

<sup>3</sup>This notion continues to stimulate research. For instance, Valla et al. (2011) report that 21st century college students can do significantly better than chance in identifying people who have been convicted of crimes from anonymous head shots of white male 20-25 year-olds.

<sup>4</sup>Of all people who were 18 years old in California in 1974, only 24% were arrested at least once over the next 11 years—and this is the age group with the highest propensity to commit crime in an era of high crime. However, contingent on being arrested, the probability of being arrested at least one more time was 45.9%. The corresponding figures for index crimes were 10.5% and 36.7% respectively (Tillman, 1987).

them to prison, for instance, or stopping them on the street for humiliating searches. Harming innocent people to prevent crimes they have not committed strikes many—including the framers of the U.S. Bill of Rights—as an activity governments have no right to be involved in. Policies that help people who are highly likely to commit crimes—providing more recreational opportunities, for instance, for boys than girls (since women commit far less crimes than men do)—run into the same difficulty. Should governments deny people resources because they lack criminogenic characteristics?

In this section we examine views of crime that emphasize relatively stable characteristics of criminals. In the first part, we look at what we call the *strong claim of criminogenic characteristics*, that the number of people with certain traits affects the volume of crime. Relatively few traits have been shown to cause crime in this sense: being a young man, growing up breathing atmospheric lead, and suffering from major depressive disorder or attention deficit hyperactivity disorder. In addition, the strong claim is an important component of the arguments that abortion and incarceration reduce crime. We will examine the abortion controversy in this section, but defer looking at incarceration to Section 5.

A much larger number of studies examine what we call the *weak claim of criminogenic characteristics*, that relatively stable traits predict who commits crimes. These studies show only that people with certain characteristics are more likely to commit crimes than people without these characteristics, and sometimes that the relationship between having these traits and committing crimes is causal. We know only, for instance, that graduates of some high quality preschools commit fewer crimes; we don't know that total crimes go down (with an appropriate lag) when such preschools expand. Someone else could commit the crimes that these preschool graduates would have committed.

The weak claim is about individual behavior—who commits crimes? The strong claim is about general equilibrium: how many crimes are committed? To take a labor market analogy, a weak claim would state that high school dropouts are more likely to work at fast food restaurants than otherwise similar workers who are better educated, while a strong claim would state that an increase in the proportion of dropouts in the population raises the proportion of workers who are employed at fast food restaurants.

The final part of this section looks at disparities in crime across identity groups and asks how much of the concentration of crime in particular communities can be explained by their distinctive distribution of characteristics.

One way to distinguish this section from the next is to say that this one is about preferences and endowments, while the next is about incentives. That is approximately true. But, in fact, neither the strong claim nor the weak claim papers establish that the traits in question are operating through preferences rather than incentives. For instance, people with a

history of attention deficit hyperactivity disorder (ADHD) are more likely to commit violent crimes; there are both strong and weak claim papers on this relationship. But people with a history of ADHD might be more likely to commit these crimes not because they are more aggressive or impulsive, but because they earn less money and so would suffer a smaller loss if they were imprisoned. Almost any trait that changes preferences in the direction of more criminal activity (or more current consumption) is likely to be correlated with low income, if only because most employers do not like their workers committing crimes and being arrested. Characteristics might also alter the non-pecuniary costs of imprisonment; a person unable to enjoy a happy and fulfilling life outside of prison might lose less from entering prison. We do not think that any of the papers we survey definitively separate preferences from incentives, although Lochner and Moretti (2004), discussed further below, shed considerable light on this question for education.

## **2.1 The Strong Claim of Criminogenic Characteristics**

### **2.1.1 Age and Gender**

About 93% of state and federal prisoners in 2010 were male, as were 87% of residents of juvenile detention facilities in 2011, and 87% of jail inmates in 2011. In 2011, 64.2% of arrestees were between 15 and 34, compared with 27.4% of the residential population.<sup>5</sup> Hence the weak claim about young men is undoubtedly true. Evidence for the strong claim, however, is not consistent, and many studies fail to support it. Pratt and Cullen (2005) provide a meta-analysis of over 200 ecological studies of crime, most of which contain age structure and sex ratio variables. Of 31 predictors that they study, age structure and sex ratio are ranked 16th and 19th most powerful respectively. Pratt and Cullen describe them as “mid-range predictors of crime [that] are likely to make a significant contribution to the proportion of explained variance in a statistical model” but certainly not as robust as the effects of predictors ranked higher in the distribution (p. 399). Perhaps the results would have been stronger had more studies looked at the proportion of young men in the population, rather than age and sex separately.<sup>6</sup>

---

<sup>5</sup>Sourcebook of Criminal Justice Statistics, Tables 6.33.2010, 6.11.2011, 6.17.2011 and 4.4.2011.

<sup>6</sup>Two studies of how crime reacts to unconventional closings of high schools, Jacob and Lefgren (2003) and Luallen (2006), come close to supporting the strong claim by showing that juvenile property crime increases when high schools are closed; they would have supported the strong claim if their dependent variable had been total property crime, rather than juvenile property crime.

### 2.1.2 Childhood Lead Exposure

The evidence that atmospheric lead affects the volume of crime is more convincing than the evidence on age and gender. Childhood lead exposure increases impulsivity and aggressiveness, and lowers IQ. Animal studies show links to ADHD and anti-social activity. Following the 1970 Clean Air Act, lead was almost entirely removed from gasoline in the U.S. between 1975 and 1985. Among children under 6, lead in blood fell from 18  $\mu\text{g}/\text{dL}$  in 1976 to 2.8  $\mu\text{g}/\text{dL}$  in 1991. Lead was phased out of gasoline in different states at different times, and Reyes (2007) uses this interstate variation in lead reductions to identify the effect of childhood lead exposure on crime. She uses state-year observations to link crime to childhood lead exposure lagged twenty to thirty years. The elasticity of violent crime (essentially, robberies plus aggravated assaults) with respect to lead exposure is around 0.8. Lead has no significant effect on property crime. The effect on murder is not robust, but suggestive. Since gasoline use per square kilometer and children per square kilometer are both higher in urban than other areas, the effects of leaded gasoline are probably concentrated in urban areas.

This finding is like the other supporting results about the strong claim. Instead of moving directly from changes in the distribution of characteristics in the population to the volume of crime, these studies start with some exogenous event (in this case, reduction in atmospheric lead) that plausibly changes the distribution of characteristics in the population (fewer people with ADHD), and show that the exogenous event causes changes in the volume of crime.

### 2.1.3 Schizophrenia, ADHD, and Major Depressive Disorder

“Mental illness” refers to many different conditions, and “crime” refers to many different activities. Some mental illnesses (for instance, substance abuse disorder and conduct disorder) are even crimes by definition. It makes more sense to try to link particular disorders to particular crimes than to try to link two amorphous abstractions.

We are aware of only two papers that provide evidence for a strong claim. Marcotte and Markowitz (2011) look at changes in prescriptions for anti-psychotic drugs for treatment of schizophrenia, various classes of anti-depressants for treatment of major depressive disorder, and stimulants for treatment of ADHD. These psychopharmaceuticals are all known to be effective. Marcotte and Markowitz use state-quarter variation in prescriptions to identify the effects on violent crime, with state and quarter fixed effects and many covariates. Prescriptions for stimulants and for “newer generation antidepressants”—*Wellbutrin* is the best known drug in this class—reduced violent crime significantly. The elasticities were small, less than 0.1, but were economically significant because of the fast growth in prescriptions.

Anti-psychotics and the other tested class of antidepressants—serotonin reuptake inhibitors and serotonin-norepinephrine reuptake inhibitors (SSRIs and SNRIs)—did not significantly reduce violent crime. Along similar lines, Cuellar and Markowitz (2007) show that more state Medicaid spending and more Medicaid prescriptions for stimulants are associated with less violent crime; and so is more state spending on older antidepressants.

Evidence for the weak claim, that people with various kinds of mental disorders are more likely to commit various crimes, is abundant; see, for instance, Frank and McGuire (2011). People with mental illness, moreover, are more likely to be victims of crime. A review of the older literature on this question concluded: “Victimization is a greater public health concern than perpetration” (Choe et al., 2008, p.153). Thus it is unclear how much the mechanism that leads from more psychopharmaceutical prescriptions to fewer violent crimes acts by changing the distribution of characteristics of potential offenders, and how much it operates by changing the distribution of characteristics of potential victims.

#### **2.1.4 Family Structure**

People who grow up in families that do not always have two parents are more likely to commit crimes, and Antecol and Bedard (2007) show that this relationship is probably causal (they use state changes in divorce laws as an instrument). Many cross-section studies also find that the proportion of families headed by single parents is associated with more crime; in fact, Pratt and Cullen (2005) find that family disruption is the 9th strongest of the predictors of crime in their meta-analysis. Cross-section studies often regress crime on contemporaneous measures of family structure, which is not the relevant variable. However Kendall and Tamura (2010) is a study that properly lags family structure (in this case, non-marital births). They find that more non-marital births in a state are associated with lagged increases in murder and car theft. To our knowledge, no test of the strong claim has been attempted with a strategy for identifying causality.

#### **2.1.5 Abortion**

Donohue and Levitt (2001, 2004, 2008) famously—and controversially—argue that legalizing abortion in the U.S. in the early 1970s caused a large portion of the crime decline in the 1990s. We examine this claim here because the mechanism they use to explain this association relies on the strong claim of characteristics. The argument is based on two propositions: first, that legalizing abortion caused a major change in the distribution of characteristics of young men, and second, that this change in the distribution of characteristics reduced crime. Only the second proposition is relevant for this section, since it is an instance of the strong claim of

characteristics. But unless the first proposition is correct (abortion changed characteristics), abortion tells us nothing about the second proposition (characteristics changed crime). We do not believe that the first proposition is supported by the available evidence.

The naïve theory about abortion and characteristics is that births are reduced one-for-one by abortions; non-aborted births are unaffected; and the change to the number of children with any characteristic is just the number of aborted children who would have had that characteristic had they been born. Since women who have abortions in the U.S. plausibly would have had children with more criminogenic characteristics, including unwantedness, than pregnant women who do not, this theory implies that abortion produces a less criminogenic distribution of characteristics—after a lag of about 15 to 20 years. Donohue and Levitt motivate their work by implicit reference to this theory, and it underlies the specifications they estimate.

The naïve theory does not describe the U.S. experience with abortion. The consensus estimate is that legalizing abortion reduced births by around 4% or 5% (Levine et al., 1999; Ananat et al., 2009). But the number of abortions, relative to the number of births, is an order of magnitude greater: around 30% or 40% in the 1970s (Statistical Abstract, 2001, Table 92). Legalized abortion increased the number of pregnancies—Ananat et al. (2009) show causality—and decreased the ratio of births to pregnancies. One can imagine not only babies who were never born because of abortion, but babies who were born *because* of abortion, and who would not exist had abortion not been legal.

The available evidence indicates that abortion did not substantially alter the distribution of any characteristics within cohorts, although it made cohorts smaller to a modest degree. Ananat et al. (2006, 2009) try to find effects on a number of non-criminal outcomes; while they find modest effects for a few of these, Joyce (2009) seems accurate in his assessment that they do not show large or pervasive changes in non-criminal outcomes for cohorts affected by abortion law changes. On criminal outcomes, both Ananat et al. (2006) and Joyce (2009) show that abortion did not reduce arrest rates, although total arrests declined because cohorts were smaller.

The clearest change associated with the legalization of abortion is a decline in the size of cohorts by about 4-5%. As we saw in Section 2.1.1, the effect of age structure on aggregate crime has been studied extensively, and does not seem to be very important. If abortion were a clean natural experiment that exogenously reduced cohort size by a large amount, it could tell us something about this important effect. But the saga of the 1970s is anything but a clean natural experiment; *Roe v. Wade* was not the Mariel boatlift in reverse.

Donohue and Levitt (2001, 2004) do show that drops in crime by state follow increases in abortion with appropriate lags, but do not establish that this relationship is causal.

We do not understand why aggregate crime correlates with effective appropriately lagged abortion rates, since the explanation offered by Donohue and Levitt, and the one that most immediately comes to mind, is not tenable. The key may be that abortion rates are not exogenous, as Ananat et al. demonstrate, and the forces that were moving abortion rates may have had other effects as well (on the behavior of potential victims as well as the that of potential offenders). Feminism seems a likely candidate explanation: it obviously moved abortion rates in the 1970s, and it had innumerable, pervasive, and long-lasting repercussions. How that might have worked and how it could be tested we have no idea. We hope future scholars will approach the Donohue and Levitt correlation as a puzzle, not a battleground.

## 2.2 The Weak Claim of Criminogenic Characteristics

Many characteristics appear to predispose people to commit crimes. In this section, we look only at areas that have received considerable attention: genetics, education, family structure, social and behavioral skills, military service, and peers. (We have already noted that the weak claim holds for age, gender, and some psychiatric disorders.)

In each of these areas, certain traits are associated with later evidence of criminal activity, usually self-reports, arrests, or convictions. So weak claim papers show more direct evidence of criminal *offending* than strong claim papers do—in strong claim papers, after all, greater crime could be caused by changes in the behavior of potential victims or the police. But even the weak claim papers do not show actual offending: the traits might alter the probability of self-reporting, being arrested, or being convicted, conditional on offending.<sup>7</sup>

### 2.2.1 Education

Almost all work on education has been targeted on the weak claim. The weak claim has been demonstrated for some kinds of preschool education, for school quality, and for educational attainment, especially high school graduation. These processes seem to operate not through the cognitive skills of the students who experience them, but through other, non-cognitive, channels.

Several randomized controlled trials (RCTs) have been completed on high quality preschool programs, and some of them (but not all) have shown that participants in these programs are

---

<sup>7</sup>If certain traits are correlated with committing crimes, Bayesian juries will be more likely to convict people with those traits, conditional on the evidence presented in court, and Bayesian police will be more likely to arrest them. Juries and police will also act this way if they believe the correlation is present, but are wrong. Thus in the experiment by Valla et al. (2011) that showed college students being able to identify convicted criminals from headshots, the mechanism may have been that juries convicted people whom they thought looked like criminals, and college students had the same beliefs as jurors. That is, students may have identified those more likely to be convicted and not necessarily those more likely to have been offenders.

less likely to be punished for crimes when they are older. The High Scope Perry Preschool in Michigan provided half-day preschool for three- and four-year-olds in the early 1960s, along with bi-weekly home visits. By age 40, it reduced the fraction of men arrested five or more times from 0.69 to 0.45, and the fraction of women from 0.34 to 0.24. It also raised incomes at age 40. The Syracuse University Family Development Program reduced juvenile delinquency by age 15 from 22% to 6%. On the other hand, two other RCTs involving similar programs—the Abecedarian Project in North Carolina and the Infant Health and Development Program at multiple sites—failed to reduce arrests significantly, although participants have been observed only to ages 21 and 18 respectively (Lochner, 2011).

Quasi-experimental studies, some on much larger programs, often show reductions in crime, too, but there are also some exceptions. The Chicago Child Parent Center (CPC) was evaluated by comparison with a matched sample from nearby neighborhoods who would have been geographically ineligible for the program. It reduced arrests by a third by age 18 (Reynolds et al., 2001). Three other studies—Garces et al. (2002), Carneiro and Ginja (2008), and Deming (2009)—look at the large federally funded preschool program called Head Start. The first two papers find significant reductions in being booked, being charged with crime, or being sentenced, especially for African Americans, while the third paper does not find a significant impact on crime.

There is no explanation known now for why these programs had disparate results. None of these programs raised teenage measures of cognitive skill, and the results on high school graduation rates are mixed but only weakly correlated with the results on crime. Interventions with young children can reduce crime in adolescence and adulthood, but we do not know yet precisely what those interventions are, or through which mechanisms they operate.

School quality also matters: children who attended better schools are less likely to commit crimes in adolescence and young adulthood. Cullen et al. (2006) and Deming (2011) both examine the results of public school choice lotteries, in Chicago and Charlotte-Mecklenburg respectively. Winning a lottery increases the probability that a student will attend a public school that is better along several dimensions. In neither case did winning the lottery improve academic outcomes, but both papers find that lottery winners were less likely to be arrested or incarcerated—during high school for Cullen et al., and after high school for Deming.

Next consider educational attainment. Less educated people are more likely to commit crimes than more educated people. In 1997, two-thirds of prison inmates in the U.S. were high school dropouts (Lochner, 2011). The association is not necessarily causal: some other factor—time preference or poor families, for instance—could be causing people to be both dropouts and criminals. By using the legal school leaving age as an instrument, researchers have fairly well established now that the relationship is causal: low educational attainment

(in particular, not finishing high school) causes criminal activity. Lochner and Moretti (2004) were the first to establish this relationship for the U.S., and Machin et al. (2011) obtained similar results for the United Kingdom.<sup>8</sup>

This effect probably operates through earnings—thus incentives—rather than through preferences. Lochner and Moretti (2004) use the existing literature to compound the effect of education on earnings with the effect of earnings on crime, and thus compute the effect of education on crime that would be expected if education did not affect preferences. This estimate is not very different from the effect that they find. Similarly, when Grogger (1998) enters both education and earnings in a cross-section regression to explain individual criminal activity, the coefficient on education becomes insignificant.

While evidence for the weak claim for education is strong, evidence for the strong claim is weak. In a cross-national study of murder and robbery, for instance, Fajnzylber et al. (2002) find no significant effect for average educational attainment. Of the 31 predictors of crime in the meta-analysis by Pratt and Cullen (2005), education is the 29th strongest, with essentially no effect. An exception is Buonanno and Leonida (2006), who use generalized method of moments methods to look at property crime in a panel of Italian regions.

### 2.2.2 Psychological and Character Traits

People who approach life in certain ways are more likely to commit crimes than people who do not. Anger, hostility, and impulsiveness are positively correlated with conduct problems; agreeableness (straightforwardness, compliance, altruism, and trust) and conscientiousness are negatively correlated. Personality matters.

More importantly, the relationship between personality traits and crime appears to be causal. We know this from a series of RCTs that have shown that interventions designed to alter how people approach life can reduce crime.<sup>9</sup> But not every personality-altering intervention reduces crime. The most famous interventions are all failures, including *Scared Straight*, DARE, and boot camps (Hill et al., 2011).

What the traits are that are altered in crime-reducing interventions is not settled. Moffitt and Ross (2011) argue that self-control is the key trait. Hill et al. (2011) take a more eclectic approach, but emphasize the role of developing “more effective strategies for dealing with social situations.” Interventions that get young people to change their routine or automatic reactions to possibly stressful social situations often reduce crime (but whether they make

---

<sup>8</sup>These papers are about the weak claim rather than the strong because they show only that crime committed by cohorts affected by the legal change went down, not that total crime went down.

<sup>9</sup>Of course, these traits do not cause “crime” in general; they cause those crimes that people in the RCTs are most likely to get caught at or admit to. Impulsiveness, for instance, may not make people better at embezzling, although it may make them more likely to get caught if they are embezzling.

young people who change better off is unknown).

“Becoming A Man” (BAM) was an RCT in Chicago that showed impressive crime reductions from trying to change the social skills of teenage boys. The premise was that many teenage boys in poor neighborhoods reacted to stressful social situations in ways that led to crime: they were hyper-vigilant to threat cues, and quick to attribute malevolent intent to others (this is called “hostile attribution bias”). BAM combined exposure to pro-social adults with cognitive behavioral therapy (CBT) in order to inculcate less criminogenic habits. The intervention was short and inexpensive. Treatment reduced arrests for violent and other crimes (mainly vandalism, trespassing, and weapons offenses) by 30 to 40 percent in the first year. Academic outcomes also improved (Heller et al., 2013).

After the first year, crime reductions were not statistically significant. Maybe this “fade-out” should not be surprising. If the neighborhoods in which these boys lived taught them to respond with hostile attribution bias before BAM, these neighborhoods might be expected to teach the same thing after BAM. Previous interventions that tried to inculcate social skills were not as successful as BAM (Hill et al., 2011), and Heller et al. (2013) speculate that BAM’s key ingredient was CBT. But the key ingredient may have been BAM’s sample size and its pervasiveness. There were 2740 participants, about three-fourths of the male students in the schools in the program. For a while anyway, the BAM treatment group may have encountered other members of the BAM treatment group often enough that the new habits would not be unlearned quickly. Moreover, the observed “fade-out” may not have been fade-out at all, but partial learning of new habits by the control group, as encounters between treatment and control group members led both to a new equilibrium.

### **2.2.3 Brain Functioning, Brain Structure, *In Utero* Experience, and Genetics**

On average, the brains of people who commit crimes, especially violent crimes, tend to work differently from those of people who do not. They also tend to have different brain structures, and this is part of the reason for different brain functioning. Different brain structure, in turn, is associated with post-birth experiences (like exposure to poor parenting and atmospheric lead), with *in utero* experience, and with genetics. A few of these relationships have been shown to be causal. Lombroso did not miss the mark entirely.

Just as crime covers a large array of activities and motives, the ways that criminals differ from non-criminals are many and varied (Raine, 2013). One set of differences is tied to the cognitive parts of the brain like the ventral prefrontal cortex and the angular gyrus: those who commit certain types of crimes fail to regulate their emotions well and often make bad judgments. But crime is not solely the failure of rationality to control passion. The limbic, emotional parts of the brain and the autonomic nervous system also matter: criminals tend

to be fearless and sensation-seeking (this is tied to a slow heartbeat); they also lack empathy and moral reasoning skills (fear-conditioning is tied to developing a conscience). Parts of the cortex that handle inhibition and the ability to learn to avoid punishment also tend to differ in criminals.

In all of these areas, differences in both functioning and structure have been detected. For instance, in one experiment, 41 murderers and 41 age- and sex-matched normal controls had their brains scanned after performing a repetitive task that required concentration. The murderers, especially the reactive emotional ones, showed significantly less prefrontal glucose metabolism; their brain *function* was different (Raine, 2013, pp. 66-67). The brain function of pedophiles has also been shown to differ from that of people sexually attracted to adults (Ponseti et al., 2014). *Structure* studies have shown that people diagnosed with antisocial personality disorder have around 11% less gray matter (by volume) than average in their prefrontal cortexes, and that psychopaths have 18% less amygdala volume. The parts of the amygdala with the greatest volume reduction govern fear conditioning and avoidance learning (Raine, 2013, pp. 139, 161-162). Almost all of the studies of brain functioning and structure say nothing about causality, but some of them measure physiology before crimes are committed: for instance, in Mauritius, lack of fear conditioning at age 3 predicted criminal convictions by age 23 (Raine, 2013, pp. 118-119).

What causes these differences in function and structure? Obviously, environment matters. Most of the experiences we have already shown to influence criminality—breathing atmospheric lead, using psychotherapeutic drugs, going to school, being raised by a lone parent—probably operate through changes in brain function and structure. Indeed, the best evidence for a causal connection between brain structure and behavior comes from bizarre and gruesome “natural experiments” that destroy parts of a person’s brain and alter his or her behavior. The most famous neuroscience natural experiment was performed on Phineas Gage. He was a shrewd, smart, reliable, self-controlled railway construction foreman until one afternoon in 1848 when a blasting accident sent a metal tamping rod, three and half feet long and more than an inch in diameter, through his skull, entering his lower left cheek and exiting from the top middle part of his head. Although Gage survived, the accident probably destroyed much of his prefrontal cortex, and he became profane, impatient, impulsive, irresponsible, sexually promiscuous, and unable to hold a steady job (Raine, 2013, pp. 143-145).

*In utero* experience also affects brain function and structure. In particular, maternal smoking and alcohol consumption are correlated with abnormal brain development in the fetus and later criminal offending. The smoking relationship holds for second-hand smoke, and the alcohol relationship holds for children adopted away from their natural mothers

(Raine, 2013, pp. 198-205). Hunger during pregnancy also causes children to develop antisocial personality disorder; this is a result from a natural experiment from the Dutch “hunger winter” of 1944-1945, as reported by Neugebauer et al. (1999).

Finally, genetics also matters. Twin studies and adoption studies both show correlations between parent offending and child offending, but of course no causality. So far several genes have been found to influence brain structure, brain functioning, and aggressive behavior and delinquency. Of these, MAOA is the most controversial and best studied. The MAOA gene produces an enzyme called monoamine oxidase A-MAOA enzyme. This enzyme enters into the operation of serotonin, and several other neurotransmitters. When nerve cells transmit information between each other, they produce serotonin in the gaps between them. If the serotonin remains outside the cells, it becomes toxic. The MAOA enzyme works to degrade the serotonin, and get it reabsorbed back into the cells. Poor serotonin reuptake may lead to ADHD, drug abuse, alcoholism, and impulsivity. MAOA may also contribute to reduced volume of the amygdala and the orbitofrontal cortex (Raine, 2013, pp. 61, 260).

There are several different genetic polymorphisms of the MAOA gene—that is, people inherit different versions of the instructions for producing MAOA enzyme. A few people (one famous Dutch family in particular) produce no MAOA enzyme. A tiny number of people have the “2-repeat” version. Most people have “3-repeat,” “3.5-repeat,” “4-repeat,” or “5-repeat” versions. The more repeats, the more enzyme produced. Most studies divide the population into a “low-MAOA” group—that is, 2-repeat and 3-repeat—and a “high-MAOA” group—everybody else.

The main consensus of many studies (though not a unanimous one) is that among English-speaking men of predominantly European descent, low-MAOA individuals who suffer abuse of one kind or another in childhood are more likely to engage in anti-social activities and violent crime in young adulthood than high-MAOA individuals who experience abuse. The intuition behind this result is that childhood abuse leads to heavy serotonin release, which damages nerve cells unless copious amounts of MAOA enzyme are on hand. This result, however, does not appear to hold for Taiwanese (Lu et al., 2003), or African Americans (Widom and Brzustowicz, 2006).

The proportion of people with the low-MAOA genotype ranges from 30 to 80 percent in various populations. In that sense, it is a weaker predictor of violent behavior than being male. Furthermore, one should also be careful in interpreting correlations between genotypes and behavior. People with a certain genotype are not randomly assigned to parents. The measured effect is that of having the genotype, and of having parents typical of the parents of people who have the genotype.

### 2.2.4 Other Characteristics

Galliani et al. (2011) find that men who have served in the military are more likely to commit crimes. They use the results of the draft lottery in Argentina to identify a causal effect of military service. This effect is present in both war and peace.

People who eat more fish are less violent and hostile. This has been demonstrated in many studies, including RCTs. The active ingredient in this relationship appears to be omega-3 fish oils, which enhance the working of brain cells in various ways. In a cross-section of developed nations, there is a negative correlation between seafood consumption per capita and homicides per capita. One might therefore claim that fish-eating satisfies the strong claim of characteristics as well as the weak, but the evidence is not abundant (Raine, 2013, pp. 213-216).

## 2.3 Race and Ethnicity

We have omitted race and ethnicity from our discussion so far because they are correlated with far more than preferences (if they are correlated with preferences at all). But they are characteristics that are correlated with crime.

As far as the strong claim goes, the meta-analysis of ecological studies by Pratt and Cullen (2005) found “percent nonwhite” to be the fourth best predictor of aggregate crime out of 31 variables tested; it has a far stronger correlation with aggregate crime than any of the variables we have discussed. Since most of these studies include many other variables, we can be fairly certain that the effect of race on aggregate crime is not explained by the traditional variables that we found could affect aggregate crime—age structure and single parenthood.

What about the non-traditional characteristics for which the strong claim holds—lead exposure, ADHD and major depressive disorder (MDD), *in utero* exposure? Minorities may plausibly be exposed to more atmospheric lead than non-Hispanic whites, but the relationship has not been explicitly explored. Reyes (2007), however, argues that lead affects crime primarily through ADHD (the IQ channel is minor).

Hence we are left with ADHD and MDD. These disorders are unlikely to explain much of the impact of race on aggregate crime because the prevalence is fairly similar across groups; indeed, these disorders appear to affect non-Hispanic whites disproportionately. Diagnosed ADHD is slightly more prevalent among non-Hispanic white children (ages 5 to 17) than non-Hispanic black or Hispanic children (Akinbami et al., 2011). Kessler et al. (2006), in a large survey of clinician-assessed adult ADHD found that non-Hispanic whites were more likely to have this disorder than minorities; this relationship remained after holding a number

of other variables constant. Riolo et al. (2005) report greater prevalence of clinician-assessed MDD among whites than African Americans or Mexican Americans.

The weak claim also holds for race and ethnicity: minorities are more likely to be arrested and incarcerated for most crimes (and possibly to commit more crimes). Education does not explain the disparity: Lochner and Moretti (2004) estimate that educational attainment accounts for only about 23 percent of the difference between blacks and whites in incarceration rates. Minorities, moreover, are not more likely to be veterans than non-Hispanic whites are. In 2010, 11.3 percent of veterans were African Americans, as opposed to 13.1 percent of the general population and 12.2 percent of the population 18 and over. Similarly, 5.5 percent of veterans were Hispanic, as opposed to 16.9 percent of the general population and 13.6 percent of the population 18 and over.

The argument that characteristics related to preferences might be responsible for a sizable portion of the racial crime gap is probably strongest for the personality traits like aggressiveness, impulsiveness, and hostile attribution bias that we discussed in Section 2.2.2. These are not clinical disorders, and no good national prevalence data seem to be available. They were common, however, among the young black men in Chicago for whom BAM was designed.

What is not clear about these characteristics is whether they should be treated as fundamentals that are acquired genetically or haphazardly early in life, or as best responses to the environment in which many black youths find themselves. The quick fade-out of the effects of BAM suggests the latter.

Genetic explanations have also been examined, although little genetic research has involved minority groups. The low-MAOA genotype varies by race: it is present in about 30 percent of white males, 56 percent of Maori males, 77 percent of Chinese males (Raine, 2013), and it appears to be present in African Americans more than whites in some samples (for instance, Sabol et al. (1998) found that 59% of African Americans and 33% of whites had the low-MAOA genotype, although Widom and Brzustowicz found that in both white and nonwhite males the low-MAOA genotype was present about 41% of the time; both samples had about 100 nonwhites or African Americans, but Sabol et al. had a much larger sample of whites). It is hard to see how MAOA genotype differences could explain a large proportion of the black-white crime gap, since MAOA appears to have little effect on violence among African Americans, since ADHD prevalence does not vary by race, and since persons of Chinese descent in the U.S. tend to be less violent than whites. Genetic variation may be important, but genetic variation depends not just on MAOA, but on many other genes as well.

To summarize, the characteristics we have discussed in this section seem not to be very important causes of the racial crime gap, and it is important to consider incentives and

interactions as determinants of behavior. We do this in the sections to follow.

It is apparent that criminogenic characteristics are neither evenly distributed across space nor stable over time. Atmospheric lead is a clear example of extreme spatio-temporal variation, being concentrated in urban areas and declining dramatically over time. The sorting of households across residential locations can also induce variations in population characteristics across space. But such sorting is at least in part a response to incentives, which we examine next. We revisit characteristics in Sections 6 and 7, when looking at variations across time and space in the pattern of crime.

### 3 Incentives and Deterrence

Instead of looking at who criminals are in order to understand why they commit crimes, another tradition in criminology looks at the incentives they face. This tradition starts with Cesare Beccaria's (1738-1794) treatise, *On Crimes and Punishments (Dei Delitti e Della Pene)*. Beccaria believed that people rationally committed crimes when it was in their best interest to do so, and that they could and should be deterred by expected punishments of appropriate size. He was the first economist to study crime.

Beccaria's view has both positive and normative components. The positive implication is that differences in rewards and punishments can explain differences in criminal offending over time and place. The normative implication is that governments should deter crime by setting punishments for various crimes as high as the gains that criminals might expect from committing those crimes, and no higher. For Beccaria, the relevant question in deciding whether a person should be punished is whether he has committed a crime, not whether he will commit a crime. The criminal justice system is backward-looking; prediction, the central concern of the previous section, plays no role.

Two centuries later, Becker (1968) revived Beccaria's approach: he wrote that his "efforts can be viewed as a resurrection, modernization, and thereby I hope improvement on these much earlier pioneering studies" (p. 209). Becker's paper inspired a continuing stream of research among economists, and his name has become synonymous with deterrence in particular and incentives to commit crime in general.

Although dividing approaches to crime into those that emphasize characteristics (Section 2) and those that emphasize incentives (this section) is convenient for expositional purposes, the distinction is not a deep unbridgeable gap but a question of emphasis, and emphasis depends on the location of heterogeneity. If, for instance, we are looking at a cross-section and people differ little in criminogenic characteristics but face different incentives, perhaps because of more effective policing or harsher punishments in some localities, then incentives

will predict crime well and criminogenic characteristics will not. Conversely, if everyone faces the same expected punishment for committing a crime, criminogenic characteristics will determine who commits crimes and who does not. The same holds for the time series: whether changes in crime over time can be explained better by changes in incentives or changes in criminogenic characteristics depends in large measure on which is changing more during the period in question.

Normative prescriptions also depend on the location of heterogeneity. Beccaria (1764, p. 101), for instance, argues that the appropriate expected punishment for a crime is precisely the gain that criminals realize from committing it: anything less is ineffective, and anything more is unjust and welfare-destroying. This formulation, however, presumes no heterogeneity in the gains that people might realize from committing identical crimes.<sup>10</sup> Similarly, universal preschool may be very effective per dollar or per student through reducing criminogenic characteristics if students are homogeneous and the same “dose” reduces criminality in everyone, but if students are heterogeneous and many are in no danger of committing crimes with or without preschool, the attractiveness of this strategy is considerably diminished.

In this section, we review theoretical and empirical results on deterrence, and on incentive effects of earnings, unemployment, and poverty.

### 3.1 Certainty and Severity

The effectiveness of a threat of punishment depends on how certain it is that punishment will follow the crime, and how severe that punishment is. It has been traditional to think of certainty and severity as two separable dimensions of punishment, and to try to estimate the effects separately. In fact, the two dimensions are usually not entirely separable, either in policy or in estimation, but the distinction is still useful. Beccaria (1764, Chapter 19) added a third dimension, celerity, arguing that swift punishments deter more than delayed ones, but modern economics has not followed him.

Empirical studies of severity appear to be harder than studies of certainty. The primary punishment for serious crimes in developed countries is incarceration, and incarceration can reduce crime through incapacitation as well as deterrence (prisoners cannot commit index crimes against non-prisoners, and inter-prisoner crime is hard to commit). Execution, a less widespread mode of punishment, also incapacitates (more effectively than incarceration). A host of ancillary punishments, meted out by both governments and private parties, are also used and are little studied.<sup>11</sup> Some, like disenfranchisement, have little incapacitative effect,

---

<sup>10</sup>It is possible, of course, to vary penalties based on offender characteristics such as income or wealth, and many countries in Europe have implemented such contingent fines for traffic violations.

<sup>11</sup>See Curtis et al. (2013) for a survey of how public housing authorities punish people who have been

while others, like restrictions on the residences and activities of former sex offenders, are intended to be primarily incapacitative. Ancillary punishments like ineligibility for student loans and occupational bars do not incapacitate; indeed, they may increase the incentives for crime after imprisonment.

It is commonly believed that crime responds more to certainty than to severity—specifically, that the elasticity of crime with respect to measures of certainty is greater (in absolute value) than the elasticity with respect to severity. For instance, (Beccaria, 1764, p.100) wrote: “Crimes are more effectually prevented by the *certainty* than by the *severity* of punishment. . . The certainty of a small punishment will make a stronger impression, than the fear of one more severe, if attended with the hopes of escaping; for it is the nature of mankind to be terrified at the approach of the smallest inevitable evil, whilst hope, the best gift of Heaven, hath the power of dispelling the apprehension of a greater; especially if supported by examples of impunity, which weakness or avarice too frequently afford.”

Becker (1968) gives two separate circumstances that make the certainty elasticity greater than the severity elasticity, one concerning choice by individual potential offenders, and the other concerning strategies of policy-makers.

For individual potential offenders, the certainty elasticity will be greater than the severity elasticity when they are “risk preferrers” in wealth equivalents. For Becker, penalties are measured in wealth equivalents, as if they were all fines. Thus a person’s expected utility  $EU_c$  after committing a crime is the expected value of a lottery

$$EU_c = pu(y - f) + (1 - p)u(y),$$

where  $p$  is the probability of being convicted and punished,  $u(\cdot)$  is a von Neumann-Morgenstern utility function,  $y$  is wealth if not convicted and punished, and hence  $f$  is the wealth equivalent of whatever penalty is meted out. Becker interprets  $p$  as certainty and  $f$  as severity.

Consider an increase in  $p$  adjusting  $f$  to hold  $pf$  constant; that is, consider equal percentage changes in certainty and severity, but in opposite directions. Write  $pf = k$ . Then

$$EU_c = pu\left(y - \frac{k}{p}\right) + (1 - p)u(y),$$

and so

$$\frac{\partial EU_c}{\partial p} = -[u(y) - u(y - f)] + fu'(y - f).$$

---

arrested for or convicted of various crimes, and their families.

By the mean value theorem, there is some  $z \in [y - f, y]$  such that

$$fu'(z) = u(y) - u(y - f).$$

Hence

$$\frac{\partial EU_c}{\partial p} = f[u'(y - f) - u'(z)].$$

For a person who is risk-preferring,  $u'' > 0$ . So  $u'(z) > u'(y - f)$ , since  $z > y - f$ . In this case, increasing  $p$  with an offsetting decrease in  $f$  reduces the expected utility of crime.

The opposite is the case for people who are risk averse. Crime will respond more to changes in severity than to equal percentage changes in certainty.

For policy-makers, Becker shows that if  $p$  and  $f$  are chosen optimally, then in the neighborhood of the optimum, the elasticity of crime with respect to  $p$  is greater than the elasticity with respect to  $f$ . The argument is a *reductio ad absurdum* in the spirit of the proof that a profit-maximizing monopolist never operates on the inelastic portion of the demand curve.

For Becker's policy-maker, the optimum minimizes the sum of three costs: the costs of crime, the costs of detection, and the cost of punishment. For any fixed amount of crime, the optimal pair  $(p, f)$  minimizes the sum of the cost of detection and the cost of punishment. Given the amount of crime, detection costs depend on  $p$ —the more police, the more crimes solved—and punishment costs depend on the product  $pf$ . Suppose  $(p^*, f^*)$  minimizes this sum, and the severity elasticity is greater than or equal to the certainty elasticity: at the margin, potential criminals are risk neutral or risk averse. Then reduce  $p$  and increase  $f$  to keep  $pf$  constant. This holds punishment costs constant and (weakly) reduces crime (crime is constant if the marginal potential criminals are risk neutral). But then detection costs can be lowered without raising the initial level of crime. Hence  $(p^*, f^*)$  cannot be optimal.

Essentially, with risk-averse criminals, policy-makers can drive crime and enforcement cost to zero by threatening an infinitely horrible punishment at infinitesimally low probability. Hence, if  $(p, f)$  is set optimally, the potential criminals on the margin are risk-preferring, and certainty elasticity exceeds the severity elasticity.<sup>12</sup>

There is little reason to believe that either of Becker's two conditions, risk-preferring marginal criminals or optimal policies, is satisfied at any historical moment. But inequality of the two elasticities should not be taken as a sign of sub-optimality. Only by assessing

---

<sup>12</sup>Note that this argument requires potential criminals to make accurate assessments of the detection probability. In contrast, Beccaria's understanding of the trade-off between certainty and severity hinges on an underestimation of the likelihood of punishment relative to its true value, based on exaggerated "hopes of escape." If this effect is sufficiently strong, then even those who exhibit risk aversion conditional on their subjective beliefs may be better incentivized to abstain from crime through certain rather than severe punishments. Put differently, the certainty elasticity may be higher than the severity elasticity even if the marginal criminal is risk averse, provided that the probability of apprehension is systematically underestimated.

costs and elasticities in a particular situation can economists determine the optimality (or not) of particular constellations of policies.

## 3.2 Empirical Studies of Deterrence

Since Becker's work, many estimates of deterrence have been made. Durlauf and Nagin (2011) provide a complete and critical review. We will focus on the most compelling work. The bottom line is that substantial evidence finds large effects of certainty of punishment on crime, but evidence on severity is spotty.

### 3.2.1 Certainty Studies

Whether a crime is punished depends mainly on how police respond to it, and so studies of certainty are almost all studies of police and what they do. Courts matter too (and for courts, both Type 1 and Type 2 errors affect deterrence), but we are not aware of any studies of court error.

**Responses to Terrorist Attacks** Various terrorist incidents and threats have caused police departments to redeploy their forces in unexpected ways. These incidents are plausibly exogenous to the more mundane index crimes that we study, and the redeployments are natural experiments for the effect of police presence on index crime.<sup>13</sup>

Di Tella and Schargrodsy (2004) look at a redeployment in Buenos Aires that followed the bombing of a Jewish center in 1994. Police were stationed at every Jewish and Muslim institution. Car thefts fell by 75 percent on the blocks where the extra police were stationed, and did not rise elsewhere. Theory predicts the fall in the affected blocks, but does not predict the complete absence of displacement, unless the crimes that were deterred were so close to the margin that walking an extra block or two to find another equally attractive target was not worth the effort, or the potential thieves had ties to the particular blocks they were operating on that could not be carried over to other blocks. Klick and Tabarrok (2005) for Washington, D.C., Poutvaara and Priks (2009) for Stockholm, and Draca et al. (2011) for London find similar results.

The type of crimes affected by simple presence are intuitive: auto theft and thefts from cars in Washington, auto theft in Buenos Aires, football and hockey hooliganism in Stock-

---

<sup>13</sup>As noted in the Introduction, we do not discuss the causes or consequences of terrorism itself. For the sake of completeness, however, we note that there is a literature on the consequences of terrorism for urban form, ranging from the theoretical contributions of Mills (2002) and Glaeser and Shapiro (2002) to the empirical work of Blomberg and Sheppard (2007), Glaeser (2007), Abadie and Dermisi (2008), and Arbel et al. (2010). Researchers have also looked at how terrorism affects urban public finance (Wildasin, 2002) and residential segregation (Gautier et al., 2009).

holm, thefts and street-level violence in London (burglaries respond to police presence in Washington, but not in London). In all these papers the implied elasticity of total crime with respect to police presence is about 0.3-0.5. Notice that this is an elasticity with respect to police, not with respect to the probability of punishment, the variable in Becker's theory. The closer one gets to the elasticities in Becker's theory, the worse the estimates become.

**“Hot spots”** Some types of crime, like drug dealing and shooting, are highly concentrated in very small areas of cities. “Hot spots” tactics flood these zones with visible police. A number of experiments and quasi-experiments of hot spots policing have been conducted and generally have found that it reduces crime in the targeted zones. No evidence of displacement has been found; reducing crime in hot spots does not appear to raise it elsewhere. Braga (2008) reviews these studies.

Police try many different approaches to crime, and even if none of them work, a few of them will generate statistically significant positive results. But the repeated results on terrorist responses and hot spots suggest that the positive results are not just reflecting good luck.

**Perceived probability of arrest** Lochner (2007) finds that young men who say they have a higher probability of arrest if they commit a particular crime are less likely to commit that crime. Perceived probabilities are influenced by the ratio of crimes to arrests in the jurisdiction in which the young men live. Whether the reluctance of these individuals to commit these crimes leads others to do so instead is not known.

Notice that the results about police presence are also about the perceived probability of arrest. The theory is that a potential offender who is, say, contemplating stealing a car notices a police officer standing next to the car and thinks, “If I steal this car now, I will surely be arrested, probably before I get the door open.” He does not think, “Ten percent of the motor vehicle thefts around here are solved by arrests and that is the probability I will be arrested.” Consequently, there is no arrest and the arrest rate is in this case unaffected and irrelevant.

This example should also remind us that “perceived probability of arrest” is not a well-defined quantity; even for the same person it varies greatly with the circumstances under which the contemplated crime would occur. Operationally, the variable that Lochner uses is based on answers to a questionnaire that does not fully specify the circumstances of the contemplated crime.

The relevant magnitude for deterrence, moreover, is not the perceived probability of arrest, but the perceived difference between the probability of arrest contingent on offending,

and the probability of arrest contingent on not offending.<sup>14</sup>

**Actual arrest rates** Actual arrest rates—the ratio of arrests to reported crimes—are negatively correlated with reported crime, either contemporaneously or slightly in the future. This correlation was one of the strongest results of 20th century criminology (Nagin, 1998). Four separate problems, however, make it hard to accept this correlation as causal, or the implied elasticity as an estimate of the Becker elasticity of crime with respect to the likelihood of punishment.

The first problem is measurement error. In the usual regressions, reported crime is both the dependent variable and the denominator of the independent variable, but it is only a noisy measure of actual crime (the goal of policing is to reduce actual crime, not reported crime, even if the incentives of officers are not perfectly aligned with this goal). This form of measurement error makes the absolute value of the elasticity estimated with reported crime greater in expected value than the elasticity that would be estimated with actual crime. When the reporting rate is high, reported crimes are high and the arrest rate is low (the denominator is large), and this introduces a bias in the estimated elasticity, making it larger in absolute value. Levitt (1998a), however, argues that the bias from measurement error is probably small (the method is to show that estimates across a variety of equations do not differ in the way predicted by theory if the bias were sizable).

The second problem is endogeneity. The arrest rate is endogenous: for instance, extraneous reasons could drive up crime, overwhelm the police, and so drive the arrest rate down. Few papers attempt to deal with endogeneity. The main exception is Sampson and Cohen (1988), who use a measure of police aggressiveness and professionalism as an instrument for arrest rates. They find a significant negative effect of arrest rates on robbery, but not on burglary. The exclusion restriction is that police aggressiveness and professionalism affects robbery only through the arrest rate. As the terrorism papers show, this restriction is dubious.

The third problem is that because the periods over which crimes and arrest rates are measured is finite, arrests can reduce crime from incapacitation as well as from deterrence. Suppose data are reported for a calendar year. Criminals arrested in January for crimes in January may spend all or most of the year in jail or prison if they cannot make bail or if they are tried and convicted within a few months. Arrest rates are also serially correlated and so a high arrest rate in the current year is likely to be correlated with many previous year criminals incarcerated.

---

<sup>14</sup>This holds when a single decision is being made. O’Flaherty (1998) shows that in a repeated decision context, offending should be more sensitive to the false arrest probability than to the true arrest probability.

Levitt tries to estimate the incapacitation effect by looking at how arrests for one crime affect commission of other crimes. Arrests for murder, for instance, should affect burglary only through an incapacitation effect; the murder arrest rate should not deter burglaries. Proceeding from this insight, he concludes that incapacitation effect is important for some violent crimes like rape, but not for property crimes or other violent crimes. He does not instrument for arrest rates, though.

The final problem with arrest rates studies is conceptual. The probabilities of arrest that matter for criminal decision-making vary by person, time, and circumstance. The arrest rate that researchers use is an average of these specific arrest probabilities. But it is not a simple average; it is an average over the opportunities when crime actually occurred.

To see what this means, suppose there are a lot of criminal opportunities (combinations of person, time, and circumstance) indexed by  $j$  and at each criminal opportunity there is a probability  $p_j$  that the perpetrator will be arrested if the crime is committed. There are  $n$  opportunities, each equally probable. In each of them the private benefit of committing the crime is the same, and the punishment if arrested is the same. Let  $\hat{p}$  denote the maximal arrest probability for which committing a crime is profitable. The crimes that are committed are the set  $A$  or “active opportunities”:

$$A = \{j \mid p_j \leq \hat{p}\}.$$

Then the observed arrest rate is

$$\frac{1}{|A|} \sum_{j \in A} p_j.$$

Police tactics alter the vector  $(p_1, \dots, p_n)$ . The arrest rate acts like the Becker probability of punishment only if police tactics always cause uniform percentage shifts in  $p_j$  for  $j \in A$ , and do not change the membership of  $A$ . This is a strong restriction, and unlikely to reflect good police work.

Suppose, for instance, that police are concerned about reducing crime, and have been given a small amount of additional resources. They would want to concentrate the new resources, to the extent they could, on those opportunities  $j$  for which  $p_j$  is slightly less than  $\hat{p}$ , and increase the probability of arrest there. This would reduce crime by reducing the membership of set  $A$ , but leave the arrest probabilities for the remaining criminal opportunities that were still being acted on unchanged. But because the criminal opportunities that ceased being acted on were those with the highest arrest probabilities, the arrest rate falls—only the hard cases are left. So variation in the arrest rate will not reflect variation in crime or in the relevant arrest probabilities.

The arrest rate is therefore a poor proxy for certainty of punishment in Becker's theory.

**Probation sanctions** Probationers are people who have been found guilty of crimes, but sentenced to periods of supervision and restriction in the community, rather than to incarceration. They lose some of their freedom, but not all of it. If they are found to have violated the terms of their probation, they can be incarcerated or otherwise sanctioned. Project Hope, in Hawaii, modified traditional probation terms to include frequent drug testing and short (one or two day) periods of incarceration in the event of drug test failure. Regular probation had less frequent testing, sanctions that were not always administered, and much more severe sanctions. So Project Hope increased certainty and reduced severity. In a randomized control trial, the result was better compliance and fewer days in jail (Durlauf and Nagin, 2011; Kleiman, 2009).

Project Hope provides information on both certainty and severity. But since reducing the severity of the sanction was unlikely to increase compliance, it is a fairly convincing demonstration that certainty can increase compliance.

**Number of police officers** Whether increases in the size of police forces are likely to reduce index crime is an important policy question, especially for state and federal governments that can provide funding, but may have little direct control over what police do. Since most (but not all) of what police do about index crime affects the certainty of punishment, not severity or incapacitation, it would probably be a weak confirmation of the proposition that punishment certainty reduces crime if police reduced crime. But a positive result about police force size is not necessary for the proposition on punishment certainty to hold: marginal additions to police forces could be frittered away on waste, sloth, unproductive activity, or devoted to victimless crimes or traffic regulation.

The evidence seems quite clear now that, on average, increasing the size of a police force reduces index crime. OLS regression is insufficient for this question because of endogeneity (places with more crime tend to have more police) and measurement error (the number of police is not measured accurately). Several different approaches to deal with this problem have been taken.

The most common approach is to use instrumental variables to handle endogeneity, but without correction for measurement error. Levitt (2002) uses firefighter and other civil service employment as his instrument; Evans and Owens (2007) use federal subsidies; and Lin (2009) uses state sales taxes.<sup>15</sup> All these papers find that police reduce crime, and

---

<sup>15</sup>The 2002 note was Levitt's second paper on this question. The first, Levitt (1997), used electoral cycles as an instrument. McCrary (2002) found weaknesses in this paper and Levitt responded with the new instrument and new results.

that the effect is larger for violent crime, especially murder, than for property crime. The elasticities of violent crime with respect to police employment are 0.5 or more (sometimes greater than 1.0).

Chalfin and McCrary (2013) present evidence that police force size responds primarily to idiosyncratic shocks, and so endogeneity is not a large problem. But measurement error in their view is a substantial problem. They correct for measurement error, and find results similar to those in the other IV papers. Still the murder elasticity is greater than 0.5.

The unresolved question is whether the entire crime reduction that police cause is due to deterrence. Arrests for index crime, as we have noted, often cause incapacitation. Police also pick up people on outstanding warrants, and sometimes when they arrest parolees or probationers for minor crimes, those arrestees are sent to prison (even if they do not appear as index crime arrests).

Chalfin and McCrary believe that the greater police impact on violent crime than on property crime is evidence for incapacitation, but the issue remains open. Some violent crime, like robbery and bar-room brawling, necessarily occurs in public, where police can be found, while much property crime can be done more furtively—by definition, the perpetrator of a violent crime must confront the victim. The protective responses of potential victims may also matter; see Section 4 below. Remember that the effect of police on crime measured here is the net effect after potential victims have adjusted their precautionary behavior.

### 3.2.2 Severity Studies

The empirical literature on severity is much sparser than that on certainty, and the results are less definitive. The papers that show any effect are few. That may be because severity is hard to measure, or because severity is too heavily intertwined with incapacitation, or because it really has little or no effect.

**Collective pardon** Perhaps the cleanest test of whether sentence severity reduces crime comes from a 2006 prison release in Italy. Because of overcrowding, Italian authorities declared a collective pardon and released large numbers of prisoners before their sentences ended. If they re-offended, their remaining sentences would be added to the sentence for the new crime. Thus former prisoners who had longer remaining sentences faced more severe punishment for future crimes. Drago et al. (2009) found that former prisoners facing more severe punishment were less likely to re-offend. Their estimates imply an elasticity of recidivism with respect to sentence length of  $-0.74$ , but the differences in question are on the order of magnitude of a few months.

**Prison conditions** Katz et al. (2003) find that worse prison conditions deter crime. They proxy for prison conditions with the death rate of prisoners. Homicides, violent crime, and property crime all go down when prison deaths go up.

**Age of majority** Punishment is more severe for adults than for juveniles, and so when individuals become 18, they should reduce criminal offending. Lee and McCrary (2009) use individual-level data to look for a discontinuity at the eighteenth birthday. They do not find one (the point estimate is negative, but tiny and insignificant). Levitt (1998b) found a drop, but his data were cruder.

**California sentence enhancement** California’s Three Strikes and You’re Out law took effect in March 1994. It mandated a 25-year minimum sentence for conviction on a third “strikeable” offense. Thus sentence severity increased considerably in March 1994, and it increased more for people with more strikeable convictions.

Crime did not decrease noticeably in California in March 1994, but individuals with two strikes reduced offending (or became less likely to be convicted). Zimring et al. (2001) found a discontinuity in offending by this group at March 1994. Helland and Tabarrok (2007) compared future offending of people who were convicted of two strikeable offenses, and those who were “almost” convicted of a second strikeable offense: they were charged with one, but ultimately convicted of something else. Those with the second strikeable conviction committed less subsequent crime.

### 3.2.3 Violence Reduction Initiatives

Beginning with Operation Ceasefire in Boston, a number of cities have experimented with targeted programs to deter violence among high-risk individuals. These programs raise severity, certainty, and salience; they are surely designed to deter, but the elements of deterrence are too intertwined to disentangle. Details differ, but most programs revolve around “call-ins.” A dozen or two selected people—parolees or known gang members, for instance—are called to a meeting with law enforcement and community leaders. The law enforcement people tell the participants that they are being watched, and that the first gang or group to engage in violence will be severely punished. If guns are involved, federal rather than state imprisonment will follow. They show slides about recent long sentences of people the participants might know. Former federal prisoners talk about what federal prison is like: it’s cold, it’s far away, nobody visits, and you and your friends are a small minority amidst prisoners from all over the country.

Then community leaders and representatives of social service agencies promise to help anyone who wants to change his lifestyle, and lets them do so in a less public way. Families of murder victims talk about the pain they bear and urge the participants not to get themselves killed.

Thus the violence reduction initiatives combine greater certainty of punishment (promised credibly since it is the “the first” who are punished, not everyone everywhere), greater severity of punishment (worse prison conditions, not just more years), and enhanced incentives to abjure violence.

These initiatives have been studied in Boston (Kennedy et al., 2001), Richmond (Raphael and Ludwig, 2003), and Chicago (Papachristou et al., 2007). Generally, they appear to have reduced murders, although whether the early studies were large enough to justify their strong conclusions is open to question (Raphael and Ludwig, 2003; Cook and Ludwig, 2006). The programs are evolving, however, and more data are accumulating.

Quite apart from their effects on certainty and severity, such violence reduction programs can also operate through a *coordinated* change in beliefs. A generalized expectation that others are less likely to kill can reduce the incentives for any given individual to kill preemptively, for instance during an escalating dispute (O’Flaherty and Sethi, 2010c). We explore this mechanism further when discussing homicide in Section 4 below.

### 3.2.4 What Empirical Studies Tell Us

Deterrence works. Some things—though not everything—that authorities can do will usually reduce crime. Finding empirical correlates of Becker’s certainty and severity elasticities, however, is probably impossible.<sup>16</sup> Nevertheless, cost-benefit calculations for various strategies can be made.

## 3.3 Income, Earnings, and Employment

The young men who commit most index crimes are generally believed to be disproportionately poor, although good data on the legitimate income of arrestees is hard to come by. Possibly this relationship is explained directly by long-run criminogenic characteristics: the same characteristics (being a high school dropout, a child of a lone parent, being impulsive, or having a poorly functioning prefrontal cortex, for instance) that incline people to commit index crimes may also incline them to earn little or no money in the legitimate labor market

---

<sup>16</sup>The exception to this is laboratory experiments, like Harbaugh et al. (2001). That experiment indicated that both certainty and severity reduce crime, but that subjects tested were generally risk averse. But since these variables cannot be re-created outside the laboratory, it is unclear how laboratory estimates can generalize.

because these characteristics are unattractive to employers. Labor market conditions might have no independent effect on crime.

Alternatively, committing index crimes might be a time-intensive activity, and so people whose opportunities were most limited in legitimate labor markets (for whatever reason) would have comparative advantage at it. Poor young men might commit crime because of their incentives, not their characteristics. If incentives were the reason, moreover, the volume of crime would change as incentives changed.

The standard theory gives several reasons why labor market opportunities would affect the incentives to commit crime. First, planning and committing crimes takes time, and so does evading capture after a crime has been committed. People with lower market wages or none at all have lower opportunity costs.<sup>17</sup> Second, being arrested and tried also uses time, some of which may disrupt one's legitimate employment. The opportunity costs here include not only time, but the possible loss of one's job. Legal representation may also be subsidized for people with low incomes. Third, incarceration uses a great deal of time, and is obviously cheaper for people with lower expected wages and employment rates. Fourth, the stigma costs of a criminal conviction, especially the labor market losses, are also likely greater for people with higher earnings. A criminal conviction is likely to cost a college president more than a laborer.<sup>18</sup>

On the whole, it seems likely that not only monetary but also subjective welfare costs of committing crimes are greater for more affluent individuals. What about the benefits? Given standard assumptions about the marginal utility of income, a given monetary gain results in lower welfare gains at higher incomes. On this reasoning, property crimes and robbery, where the motive is acquisition, should yield greater subjective welfare benefits to the poor. For assault, murder, and rape, where motives are more various, no definitive statement is possible.<sup>19</sup>

One weakness of this labor market story is that it seems to apply only to people attached to the labor market, while much crime is committed by teenagers whose attachment to the labor market is limited, whether they are rich or poor. But most of the arguments carry over fairly easily, since the costs are in the future. Opportunity costs of teenagers who are

---

<sup>17</sup>Freeman (1996), however, provides some evidence that most crime does not absorb an extravagant amount of time, and one can easily maintain a full-time job while being an active criminal.

<sup>18</sup>Note, however that certain costs associated with a conviction may be borne only by people who are poor: losing access to public housing or subsidized student loans is not a great hardship for the affluent. Furthermore, the ability to mount a credible defense requires wealth, so the expected likelihood of incarceration is almost certainly lower for those with greater wealth.

<sup>19</sup>We are considering only index crimes here, but more generally, there are crimes that are expensive to commit and therefore available only to those with sufficient wealth. It is hard, after all, to borrow money to hire lawyers to harass people you do not like, however much you may seek this end, but you do not need to borrow if you have wealth.

on a trajectory for well-paying jobs are higher in terms of incarceration and stigma, at least. School activities can be especially valuable to these teenagers, certainly more so than to those who do not expect to have attractive labor market opportunities later in life.

So it is plausible that people with worse labor market prospects should be more likely to commit index crimes, and that labor market conditions should affect crime by affecting incentives. Very little modern work has been done on the first implication. The most sophisticated papers ask how various income support programs affect recidivism by recently released prisoners. These papers find an income effect (not just a substitution effect), especially for property crime. Berk and Rauma (1983), for instance, one of the earliest regression-discontinuity applications in any field, find that unemployment compensation reduces recidivism, even though it probably discourages work.

The second implication has been more extensively studied. In their survey of ecological regressions, Pratt and Cullen (2005) found that unemployment with length considered was the second strongest predictor of aggregate crime rates, out of 31. Poverty ranked tenth. But measures of unemployment that did not account for length were only moderately strong predictors.

Simple regressions of crime on unemployment or wages face several problems. First, general measures of labor market conditions may be poor proxies for the labor market conditions that people on the margin of committing crime face. Second, because many of the costs of crime are in the future, short-run fluctuations, especially in unemployment, may not be very important, especially for teenagers. Third, business-cycle fluctuations may reduce the benefits of crime at the same time that they reduce its costs. There may, for instance, be less to steal when unemployment rates go up, and murder may fall because the drug trade shrinks. These three problems bias down the simple estimates of labor market incentive effects.

Three other problems bias these estimates up. Private and public protection efforts may be cut back when the economy turns down: cities hire fewer police, and private employers hire fewer security guards. Second, crime might reduce employment, especially in the cross-section, if employers find a crime-ridden environment unproductive, or workers demand compensating differentials. And finally, both the fluctuations in crime and the fluctuations in labor market outcomes might be driven by fluctuations in characteristics (especially characteristics unobservable in standard data sets like ADHD and slow pulse), and so incentives might be playing no role.

Several papers have handled a substantial number of these problems and find that labor markets do affect crime through incentives. Raphael and Winter-Ebmer (2001) look at unemployment. They use many control variables to reflect the behavior of public authorities and potential victims, and specify variables that describe marginal offenders (for instance,

they distinguish between male and female unemployment rates for rape). They also instrument for state unemployment rates with oil price and defense contract shocks. Instrumenting resolves both the reverse causality problem and the difficulties with unobserved criminogenic characteristics. Higher unemployment raises property crime, but the effect on violent crime is mixed and small. It may even reduce murder.

Gould et al. (2002) look at both the wage rates of non-college-educated men and their unemployment rates. To correct for observable characteristics, they use state-year residuals from a wage equation rather than simply wages. They also use instrumental variables reflecting labor demand. For unemployment rates, their results are similar to those of Raphael and Winter-Ebmer. The wage rate effects are somewhat stronger than the unemployment rate effects, as might be expected, and often show sizeable impacts on violent crime as well as property crime.

Johnson et al. (2007) show that at least part of the effect that these papers find is an income effect not a substitution effect. They look at federal relief aid in the Great Depression, and find that increases in federal aid to a city reduced property crime (including robbery). Work relief—assistance tied to required employment—reduced property crime more than unconditional aid.

Corman et al. (2013), on the other hand, show an independent substitution effect. Welfare reform in the 1990s caused little change in the income of single parent families, but increased employment. They find that welfare reform reduced women’s arrests for shoplifting. Thus Johnson et al. (2007) show that there is an income effect, Corman et al. (2013) show that there is a substitution effect, and both papers suggest that the total effect is the sum.

It is a legitimate inference from these papers that part of the reason why poorer people commit more crime is that their incentives are different. But no study has asked how much of the income gradient in crime offending is due to labor market incentives. By the same reasoning, many of the effects we attributed to criminogenic characteristics in Section 2 were probably overstated, since many criminogenic characteristics lead to lower wages and higher unemployment. The big gap is that no one has estimated a cross-sectional income or wage gradient in offending.

### 3.4 Race and Incentives

Minorities, especially African Americans, are more likely to commit most index crimes, and, unconditionally, are more likely to be punished for committing index crimes.<sup>20</sup>

---

<sup>20</sup>Both statements need to be qualified. Nobody truly knows who commits index crimes, but considerable evidence indicates that minorities commit most of these crimes disproportionately; see Sampson and Lauritsen (1997). Second, Hispanic involvement in the criminal justice system is poorly measured because

Because the elasticities of crime with respect to both certainty and severity are less than one, certain explanations for these two statements can be ruled out, at least for traditional punishments. It cannot be the case that minorities commit more crimes because they are punished *less* conditional on offending; this would not be consistent with the fact that they are punished more unconditionally. For instance, if the expected punishment for African Americans were less than that for non-Hispanic whites, the former would commit more crimes, but not enough that their arrests and presence in prisons would be greater. So the reasons for high minority involvement in crime must lie elsewhere.

The older consensus in criminology was that arrests for index crimes by race were roughly proportional to offenses and that convictions and sentencing for index crimes were not seriously biased (Sampson and Lauritsen, 1997). More recent work on prosecutions and sentenced has found many exceptions to this conclusion, but no consistent pattern, although often studies find that black and Hispanic defendants are treated more punitively. But some studies find the opposite (Kutateladze et al., 2012). Bail setting appears to be an exception, as Ayres (2001) found more restrictive conditions for black defendants, and Kutateladze et al. (2012) report on more recent studies with similar findings for both black and Hispanic defendants. Bail, though, affects jail population, not prisons or arrests.

Minorities might be less effectively deterred if they *perceived* lower expected punishment, even if actual punishment were the same or greater. Lochner (2007) reports results on perceived punishment, but these do not paint a consistent picture. In the National Longitudinal Survey of Youth 1997 cohort, blacks and Hispanics perceive lower probabilities of arrest for property crimes, both unconditionally and conditional on the official arrest rate in their county, and no information is available on violent crime. In the National Youth Survey, blacks and Hispanics perceive higher arrest probabilities for petty property crimes, but essentially the same arrest probabilities for violent crimes and more serious property crime.

On perceived severity of sanctions, we are not aware of any conclusive findings. On the one hand, minorities might be more comfortable (less uncomfortable) in prisons dominated by minorities; they might feel less stigma in their communities because their communities contain more ex-offenders; they may not lose as much income from employer disfavor because they would not have had as much income to start with. On the other hand, losing voting rights and dignity may sting more deeply for blacks because of the long struggle it took to achieve them in America; loss of housing subsidies may hurt more because they would have relied on them more; and employers may be more willing to look at a white ex-offender as

---

many law enforcement agencies do not gather ethnicity information in ways that are consistent with federal government guidelines.

a “kid who made a mistake” rather than a hardened criminal. In fact, in an employment audit, Pager et al. (2009) find that a criminal record is a greater penalty for black men than for white. No answer about punishment size is obvious.

Repeated temptations may also matter, especially if minorities think they are more likely to be punished unjustly and are more likely to live in neighborhoods where temptations occur more often. Under such circumstances, some of the results of the Becker model of “one-shot temptations” do not carry over (O’Flaherty, 1998). Essentially, people who think they will go to prison eventually (because of wrongful conviction or inadvertent mistakes on their part), no matter what they do today will not be much deterred by threats of punishment for today’s crime (especially if they do not discount the future heavily). But no empirical work has been done on this question as far as we are aware.

Earnings and employment are one area where racial differences are clear, and where evidence shows an incentive effect. Blacks and Hispanics earn lower wages than non-Hispanic whites when they work, and are more likely to be unemployed or out of the labor force (independent of any criminal justice system actions, apparently). Thus arrest and imprisonment should be a less of a deterrent.

Putting a number on this effect, however, seems impossible at this time. Recall that no high-quality studies look at cross-section variation in offending by earnings. It is hard to see how the time-series results could be translated into the cross-section. Cross-section effects, for instance, are likely to be non-linear, but the time series studies have understandably looked only for linear effects. A serious cross-section analysis would also have to model the earnings and employment outlooks of teenagers.

The time series studies found larger labor market effects for property crimes than for violent crimes, and practically no effect for murder. Racial differences in offending for property crimes are much smaller than those for murder and robbery. If the time series results carry over to the cross-section, it seems likely that earnings and employment explain a much larger part of the racial gap for property crime than for robbery and murder. That is, the significant racial disparities in offending and victimization for homicide and robbery cannot easily be attributed to income and employment differences. We return to this issue in more detail when looking at interactions in Section 4.

In summary, then, labor market incentives possibly explain a considerable part of the racial gap in property crime offending, but cannot account for the homicide and robbery data. We have no reason to believe that any particular racial or ethnic group is especially likely to be deterred from index crimes by existing punishments. Arguments exist to suggest all manner of effects and many questions still lack answers.

## 4 Interactions

While Becker's concern was with the optimal design of monitoring and enforcement systems, his general approach provided a versatile framework within which a variety of related phenomena could be examined. Cook (1986) considered interactions between potential victims and would-be offenders, with the former attempting to protect themselves and the latter seeking to find the most lucrative targets. Victim selection, from this perspective, is seen as an economic activity in its own right and responsive to incentives. Potential offenders will tend to target those who are easy to find, offer minimal resistance, have a lot to offer, and have limited recourse to the law. But victims who are the most attractive targets will also be the most inclined to use defensive measures: avoiding areas with high victimization rates, moving in groups, installing alarm systems, and so on.

The net result could well be lower victimization rates per capita for those who would otherwise be the most desirable targets. This helps account for the fact that elderly women are less likely to be robbery victims than young men, and banks are held up less often than gas stations. A high level of fear among some groups can result in so great a decrease in exposure to crime that even if victimization is high per unit of exposure, measured aggregate victimization rates will be low for the group.<sup>21</sup>

This perspective also suggests that the removal of some individuals from the population of potential offenders through incarceration or rehabilitation need not significantly reduce overall crime rates. Faced with less competition, the remaining offenders would see an increase in returns. This could cause them to scale up their activities, and could bring in new entrants that swell their ranks. That is why we had to distinguish between strong and weak claims of criminogenic characteristics.

Interaction effects are also important within the population of potential offenders. Those engaged in activities such as drug selling, gambling or prostitution are often attractive targets for robbery, both because they are likely to be in possession of cash or other valuables, and because they are unlikely to report the crime. Street vice also requires location choices to be made, and these clearly involve interactions with the choices of others. Homicide is sometimes preemptive, or retaliatory, or motivated by reputational concerns, which calls for a strategic analysis. Effective law enforcement critically depends on witness cooperation, the costs of which depend on the behavior of other potential witnesses. In this section we deal with interaction effects such as these.

---

<sup>21</sup>The importance of precautions in determining rates of victimization may be illustrated by considering fatalities from lightning strikes: over the period 2006-2012, more than 80% of such victims were male (Rice, 2014). While some of this may be attributed to physiological gender differences such as body mass, it seems likely that the main cause is differential exposure to conditions in which one is vulnerable to a strike.

## 4.1 Private Actions and Displacement

Private actions, sometimes in concert with public initiatives, are a major factor in determining the aggregate level and spatial distribution of crime. In fact, without private action it is impossible to imagine any crime control policy being effective. For one thing, the willingness of victims and witnesses to report crimes, provide information to police, and testify in court are all crucial inputs in the production of law enforcement. The use of alarms and locks, hiring of security guards, installation of cameras, use of credit and debit cards as substitutes for cash all affect the returns to property crime. Technological innovations that make it easier to trace stolen vehicles, or uncover fraudulent credit card use all play a role. Electronic sensors on high value items in stores make theft of merchandise harder to execute. Well before high tech surveillance became possible, Jacobs (1961) celebrated the “eyes on the street” that deterred crime in Greenwich Village.

Private actions to avoid victimization can have significant external effects, both positive and negative. For instance, private security guards face an incentive to protect a particular area or premises, not reduce crime overall. This can result in displacement of crime to other venues, increasing inequality in exposure to crime without lowering the aggregate volume. However, if not all criminal opportunities are equivalent, the protection of the most lucrative targets will lower the overall returns to crime (Ehrlich, 1973). On the margin between criminal and noncriminal activities, therefore, the protection of some locations should raise the relative return to non-criminal activities and lower the volume of crime. For example, better protection of high value motor vehicles through improved locking or tracking systems shifts crime to lower value models, while also lowering returns to motor vehicle theft, and gated communities shift burglary to communities without gates and lower the returns to burglary (Helsley and Strange, 1999). Displacement (and negative external effects on others) occurs together with an overall reduction in crime.

This point is very clearly illustrated in a study by van Ours and Vollaard (2013) on the electronic engine immobilizer, an inexpensive device that makes motor-vehicle theft substantially more difficult and costly unless the offender has access to an original key. A European Union requirement made installation of the device mandatory for all new cars as of 1998, and the proportion of new cars equipped with the immobilizer rose steadily from essentially zero to 100% over the five year period starting in 1994. The authors examine theft data from the Netherlands using the policy shift as an exogenous shock and find evidence of a substantial reduction in aggregate motor vehicle theft, sustained over a decade, and only partially offset by target displacement. Roughly one-third of the decline in theft rate for cars with the device was shifted to older cars. Since the stock of cars without the immobilizer was steadily dwindling over time, this displacement effect quickly became negligible. The

authors conclude that the policy comfortably survives a cost-benefit analysis.<sup>22</sup>

Ordinarily a mandate like this would be justified by a significant market failure, which in this case is hard to identify. The cost of the immobilizer is small relative to the *private* benefits to most car owners and insurers, even if one disregards any positive external effects from installation.<sup>23</sup> Furthermore, the regulation was a blunt instrument that took no account of differences in the risk of theft faced by individual owners. As the authors note, a policy aimed at lowering “a risk that is already low through a one-size-fits-all measure that does not distinguish between targets at high or low risk sets a high threshold for achieving positive net benefits.” Nevertheless, given the limited market penetration of the technology in countries where it is not mandated, the authors conclude that in decisions involving rare events, individuals do not always act in their own best interest.

It is important to note that, in principle, displacement in response to a deterrence policy can result in *increased* social costs relative to the status quo, even if one entirely disregards the cost of implementing the policy. For instance, the mandatory use of immobilizer could have induced would-be car thieves to switch to carjacking instead, a crime with substantially greater victim costs (including the costs of injury). Fortunately this appears not to have occurred on a scale that would lead one to question the conclusions of the study, but tactical displacement that sharply raises victims cost must be considered in any prospective evaluation of such measures.<sup>24</sup>

Helsley and Strange (2005) explore the interaction between private and public crime reduction initiatives, where only the latter can be used to implement increasing marginal penalties for crimes of greater severity. When the two types of protective activities (public and private) are strategic substitutes, an increase in private protection by some individuals or communities results not only in displacement to other venues, but also a contraction in public enforcement, and an overall increase in the severity of crime. There is excessive use of private protection in equilibrium (relative to the first-best), suggesting that private measures should be taxed, not subsidized or mandated, since they generate negative externalities.<sup>25</sup>

Private crime prevention measures can also give rise to positive external effects. One of

---

<sup>22</sup>Along similar lines, Vollaard and van Ours (2011) examine the effects of a Dutch law mandating burglar-resistant doors and windows in all new construction. They find that homes built after the mandate went into effect had significantly lower rates of burglary, with no evidence of displacement to burglary of older homes or to related property crimes.

<sup>23</sup>One such effect is that a lower theft rate reduces the deadweight loss associated with police activity. Some of these costs can be transferred to the owner in the form of fees for vehicle recovery and storage.

<sup>24</sup>For instance, a recent spike in carjackings in Newark has been attributed to the increasing use of engine immobilizers (Santora and Schwirtz, 2013).

<sup>25</sup>An even broader range of negative externalities from private protection is considered in Helsley and Strange (1999), who show that the spread of secure residential communities can shift crime to less well protected business districts and thereby reduce aggregate employment opportunities. This in turn can increase the incidence of crime.

the most striking examples of this is LoJack, a concealed device capable of transmitting radio signals to receivers. Although the costs are paid on installation by the vehicle owner, the benefits spread widely because the infrastructure for motor vehicle theft can be disrupted. Ayres and Levitt (1998) found substantial positive external effects from the installation of LoJack, with benefits exceeding costs by an order of magnitude. Even a low rate of installation is enough to generate substantial benefits since the professional thieves with high turnover are unlikely to avoid contact with an equipped vehicle for long. A crucial part of the success of the device come from the fact that no visible signs of installation are present. A strong case could be made for subsidizing such general deterrence measures so that some of the external benefits are internalized. For instance, if insurance companies are required to lower rates on LoJack equipped vehicles, they may all benefit, even though none has the incentive to unilaterally lower rates by much.

Cook and MacDonald (2011) survey the evidence of the role of private actions in crime deterrence, and present fresh evidence on the effectiveness of Business Improvement Districts (BIDs) in Los Angeles. These are public–private partnerships, allowing for levies to be placed on (even reluctant) business owners to finance security and other aspects of neighborhood enhancement. They find benefits far in excess of costs with significant declines in robbery, burglary and motor vehicle theft. The reduction in crime is not generated by an increase in arrests, and therefore does not impose additional costs on public institutions. In fact, arrests are found to decline significantly. Furthermore, there is little evidence of displacement: if anything, there are modestly positive spillover effects to immediately neighboring areas.

## 4.2 Deterrence and Selection

The idea that crime is an economic activity like any other, subject to entry and exit based on the usual considerations of benefit and cost, has some unexpected implications once offender heterogeneity is taken into account. For instance, deterrence measures that are successful in reducing the volume of crime will do so by encouraging exit, but those who exit will not be randomly drawn from the pool of current offenders. Those who remain active despite greater deterrence will be precisely those with less attractive outside options. If this attribute is correlated with others, such as desperation or a propensity to violence, then the nature of crime will change along with its magnitude.

This idea is explored by O’Flaherty and Sethi (2009a) in the context of robbery. Robberies may or may not involve victim resistance and, conditional on resistance, they may or may not involve violent attempts by offenders to force compliance. If successful deterrence results in the selective exit of those offenders who are least likely to respond to resistance

with violence, then the proportion of robberies resulting in victim injury will rise even as the overall incidence of robbery falls. This is indeed what we see in the data. Over the 12 year period 1993-2005, total robberies declined significantly according to National Crime Victimization Survey data, but robberies involving victim injury declined much less dramatically. Hence robberies became more violent even as they became less frequent. Furthermore, the likelihood of violence conditional on resistance rose sharply. There was some decline in rates of resistance, as one would expect given the great likelihood that it would be met with violence, but on this point the data are less clear cut.

### 4.3 Stereotypes

Victim resistance is itself a form of deterrence, and is taken into account by offenders as part of the process of victim selection. In their ethnographic study of active armed robbers, Wright and Decker (1997) provide some interesting anecdotal evidence on this point. While most of the offenders in their sample were black, many expressed a clear preference for white victims. This was driven by a belief that they would encounter less resistance from white victims, on account of exaggerated stereotypes about black male violence that are not shared by black victims.<sup>26</sup> Interestingly, a preference for white victims arises despite the fact that such victims are *less* likely to be carrying large amounts of cash.<sup>27</sup> It is clear that the likelihood of resistance rather than the anticipated take is the main criterion for victim selection. The lower perceived likelihood of resistance is itself understood by some offenders in the sample to arise from money being easier to come by for whites on average, and losses therefore being small relative to overall wealth.

Stereotypes of black male violence have a number of other implications. They make resistance less likely when the offender is black, and this increases the relative return to robbery.<sup>28</sup> As a result, rates of offending should exhibit greater racial disparities for crimes such as robbery, in which stereotypes are relevant, than those such as burglary or theft, in which no face-to-face interaction between victim and offender occurs (O’Flaherty and Sethi,

---

<sup>26</sup>One offender confesses: “I rob mostly whites... I usually don’t have no problem [with resistance], none at all. [Whites] got this stereotype, this myth, that a black person with a gun or knife is like Idi Amin or Hussein. And [a] person [who believes] that will do anything [you say].” In contrast: “A black person will try to grab the gun out of your hand. They will make you shoot them if you have to.” Another claims: “Whites accept the fact that they’ve been robbed... some blacks would rather die than give you they bucks and you damn near have to be killing [them] to get it” (Wright and Decker, 1997).

<sup>27</sup>One offender complains: “most white people have about two dollars on them, and credit cards, something like that.” Another echoes this sentiment: “whites, they have credit cards and checkbooks on them... they get robbed, they cancel it.” And another: “all they got is plastic and checks” (Wright and Decker, 1997).

<sup>28</sup>If whites in particular hold exaggerated stereotypes, they will resist black offenders at lower rates than black victims, making whites as a group more attractive to offenders. This could explain, in part, why robbery crosses racial boundaries far more frequently than homicide or rape.

2008). Put differently, the stereotype affects the relative returns to different categories of crime among offenders, as well as the relative attractiveness of criminal versus legal activities. As a consequence, racial disparities in arrest and incarceration should be expected even if the criminal justice system is entirely non-discriminatory.

This reasoning can help account not only for racial disparities in offending, but also in the manner in which the perceived identities of offender and victim affect the way in which a crime plays out. If lower resistance faced by black offenders causes entry into crime, the pool of offenders starts to include those with reasonably good outside options, who would have stayed out had they not been stereotyped. And if these individuals are less likely to force compliance when confronted with resistance then, other things equal, resisting a black offender should be *less* likely to result in violence than resisting a white offender, holding constant the race of the victim. This somewhat surprising prediction turns out to have empirical support (O’Flaherty and Sethi, 2008).

The broader point is that stereotypes can significantly affect interactions between victims and offenders and thereby give rise to differences across groups in the returns to crime. But this effect can only arise for crimes such as robbery, that routinely involve face-to-face contact. Stereotypes cannot come into play when the identity of an offender is unknown to the victim, as is normally the case for burglary or motor vehicle theft. As a result, racial differences in rates of offending are liable to be greater for some crimes than others and any analysis of such gaps needs to take account of the fact that crime is an aggregation of a range of highly disparate activities.

## 4.4 Segregation

Racial residential segregation is a central concern in urban economics. Despite a decline from the high water mark around 1970, black-white segregation remains pervasive, especially in the larger cities of the Northeast and Midwest.

There are three broad categories of explanation for this phenomenon in the literature: (i) segregation by race is an incidental effect of sorting by income and racial income disparities, (ii) discrimination in housing and lending markets prevents access to some neighborhoods for blacks, and (iii) preferences over neighborhood racial composition combined with decentralized uncoordinated location choice result in endogenous separation.<sup>29</sup>

---

<sup>29</sup>The first of these factors has long been recognized to be relatively unimportant as an explanation, since substantial segregation exists even within income groups; see Massey and Denton (1987), Farley and Frey (1994), and Sethi and Somanathan (2009). On discrimination the most compelling evidence comes from audit studies; see especially Yinger (1986). The literature on sorting is descended from Schelling (1971); see Sethi and Somanathan (2004) and Card et al. (2008) for relatively recent contributions.

The role of stereotypes in affecting rates of crime victimization provides an alternative, complementary explanation for racial segregation. If whites are more attractive robbery victims than otherwise identical blacks, they will exit high crime neighborhoods at greater rates, even if they are unconcerned about neighborhood racial composition and do not benefit from favorable treatment in housing or lending markets. This does not require stereotypes to be based on anything other than the income distribution of the group to which one belongs. For instance, if lower income individuals are known to resist at higher rates, and there are racial disparities in the distribution of income, then those who belong to a lower income group will be selectively avoided by potential offenders. Hence two otherwise identical individuals who belong to groups with different income distributions will face different victimization rates at any given location. As a result, conditional on own income, those who are visibly identifiable as belonging to more affluent groups will exit high crime neighborhoods more readily, giving rise to greater levels of racial segregation than would otherwise be observed (O’Flaherty and Sethi, 2007).<sup>30</sup>

This reasoning helps explain why those who are more attractive victims at any given location might have lower victimization rates in the aggregate. Furthermore, it suggests that racial disparities in victimization rates will be greatest at intermediate income levels, at which individuals are affluent enough to contemplate a move to a safer location but can be induced to stay by a somewhat lower victimization rate.

The idea that racial disparities in crime victimization at a given location can give rise to disparities in willingness to pay to move to a safer location has implications for group differences in savings rates. In the United States, black-white differences in wealth far exceed differences in income (Blau and Graham, 1990; Oliver and Shapiro, 1995), and it has been argued that a significant portion of this sustained disparity stems from differences in rates of saving out of current income (Altonji and Doraszelski, 2005). If whites outbid blacks for housing in safer locations (on account of being selectively targeted where crime is high), they will exhibit lower levels of non-housing consumption out of current income. Equivalently, they will exhibit higher levels of personal saving and wealth accumulation because housing is both a consumption and an investment good.<sup>31</sup>

---

<sup>30</sup>Verdier and Zenou (2004) propose an alternative theory of segregation in which stereotypes and crime play a central role. In their model employers in a central business district set wages based on employee race and location, with lower wages for those who live further away and those who are believed to belong to a group in which criminal offending is more common. Even with *ex ante* identical groups, beliefs about a higher incidence of offending among blacks can be self-fulfilling because those who are stereotyped in this way have less to gain from employment and choose to live at lower rent locations distant from the business district. This lowers the opportunity costs of engaging in crime and results in greater rates of offending.

<sup>31</sup>This effect would arise if, conditional on income, whites outbid blacks to live in more expensive neighborhoods for any reason at all. Cutler et al. (1999) argue that this has been a consistent pattern in residential choices since around 1970, and Sethi and Somanathan (2004) show that this outcome is predicted in a model

## 4.5 Peer Effects and Strategic Complementarity

Glaeser et al. (1996) argue that the incidence of crime is too variable across time and space to be explained by fundamentals alone. They argue for the importance of local peer-effects, arising from the ability of individuals to influence their social neighbors. This can add an additional source of variation across locations, so that otherwise identical cities and neighborhoods could have very different crime rates. It can also add volatility to the time series associated with a given location, in excess of any volatility arising from fluctuations in fundamentals.

Schrag and Scotchmer (1997) also discuss a number of pathways through which a rise in offending by some portion of the population results in increased incentives for others to offend. They point out that the incentives to offend depend on the payoffs of criminal behavior relative to that of innocence, and that greater crime rates can increase the former while reducing the latter. For instance, with a fixed enforcement budget, the likelihood of arrest if guilty can decline even as the likelihood of arrest if innocent falls. Similar effects arise in jury deliberations: high crime rates overall can result in greater rates of error in the determination of guilt. These are instances of *strategic complementarity*—greater offending by some makes offending more appealing to others—and this commonly gives rise to multiple equilibrium crime rates for a given set of fundamentals.<sup>32</sup>

In the simplest version of the Glaeser et al. (1996) model, individuals are arrayed in a (social) circle and are of three types. The first two types are not subject to social influence, and either always commit crime or never does so. The third type is subject to peer influence, and simply imitates the behavior of her neighbor on the left. Any given distribution of types in the population is consistent with multiple levels of crime depending on how individuals happen to be arrayed in social space. If all those who commit crime independently of peer effects happen to be adjacent, and this string of individuals is bordered on the right by an individual who is not subject to peer influence, then crime will be at the lowest level consistent with the type distribution. But if all those subject to peer influence are adjacent to each other, and this string is bordered on the left by one who commits crime regardless, the crime rate will be maximal. These are extreme possibilities, and a variety of intermediate cases can easily be imagined. Interaction effects introduce a non-fundamental source of

---

of equilibrium sorting when individuals care about both the mean income and the racial composition of their neighborhoods. Charles et al. (2009) provide an alternative and complementary theory of the racial savings gap, based on the idea that individuals use conspicuous consumption to signal that they have high incomes. The incentives to do so are greatest for those belonging to lower income groups.

<sup>32</sup>Strategic complementarity can also be a feature of victim behavior. Helsley and Strange (1999) show how gated communities can “spread like a contagion” since their increased prevalence concentrates crime outside their boundaries, and strengthens incentives for more and more households to seek better protection.

variability across space and time, and this effect is strongest when a large proportion of the population is subject to peer influence.

Conversely, volatility in crime rates relative to fundamentals can be interpreted as a measure of the strength of peer effects for particular crimes. Glaeser et al. (1996) are interested in estimating the size of the non-fundamental variability, interpreted as the strength of social interactions, for various crimes. They find extremely high levels of social interaction for robbery, assault, burglary, auto theft and larceny, but much smaller effects for murder, forcible rape and arson.

In interpreting these findings, it is important to keep in mind that homicide, forcible rape and arson are extremely rare relative to the other crimes considered. For instance, there are over 4000 larcenies per 100,000 persons in the 1986 cross-city data used by the authors but fewer than 9 homicides. Most individuals never seriously contemplate committing homicide, and we suspect that among potential homicide offenders, a very small number are certain to kill.

In fact, there is one mechanism unique to homicide among major crimes that would suggest high levels of strategic complementarity, and thus variability across time and space: preemption. Murder can be motivated by fear of being killed, and this fear is itself related to the background homicide rate. The logic of this argument was brilliantly described by Thomas Schelling in his 1960 classic *The Strategy of Conflict* as follows:<sup>33</sup>

If I go downstairs to investigate a noise at night, with a gun in my hand, and find myself face to face with a burglar who has a gun in his hand, there is a danger of an outcome that neither of us desires. Even if he prefers to just leave quietly, and I wish him to, there is danger that he may think I want to shoot, and shoot first. Worse, there is danger that he may think that I think he wants to shoot. Or he may think that I think he thinks I want to shoot. And so on. “Self-Defense” is ambiguous, when one is only trying to preclude being shot in self-defense.

This effect helps account for the substantial variability in homicide rates across time and space. For instance the homicide rate in Newark doubled over the 2000-2006 period while the national rate remained essentially unchanged. Many of these killings were traced to escalating disputes between acquaintances often over seemingly trivial matters (O’Flaherty and Sethi, 2010c).<sup>34</sup> In an environment where killing is common, the possibility of escalation

---

<sup>33</sup>See Baliga and Sjöström (2004) for a formalization of this idea, and a demonstration that cheap talk can substantially mitigate the problem.

<sup>34</sup>This pattern arises quite generally: “About half of all homicide victims are murdered by neither intimate family members nor total strangers, but rather by people with some kind of pre-existing relationship: friends, neighbors, casual acquaintances, workplace associates, associates in illegal activities, or members of their own or a rival gang” (Reiss and Roth, 1993, p. 78).

to homicide is salient, and the preemptive motive for killing looms large. But this itself contributes to a climate of fear and can cause murder rates to remain stubbornly high. Small reductions in homicide may be very hard to attain under such circumstances, but large reductions are not impossible. An effective policy to reduce homicide requires a coordinated shift in expectations, something akin to a truce in a war zone.<sup>35</sup>

“Climate” and “environment” in this model are often spatial. As in war, location often signals the type of behavior that can be expected. Just as behavioral expectations in bars differ from those in libraries, neighborhoods with a high prevalence of crime generate different expectations from those in which crime has historically been infrequent.

This reasoning also helps account for the very high rates of homicide victimization and offending among young black males. The preemptive motive for killing is operational in the presence of fear, and this depends not only on the homicide rate in the local environment but also on the observable characteristics of individuals engaged in a dispute. Those who are feared are more likely to be killed preemptively, and this can induce them to also take preemptive action, in a cascading cycle (O’Flaherty and Sethi, 2010d). These effects are especially stark when both parties to a dispute have reason to fear. Ironically, a criminal justice system that treats offenders lightly if their victims are black will also induce those potential victims to become homicide offenders. Those who fear for their lives will be induced to kill, and those who are feared will be more likely to be killed preemptively.

Along similar lines, Grosjean (2014) shows that areas of the United States that were originally settled by Scots and Scots-Irish have higher rates of acquaintance murder among white males. She attributes this to a “herding culture” that these settlers brought with them, in which a reputation for toughness was needed to prevent theft of one’s livelihood. The culture of honor served as a substitute for legal dispute resolution mechanisms in the South, while having no such effect in the North, where formal institutions were stronger. Although she does not explicitly mention this, it seems plausible that preemptive killing was an amplifying factor in this environment.

## 4.6 The Castle Doctrine and Stand-Your-Ground Laws

These considerations have implications for the effects of stand-your-ground laws, which allow individuals to legally kill others when under threat, even if an opportunity to retreat to safety is available. The Castle Doctrine refers to the principle that one does not have an obligation

---

<sup>35</sup>Formally, the shift needs to be large enough to allow for coordination on a different equilibrium with lower rates of killing. As in Schrag and Scotchmer (1997) and Glaeser et al. (1996), this model can have multiple equilibria. More generally, models of strategic complementarity exhibit an amplified response to any shift in fundamentals—a multiplier effect—even when equilibrium is unique.

to retreat in one’s own home (or “castle”), and stand-your-ground laws extend the principle to other locations at which one has a legal right to be present. Florida’s 2005 stand-your-ground law was one of the earliest examples of this, and more than twenty other states have subsequently enacted similar legislation.

By broadening the range of circumstances under which killing is treated as justifiable by the legal system, such laws make threatened individuals more dangerous and hence also more likely to be killed preemptively. The effect is strong enough to show up in empirical tests. Cheng and Hoekstra (2012) group states into those that adopted stand-your-ground laws and those that did not, and examine within-state changes in homicide rates and other outcomes across the two groups of states. They find that the laws fail to have the intended effect of deterring burglary, robbery, and aggravated assault. They do, however, have an unintended effect: they increase murder rates by an amount that is both quantitatively and statistically significant. These are not killings in self-defense, which would be classified as justifiable homicide and not murder. This is consistent with the preemption story.

McClellan and Tekin (2012) use a different data source (U.S. Vital Statistics rather than the Uniform Crime Reports) and also find significant effects on homicides in states adopting these laws. But the effect arises only for whites, and is especially strong for white males.

## 4.7 Police Stops

Consider a police force that wants to prevent crime by incapacitating the people most likely to commit crime shortly before they do so. (This is the forward-looking sort of goal we considered in Section 2, not the backward-looking goal we considered in Section 3.) It will try to predict who will commit crime, and use all the information at its disposal to do so.

For most crimes, the group of offenders is very far from being a representative sample of the population at large. As a result, a police force that was completely unconstrained in its use of diagnostic or preventive stops would have an incentive to engage in widespread profiling. That is, it would direct officers to use perceived racial and ethnic affiliation, in addition to such criteria as age and gender, in determining which individuals to detain.

Racial profiling by law enforcement agencies has attracted considerable attention since the 1990s, in the wake of some high profile lawsuits.<sup>36</sup> The earliest of these were responses to motor vehicle stops and searches on major highways, which appeared to target blacks and Latinos at rates that were two to three times as large as their share in the population of drivers (United States General Accounting Office, 2000). More recently, stop-and-frisk operations on city streets have come under similar scrutiny. The NYPD engaged in over four

---

<sup>36</sup>See *Wilkins et al. v. Maryland State Police* (1995), *Chavez v. Illinois State Police* (1998), and *Floyd v. City of New York* (2013) for prominent examples.

million stops and interrogations over the period 2002–2012, at an annual rate of more than half a million since 2006.<sup>37</sup> Blacks were over nine times as likely as whites to be stopped (Fagan, 2010), and only 0.15 percent of stops—15 out of 10,000—resulted in the confiscation of firearms.

One question that has received attention in the literature is whether the striking disparity across groups in rates of detention reflects optimizing behavior on the part of police, motivated by the maximization of arrest or contraband recovery rates, or whether it also reflects biased targeting of specific groups in excess of levels warranted by race-neutral criteria. In an influential paper, Knowles et al. (2001) developed a model with the property that equilibrium behavior on the part of police and motorists, in the absence of any racial animus, would imply equality across groups in the rates of contraband discovery. By this logic, differences in “hit rates” across groups are evidence of racial bias as an independent factor affecting stops, with groups that are victims of bias having lower hit rates. Applying this test to data on vehicle stops on I-95 by the Maryland State Police, Knowles et al. (2001) find no evidence of discrimination against black (relative to white) motorists, but do find that Latino drivers are victims of bias. Sanga (2009) extends this analysis to Maryland other than I-95, and finds that on these roads the Maryland State Police discriminate against both blacks and Latinos.

The hit rate test is simple and easily implemented, but not without shortcomings. The logic of optimization (for incapacitation) by police clearly implies equality in *marginal* hit rates across groups (Becker, 1957; Ayres, 2001). That is, the hit rates for motorists in each group whose other observable characteristics barely meet the threshold for a stop should be virtually identical, otherwise a shift towards a group with a higher hit rate would result in increased detection of criminal activity. But these marginal motorists (or pedestrians) are hard to identify from the data. The equality of *average* hit rates implied by the Knowles et al. (2001) model is derived on the basis of more stringent assumptions. In particular, the authors assume that observable characteristics are independent of whether or not an individual has actually chosen to carry contraband. There can be no outward signs of guilt conditional on being guilty. But this means that for any given set of characteristics (young black males for example, or female drivers in luxury cars), the set of vehicles searched and those not searched are equally likely to be carrying contraband. In equilibrium, each individual chooses a likelihood of criminal activity that is calibrated to leave police indifferent between searching and not searching, given that individual’s set of characteristics.

Dharmapala and Ross (2004) show that the hit rate result is very fragile. Minor per-

---

<sup>37</sup>Summary statistics by year have been posed by the NYCLU at <http://www.nyclu.org/content/stop-and-frisk-data>. The policy is formally known as stop-question-and-frisk.

turbations of the underlying assumptions can show that the I-95 data are consistent with discrimination against minorities, or with no discrimination, or with reverse discrimination.

As noted by Bjerck (2007), this indifference property of equilibrium is both empirically unappealing and implies that the police stops are unlawful. In particular, they violate the requirement that there be “reasonable suspicion” based on “specific and articulable facts” at the individual level.<sup>38</sup> This is a more permissive standard than probable cause but still requires suspicion at the individual level and thus operates as a constraint on police action. The constitution does not permit stops based solely on characteristics that are unaffected by the decision to break the law.<sup>39</sup> But allowing for such outward signs makes the hit rate test invalid as a tool for the detection of bias.

Alternative models of profiling have been proposed by Anwar and Fang (2006) and Bjerck (2007), who allow for signals that can be used as a basis for reasonable suspicion. Anwar and Fang assume that in addition to race, officers observe a noisy signal that is informative of guilt in the sense that, holding constant all other characteristics, higher values of the signal imply a greater likelihood that contraband will be discovered by a search. The signal distributions may differ across groups, which provides a rationale for statistical discrimination even in the absence of any racial bias. Holding constant the identity of the officer, the costs of search may be sensitive to the identity of the individual detained; heterogeneity in these costs is interpreted as racial bias. As in Knowles et al. (2001), officers are assumed to value the successful detection of contraband, and maximize their payoffs net of search costs. This requires setting a signal thresholds for each group such that search occurs if and only if the signal of guilt exceeds the prescribed threshold value.<sup>40</sup>

In this model, equality of average hit rates neither implies nor is implied by the absence of racial prejudice. What the model does predict is that in the absence of prejudice, the rank order of hit rates across groups should not depend on the group to which the trooper belongs. Using data from the Florida State Highway Patrol, including information on the groups to which individual troopers belong, they are unable to reject the null hypothesis of the absence of prejudice. They recognize, however, that their test has low power and that their findings should accordingly be interpreted with caution. Furthermore, they find significant heterogeneity across groups of troopers in their costs of search, and also report

---

<sup>38</sup> *Terry v. Ohio*, 392 U.S. 1 (1968).

<sup>39</sup>For instance, officers who detain pedestrians under the NYPD stop-and-frisk program must fill out form UF-250, which requires them to indicate the basis for reasonable suspicion. This can include the possession of certain objects (such as a slim jim or pry bar) or actions indicative of casing victims or locations.

<sup>40</sup>The Bjerck (2007) model has a similar structure, and also yields the conclusion that pure statistical discrimination does not imply equality in average hit rates. The two papers differ less on the theory than on the use to which it is put. Anwar and Fang conduct an empirical test, while Bjerck examines theoretically the manner in which enforcement of a colorblind policy is likely to affect the level of crime.

that an application of the hit rate test to their data would lead to the conclusion that troopers were biased against black and (especially) Latino motorists.

Despite the shortcomings noted above, the hit rate test is simple, versatile, and widely used. The NYPD stop-and-frisk data reveals greater hit rates for whites relative to blacks and Latinos, both for weapons possession and other contraband such as drugs. Gelman et al. (2007) have used this to argue that the policy is implemented in a discriminatory manner: a resource shift with increased detention of whites and reduced attention to blacks and Latinos should increase the recovery of weapons and contraband. This interpretation has been called into question by Coviello and Persico (2013), who argue that there is considerable heterogeneity across police precincts in hit rates, and this alone can give rise to disparities in aggregate data even if hit rates *within* precincts are identical across groups. For instance, if precincts with low hit rates (for whatever reason) were also those with the greatest incidence of black and Latino stops, the aggregate data could exhibit a disparity in arrest rates by group even if no individual precinct did so. The authors find that controlling for this factor by allowing for precinct-level fixed effects reverses the conclusions from the aggregate data: arrest rates for whites are modestly lower relative to those for blacks and Latinos. They recognize, however, that this could be due to discriminatory allocation of resources across precincts.<sup>41</sup>

The question of whether police stops are motivated by pure statistical discrimination or also involve racial bias is important from a legal perspective, but even statistical discrimination that meets legal constraints can impose significant costs on innocents who belong to groups with high rates of offending. The distress experienced by an individual who believes that he has been subjected to a humiliating and invasive search on the basis of racial or ethnic markers must be taken into account in any welfare analysis. Since these costs could be substantially mitigated by a policy that is credibly colorblind, it is important to consider the question of whether and to what extent colorblind policing policies would result in greater crime.

Bjerk (2007) and Harcourt (2006) argue that the effect of statistical discrimination on crime is theoretically ambiguous: a shift to a colorblind policy, under certain conditions, could even reduce overall crime. This is because maximizing the likelihood of catching those who are engaged in criminal activity does not take into account deterrence effects that could affect the overall incidence of crime. Any shift in targeting will make crime more lucrative

---

<sup>41</sup>Furthermore, if the issue of a summons (rather than an arrest) is used as the action for which a hit rate is computed, then the hit rate for blacks and Latinos is found to be lower than for whites, consistent with the aggregate data. One possible interpretation of this finding is that conditional on a violation being detected, there is a disparity in response, with whites being more likely to receive a summons rather than to face an arrest.

for groups on which pressure is eased, and less appealing to others. If the former are small as a proportion of the total population, or relatively unresponsive to incentives, while the latter are more numerous or more responsive to incentives, then the overall incidence of crime could drop. In addition, if the likelihood of detection is small, stops will have limited deterrence value no matter how they are distributed across target groups, and a transition to a colorblind policy will not have large effects on the incidence of crime.

The effect of statistical discrimination on the volume of crime is not just theoretically ambiguous, it is also empirically hard to identify. Isolating the effects of a single police practice is in general very challenging because a whole range of tactics are often implemented simultaneously as part of an overall strategy. Even if the strategy as a whole succeeds, identifying the separate effects of its constituent parts is often difficult. New York City experienced a dramatic decline in crime over the two decade period starting in 1990, while implementing a wide variety of police initiatives including the targeting of hot spots, dismantling of public drug markets, use of the CompStat system for mapping and statistical analysis, gun recovery programs, stop-and-frisk policies, and low tolerance for minor “quality-of-life” crimes. There was also a substantial increase in the size of the force in the early part of the period. In a comprehensive analysis of the evidence, Zimring (2011) concludes that the targeting of hot spots and drug markets was highly effective, while CompStat, gun recovery programs, and increased manpower were also probably important contributors to the crime decline. He finds no evidence to support the claim that stop-and-frisk policies played a major role.<sup>42</sup>

If true, this is an important point because statistical discrimination can have significant welfare effects. Bearing in mind the fact that the overwhelming majority of stops result in no evidence of wrongdoing, the impact on the innocent is an important consideration. Here it matters a great deal whether targeted persons believe that they have been stopped based on a reasonable suspicion at the individual level, or simply because they happen to fit a particular demographic profile. If the only goal of the policy were to reduce the incidence of crime to the lowest level consistent with the resources at hand, then equalization of arrest rates across groups may be a suitable measure of success. However, if equalization of arrest rates requires the use of demographic information on race and ethnicity by police, then substantial welfare cost may be imposed on members of particular groups.

This cost must be accounted for in any welfare analysis of the policy. It is not the condition of being stopped that is most irksome to an individual in a heavily targeted group, it is the realization that they have been targeted for no reason other than their group member-

---

<sup>42</sup>In addition, Zimring argues that the New York crime decline cannot be attributed to “broken windows” policing because this policy was never really tried. In particular, he maintains that statutes against prostitution and gambling were not consistently enforced, and there were sharp declines in arrest rates for non-drug quality of life offenses. There is also limited support from other cities for the effectiveness of this strategy.

ship. In his commentary on the killing of Trayvon Martin, Blow (2013) made the point as follows: “The idea of universal suspicion without individual evidence is what Americans find abhorrent and what black men in America must constantly fight. It is pervasive in policing policies—like stop-and-frisk, and in this case neighborhood watch—regardless of the collateral damage done to the majority of innocents.” No welfare analysis that fails to account for this collateral damage can claim to be complete.

Even when racial profiling is effective in reducing crime the costs incurred by the innocent who are profiled must be taken into account. Since these costs are not internalized by police, the scale of the activity is likely to be inefficiently high. Direct compensation to the innocent is not feasible for several reasons. It would create incentives to act in ways that invite stops, thus eroding the informativeness of suspicious behavior. Corruption could be encouraged if friends are stopped as a favor. And unless compensation is contingent on race or ethnicity, it would not result in the internalization of identity-specific costs of public humiliation.<sup>43</sup>

## 5 Incarceration

Incarcerating someone tomorrow who has committed a serious crime, is likely to commit more crimes tomorrow, and who will commit fewer crimes after he is released because of his experience while incarcerated serves many purposes. Retribution is gained because bad deeds have been punished. Deterrence occurs because punishment follows crime. Incapacitation results because prisoners usually cannot commit crimes against non-prisoners. And rehabilitation happens because future personalities are altered. Incarceration appears to be an all-purpose answer to many different questions.

But like a vacuum cleaner that also plays music and mixes fruit smoothies, or (to use a more common economics example) a jack of all trades who is master of none, incarceration may not do any of these four jobs well because there are inherent conflicts among them. The major conflict is between deterrence and incapacitation; deterrence is backward-looking and asks what crimes someone has committed, incapacitation is forward-looking and asks what crimes someone will commit. The optimal incarceration strategy for deterrence is unlikely to be the optimal incarceration strategy for incapacitation, and vice versa. This is the same

---

<sup>43</sup>Some degree of cost internalization can arise through media exposure and legal recourse, both of which have played prominent roles in the debate over stop-and-frisk tactics. The importance of *voice* as a means of improving organizational performance was stressed by Hirschman (1970), and media pressure has had a major impact on the investigation and prosecution of a number of high profile murder cases in India (O’Flaherty and Sethi, 2009b). But public pressure in response to especially heinous crimes can also lead to coerced confessions and wrongful convictions, as in the 1989 case of the Central Park Jogger, where five juvenile defendants served out lengthy terms before having their convictions vacated in 2002 (McFadden and Saulny, 2002).

issue that arose with police stops, and Harcourt (2006) presents a unified treatment.

Since incarceration deprives people of rights and freedoms they normally enjoy, it is supposed to be reserved for those who have already committed serious crimes; retribution and deterrence by law and tradition are supposed to trump incapacitation and rehabilitation, at least at the jailhouse door. But forward-looking considerations enter into parole, bail, probation and sentencing decisions, often through the use of formal risk assessment tools; for a history and discussion, see Harcourt (2006, Chapters 2-3).

In this section we will focus on incapacitation effects, since we have already discussed deterrence and economists rarely write about retribution. We will also say a little bit about rehabilitation. Because the goal of incapacitation is to alter the distribution of criminogenic characteristics in the non-incarcerated population, it is like the policies we discussed in Section 2. Accordingly, we must ask both about the weak claim—do incarcerated people commit fewer crimes than otherwise identical people who are not incarcerated?— and the strong—does more incarceration cause less crime?

We will also be concerned about how mass incarceration affects the neighborhoods prisoners leave and return to.

## 5.1 Accounting for Trends

The incarceration rate in the U.S. at the beginning of the 21st century was extraordinarily high in two respects: it was higher than it had ever been in U.S. history, and it was far higher than the incarceration rates in other developed countries.<sup>44</sup> Males, African Americans, and, to a lesser extent, Hispanics are disproportionately incarcerated.<sup>45</sup>

The rise in incarceration since 1980 is often attributed primarily to drug enforcement, but this is not accurate in any accounting sense. The number of people incarcerated on drug charges rose from 41,000 in 1980 to about 539,000 in 2008—an enormous increase, but still only about 30% of the total rise in incarceration over this time period (the fraction of population-adjusted rise would be somewhat greater).<sup>46</sup>

---

<sup>44</sup>Before the late 1970s, the rate was stable for many years at less than 200 per 100,000 (Raphael and Stoll, 2009a, pp. 3-4). At peak, in 2009, 756 out of 100,000 residents in the U.S. were incarcerated in adult facilities, including federal and state prisons and local jails (Glaze, 2010, Appendix, Table 2). Among developed countries, only Russia at between 500 and 600 per 100,000 approaches the U.S. rate; rich countries like Great Britain (153), Norway (73), France (96), Germany (85), Japan (58), and Canada (117) all incarcerate far fewer people (International Centre for Prison Studies, 2011, data for 2008-2011).

<sup>45</sup>In 2008, the incarceration rate for African American men overall was about 4640 per 100,000 and for Hispanic men, about 1650. For African American men aged 30-34, the imprisonment rate was 8032, and the overall incarceration rate, including jails, was probably over 11,000.

<sup>46</sup>Drug incarceration numbers for 1980 come from The Sentencing Project (2011). For 2008, drug offenders in state and federal prisons come from the Bureau of Justice Statistics, 2008, Tables 6.001 and 6.57 respectively. For jail inmates, we used the total number from Glaze (2010) and the 2004 proportion of drug

However, drug sentences are shorter than other sentences and so drug prisoners represent a higher proportion of those admitted and released from prison than of those in prison at any point in time. For instance, about 45% of state prison admissions are for drug offenses, although only about a fifth of state inmates are being held for these offenses (Raphael and Stoll, 2009b). When we look at the stock of former prisoners, drug incarceration weighs much more heavily than if we look at the stock of current inmates.<sup>47</sup>

Why, then, did U.S. incarceration grow so tremendously between 1980 and 2008? Raphael and Stoll (2009b) decompose the changes in state prison population—the largest component of incarceration—between 1984 and 2002, using a model in which individuals can transition between four states: free, incarcerated after committing a crime, on parole, or incarcerated following parole revocation. In the steady state of their model, the odds of being in prison depend on the crime rate and the certainty and severity of punishment. Each of these variables depends partly on private and partly on government actions. The crime rate depends on potential offenders and potential victims, both private parties usually, but obviously governments can do many things to influence the crime rate. The certainty of punishment depends on government efforts to apprehend and convict criminals, but also on the efforts of offenders to avert detection and capture, as well as the willingness of victims and witnesses to help authorities. Average time served depends on the government’s sentencing rules and guidelines, parole policies (for both granting and revoking), and efforts to enforce parole conditions, but also on the willingness of prisoners and parolees to abide by the rules imposed on them.<sup>48</sup>

Raphael and Stoll (2009b) compare implicit steady states of their model; since half the prison population turns over in a year they argue that steady states provide a reasonable approximation to a long-term process. Between 1984 and 2002, they find slight decreases in most crimes (per capita). The crime rate is clearly not the major reason why state prison population grew.

Prison admissions per crime rose for assault and for rape, but were steady for most other crimes. Drug admissions per capita, however, rose five-fold, and a large portion of this increase (or all of it) was due to a rise in admissions per “crime.” How much, of course, depends on the definition and measurement of drug crimes.

Expected time served before parole rose by about a third for most crimes, but more for

---

offenders in the jail population from the Bureau of Justice Statistics, 2004, Table 6.19.

<sup>47</sup>We are grateful to Steve Raphael for this observation.

<sup>48</sup>This model makes clear that there is no simple mapping from government policies to incapacitation, either in the aggregate or for groups. A harsh government might have a large prison system—because prisoners serve long sentences—or a small one—because everyone is afraid to commit crimes or no one is willing to cooperate and testify. A lax government could have many prisoners because many crimes are committed, or few prisoners because prison stays are short and few people are sent to prison.

Table 1: **Sources of Growth of Per Capita State Prison Population, 1984-2002**  
Proportion of total increase in steady state population per capita

All sources	100.0%	
Index and other non-drug crimes	38.0%	
Greater expected time		17.8%
Other changes		20.2%
Drug crimes	28.8%	
Greater expected time		1.6%
Other changes		27.2%
Parole violators	33.2%	
Greater expected time		1.3%
More prisoners		10.4%
Other changes		21.5%

Source: Raphael and Stoll (2009b) and authors' calculations. See text.

larceny and rape. (Because admissions for less serious crimes rose more than admissions for more serious crimes, average sentences did not increase.) A major change in severity, however, came from parole. Between 1980 and 2003 the proportion of parolees returned to custody per year rose from 13% to 29%. The average time served after returning from parole also rose about 13%.

With three factors for each crime and three categories of crime, no decomposition of the change in steady state prison population is going to be unique or natural. Raphael and Stoll include drug crimes with the other crimes, and do a separate analysis of parole. Because we wanted to look at drugs separately, we undertook a different decomposition using their Tables 2.2 and 2.3. This decomposition is shown in our Table 1.

Of the increase of 272 per 100,000 in state prison population, roughly equal parts were due to more index crime offenders (mainly for rape, assault, and burglary), more drug offenders, and more parole violators, with index crime offenders being most numerous. The increase in simple time served is responsible for about half of the index crime increase, but very little of the drug or parole increases. (This was calculated by increasing the time served to the 2002 level, but holding admissions per crime and crimes per capita at their 1984 levels). Raphael and Stoll (2009b, Chapter 4) find that the increase in time served was largely due to policy change, like mandatory minima and truth-in-sentencing laws.

The increase in prison admissions per crime was a somewhat larger driver of the increase in index crime prisoners. Prison admissions per crime could rise because of more effective police work, because probation was used less often, or because criminals worked in larger groups. Raphael and Stoll (2013, Chapter 2) show that the increase in admissions per crime for index offenders (for a slightly different period) is due almost entirely to an increase in

prison admissions per arrest. The change in crime by itself would have reduced the number of index crime prisoners; in an analysis not shown, we found that changing crime per capita to its 2002 level but keeping time served and admissions per crime at their 1984 levels would have decreased 1984 index crime prisoners per capita by about 13%.

Why were there more parole violators in prison? Part of the reason is more parolees, and part of the reason for more parolees is more prisoners. We made a crude attempt to correct for this (much less sophisticated than that made by Raphael and Stoll) by asking what the admission rate for parole violation would have been if it had increased at the same rate as the non-parole prison population. About a third of the increase in parole violators is due to the expansion of the prison system; the majority is due to a greater rate of parole revocation.

So the detailed picture is complicated. The leading causes of the prison increase are more drug admissions, more admissions per arrest for index crimes, longer time served for index crimes, and a higher rate of parole revocation. Index crime went down, but prison population grew along a number of other margins. But, the basic picture is simple; policy changes made the state prison system more punitive.

To our knowledge, no similar analysis have been published for jails. The story for the federal prison system is similar: it grew because of policy changes (Raphael and Stoll, 2013). The federal system, although smaller, grew faster than the state systems: between 1980 and 2010 the number of federal inmates per 100,000 population rose from 11 to 67. Most of this increase came from drug inmates: the proportion of federal prisoners being held on drug charges rose from 28% in 1974 to 55% in 2004. The proportion being held on weapons and immigration charges also rose, while the proportion held for property crimes and fraud fell.

The rate of admissions per year per 100,000 more or less doubled, and the average stay tripled, to produce six-fold population increase. The rate of arrests for drug, weapons, and immigration grew substantially, and so did prisons admissions per arrest. The growth in admissions reflects not just policy changes; the number of federal crimes grew, and many issues that state courts handled before moved to federal courts. The same sort of policy changes that raised state sentences also drove the increase in federal sentences. (The federal prison system does not have parole.)

## 5.2 Empirical Evidence on Incapacitation

Several different strands of research have tried to assess the effect of incarceration—primarily state imprisonment—on index crime. In Section 3.2 we have already surveyed the literature on deterrent effects. For incapacitation, separate strands look at the weak claim and the strong claim. A final group of papers dealing with the strong claim examine the combined

effects of deterrence and incapacitation directly, without trying to separate the two stories.

Even though around three-quarters of a million people are in jail on an average night, and around 12 million people a year spend at least one night in jail (Minton, 2012), very little is known about how jail affects crime or human capital.

### 5.2.1 The Weak Claim of Incapacitation

The simplest studies ask prisoners how many crimes a year they used to commit before they went to prison. Inmate surveys of this type give answers that cluster around 16 to 20 index crimes per year of imprisonment (Bushway and Paternoster, 2009). The implicit counterfactual is that had they not been imprisoned, prisoners would have continued behaving in the way that they behaved in the last year before they were imprisoned. Studies using matched samples produce estimates about half this size.

The only natural experiment on this question was studied by Owens (2009). In Maryland in 2001, sentencing guidelines on the use of juvenile arrest information changed in such a way that sentences for certain 23-25 year olds became shorter. Her estimate is that the average prisoner in the affected group would have committed 1.5 more index crimes per year.

Bushway and Paternoster (2009) point out that these disparate estimates are not necessarily inconsistent, since the studies were measuring different things. The inmate surveys date from before the large rise in incarceration and so plausibly prisoners in that era were more elite and dangerous.<sup>49</sup> The group that Owens studied, young prisoners for whom juvenile arrest information mattered, may also have been unrepresentative. The incapacitation effect of prison depends on who is being incapacitated.

### 5.2.2 The Strong Claim of Incapacitation

Because separating incapacitation from deterrence is usually hard, only a few papers have tried to estimate the effect of prison on crime through incapacitation.

Buonanno and Raphael (2013) is probably the strongest paper showing an incapacitation effect on crime. They look at the 2006 Italian collective pardon that released a large number of prisoners unexpectedly. This shock increased crime (primarily theft) at a rate of about 20 crimes per released prisoner per year. (They net out the small deterrence effect from enhanced sentences for some released inmates that Drago et al. (2009) studied; see Section 3.2.2.) Barbarino and Mastrobuoni (2014) find similar size effects from incapacitation when they study earlier collective pardons in Italy. Notice that we have no information on who

---

<sup>49</sup>This is not necessarily true. If, for instance, incarceration rose because all sentences were doubled, the characteristics of the average prisoner would not have changed. But Section 5.1 shows that part of the reason for greater imprisonment is more admissions, particularly for less serious crimes.

committed these 20 additional crimes; we know only that they occurred. The released prisoners could have been victims; they could have committed more than this but squeezed out other offenders; they could have committed fewer than this but spread crime like a contagion.

Provinces with smaller initial inmate populations experienced larger increases in crime per released inmate, a finding consistent with diminishing marginal returns from incapacitation. Johnson and Raphael (2012) also find diminishing marginal returns from incapacitation between American states, but with a more complex identification strategy. Liedka et al. (2006) find the crime-prison elasticity falling to zero with an incarceration rate between 325 and 425 per 100,000. Diminishing marginal returns imply that crimes per prisoner released in Italy, which had an incarceration below 100 per 100,000 population after the collective clemency, are likely to be greater than crimes per prisoner in the early 21st century U.S.

Vollaard (2013) also looked at a natural experiment in a jurisdiction with a low rate of imprisonment. In the early 2000s, the Netherlands introduced an enhanced sentencing policy for habitual offenders—individuals with more than 10 prior convictions. For these offenders, sentences for burglary and other property crime rose from about two months on average to about two years. Most of the individuals affected were older drug users; the average number of prior convictions for the affected group was over 30. Vollaard used variation across cities in the phase-in of the law—plausibly exogenous—to estimate large decreases in property crime (the affected offenders engaged in very little violent crime before the policy was implemented). He finds sharply diminishing returns. He does not, however, try to determine how much of the crime reduction is due to deterrence rather than incapacitation.

Levitt (1996) uses prison overcrowding litigation as an instrument for decreases in state prison population. If this litigation does not affect potential offenders not in prison—for instance, because they do not know about it—but does affect prosecutors, judges, and parole boards, then the effect measured should be purely one of incapacitation. Levitt finds a reduction of 15 index crimes per year of imprisonment, and an elasticity of 0.4 for violent crime, 0.3 for property crime. The crimes per prison-year estimate is around that found in the inmate surveys. Considerable debate about Levitt’s instruments has followed this paper (Durlauf and Nagin, 2011, p. 52). For instance, if prison overcrowding litigation reduces overcrowding, then prisons will be less unpleasant, and potential offenders may learn this from contacts in prison, whether they know about the litigation or not.

Kuziemko and Levitt (2004) estimate incapacitation effects for a specific group of prisoners, those sentenced for drug offenses. They show that imprisoning drug offenders has a sizable effect on violent and property crime—about as big as the effect of imprisoning violent and property criminals. Since imprisoning drug offenders should not deter violent and

property crime, and since increases in violent and property crime do not tautologically lead to greater imprisonment for drug crime, these estimates are plausibly incapacitation effects. But some questions remain. Perhaps greater drug imprisonment is caused by more police; then violent and property crime should be deterred by the same thing that is causing greater drug imprisonment. Moreover, Kuziemko and Levitt show that drug imprisonments lead to higher drug prices, and higher drug prices probably reduce demand. If the volume of drug use falls, the violent and property crime that surrounds illicit drug use may fall too. So the Kuziemko-Levitt estimates cannot be interpreted as pure incapacitation effects.

The coincidence between the Levitt (1996) estimate of the effect of prison-years on crime and inmate survey results for the weak claim makes it tempting to argue that the weak claim implies the strong: crime goes down by the number of crimes prisoners would have committed. Bushway and Paternoster (2009), for instance, cite the literature on hot-spot and terrorism-induced policing and say that because crimes prevented by policing are not displaced, crimes prevented by imprisonment are not likely to be displaced either.

This claim is based on some dubious reasoning. Suppose Mr. A and Mr. B are walking down Main Street on their way to an economics lecture, Mr. A at 8:10 am and Mr. B at 8:15 am. Both are moderately larcenous. Mr. C has left his bicycle unlocked outside 100 Main Street. Everything else being equal, Mr. A will steal the bike, and Mr. B will not. If a police officer is standing at 102 Main Street, neither will steal the bike, and one crime will be averted, with no displacement. But if Mr. A happens to be in prison this morning, and no police officer is stationed nearby, Mr. B will steal the bike instead; the crime will be displaced. Similarly, a gang may choose to lay low if police occupy its territory, but they will replace a member who is in prison. Personal displacement and spatial displacement are different phenomena.

Of course, displacement may be negative as well as positive: an individual's release from prison may cause more crime than he commits himself. The simplest example of this is the released prisoner who is shot down by old foes immediately on his return home. Models of preemptive murder like O'Flaherty and Sethi (2010c) imply that small changes in the distribution of the propensity to commit murder can set off spirals of tension that result in large changes in actual murder rates.

Using evidence from the 2006 Italian collective pardon discussed above, Drago and Galbiati (2012) found that the average disincentive that an individual's peer group from prison faced had about the same effect on his recidivism that his own disincentive did. Release of one prisoner can affect the criminal behavior of many people.

### 5.2.3 Incapacitation Plus Deterrence Effects

Starting with Ehrlich (1973), many studies have regressed crime on prison population. Donohue (2009) surveys many recent studies, and concludes that they find an elasticity of crime with respect to state prison population of around 0.15 to 0.30. This elasticity translates into 15-30 crimes averted per prisoner-year in 1977, 4-7 in 2005 (Donohue, 2009, Table 9.2).

Durlauf and Nagin (2011) maintain that because the independent variable in these regressions, prisons population, is endogenous, the correlations have no obvious interpretation. This view is based on the retrospective story of incarceration that arises if prison is solely about deterrence and retribution: prison population depends on past crimes, then, and the rules and policies under which past crimes are dealt with. The alternative, prospective view of incarceration (a view more in keeping with incapacitation and rehabilitation) is that authorities decide how many people they can afford to imprison and roughly who these people are, and then find pretexts to arrest and hold these people. The widespread use of prospective criteria in sentencing, probation, and parole decisions, as well as the sensitivity of prison population to budget constraints (Spelman (2005), for instance, uses budget data as an instrument for incarceration), is evidence for the prospective rather than the retrospective theory of incarceration. To the extent that past crime is only a pretext for incarceration, the Durlauf and Nagin critique carries less force. More research into the positive determinants of prison population seems in order.

## 5.3 Post-Prison Effects

Prison may change people—their opportunities as well as their personalities—and these changes almost certainly affect their propensities to commit crimes. If the average prisoner serves three years (an overestimate) and then lives another thirty, 90% of it free, then in the steady state the number of former prisoners is 4.5 times as great as the number of current prisoners. Post-prison effects on crime are likely to be large relative to in-prison effects. (If incapacitation reduces crime by 9 per prisoner-year, but prison experience increases crime by 2 per person-year when free, then in the steady state prison has no effect on crime. But increases in prison population would cut crime and decreases would increase crime, and so regressions would say it was effective.)

Prison could either increase or decrease crime among former prisoners. Since prisoners are not randomly selected, former prisoners are not randomly selected either, and finding causal effects of prison is hard.

Prison experience could make people less likely to commit crimes in several ways. The first is what criminologists call “specific deterrence”: the experience of being caught, convicted,

and sent to prison could make people update their priors about whether they will escape punishment for their crimes. As we have noted above, Lochner (2007) and other papers in the specific deterrence literature find modest effects of this nature. Prison experience may also alter people's views of what prison is like, but the direction of the effect is ambiguous: prison could either be less or more odious than anticipated.

Prison could also give people a chance to make traditional human capital investments, since the opportunity cost of their time is low. In the early 2000s, 31% of state prison inmates participated in vocational programs and 38% in educational programs (Lerman, 2009, p. 152). Higher legitimate wages after prison would reduce the incentive to commit crime. Prisoners may also make investments in drug and alcohol treatment, social and behavioral adaptation, and mental health care. They may become more fervent in their practice of religion, or convert to a different faith.

On the other hand, the stigma of a prison record hurts employment prospects in legitimate jobs, both from legal prohibitions and employer beliefs. Prisoners also lose employment contacts and skills while in prison, and may accumulate child support debt that produces extremely high marginal tax rates on reported earnings. The net effect of prison on employment and earnings is probably negative; see Holzer (2009) for a survey, and the many contributions in Bushway et al. (2007) for a variety of perspectives on this issue.

However, two recent studies that used random assignment of criminal cases to judges with different sentencing propensities as an instrument for imprisonment have found no effect on employment. Kling (2006) compares sentences of varying length to see whether additional prison time harms subsequent earnings, and Loeffler (2013) examines the difference between no prison time (probation, for instance) or a positive amount of it. These are both local average treatment effects, but they are at different neighborhoods in the distribution of prison spells. They do not rule out an employment effect from arrest rather than imprisonment.

Among some populations, prison is viewed as a rite of passage. As Lisa Ling observes in a 2006 documentary on Mara Salvatrucha, a criminal gang with a reputation for extreme brutality: "In the surreal world of MS-13, prison isn't punishment—It's finishing school." Such cases in which incarceration loses its deterrent effect completely are extreme and probably rare, but even for more routine offenders the propensity to commit crimes can increase as a result of having served time in prison. For instance, Bayer et al. (2009) show that a person who commits a certain type of crime (say, burglary) before prison is more likely to commit that crime after prison if he serves more time with others who have committed that crime.

Prison may also alter inmates' personalities. "[A] harsh prison environment can make inmates less social, more violent, more likely to internalize the stigma associated with being a

criminal” (Lerman, 2009, p. 153). The wikiHow, *How to Deal with Being in Prison*, advises: “It’s better to get into a fight and lose than to be seen as cowering or placating... if an altercation is unavoidable, react quickly and with aggression.”<sup>50</sup> Similarly, the wikiHow *How to Survive in Federal Prison* advises: “Don’t trust anyone. That goes for guards, prison officials, and the person in the cell next door. If someone is being nice to you... They almost always have some hidden motive that you don’t know about. In prison, nothing is free.”<sup>51</sup> Most people cannot alter their personalities quickly or at will. A personality developed for coping with prison life may easily lead to problems in civilian life. The traits that these documents advise prisoners to cultivate—aggression, preemptive violence, mistrust—can easily lead to violence and criminality in civilian life; they are almost precisely the traits that the social and behavioral interventions described in 2.2.2 try to eliminate.

Empirical studies of post-prison offending experience are of two kinds: some look at particular ways that incarceration can be structured, and others compare incarceration to some form of non-custodial supervision (or no supervision whatsoever). Rehabilitation works in the sense that some activities can reduce recidivism among those prisoners who participate relative to those who do not: vocational programs, cognitive behavioral therapy, and drug treatment, for instance (Bushway and Paternoster, 2009). Other activities increase recidivism: high security imprisonment for prisoners with little prior criminal involvement, for instance (Lerman, 2009; Chen and Shapiro, 2007). These studies cannot answer the question of whether people who go to prison and participate in effective programs are more likely to commit future crimes than otherwise identical people who do not go to prison.

The second question, whether the average prison experience is criminogenic relative to some form of non-custodial supervision, has been the subject of hundreds of studies, mostly outside of economics, and several meta-analyses. The results of these studies are mixed and not definitive (Lerman, 2009, pp. 153-154), although a review by Nagin et al. (2009) concludes that prison is probably weakly criminogenic, or null (Loeffler, 2013).

Two recent studies in economics with careful identification strategies have added to this literature. Aizer and Doyle (2013) find that juvenile detention greatly reduces the probability of high school graduation and increases recidivism. Di Tella and Schargrodsy (2009) show that assignment to incarceration rather than electronic monitoring raises recidivism moderately among adults in Argentina. Both studies use random assignment to more or less lenient judges as an instrument, and so implicitly study defendants close to the margin of imprisonment. The range over which these results generalize might therefore be limited.

The mixed results should not be surprising. Prisoners differ, prisons differ, and non-

---

<sup>50</sup> Accessed on September 20, 2013 at <http://www.wikihow.com/Deal-with-Being-in-Prison>.

<sup>51</sup> Accessed on September 20, 2013 at <http://www.wikihow.com/Survive-in-Federal-Prison>.

custodial experiences differ. So the effect of prison on future offending should not be a constant.

The final type of post-prison effect is not on prisoners, but on their children. Johnson (2009) calculates that roughly a fifth of black children have a father who has been incarcerated. Young children whose parents are or were incarcerated exhibit more behavioral problems than other children, and Johnson shows that this effect persists after adding many more controls—although he cannot establish causality. Behavioral problems as a child are correlated with criminal offending as a young adult. Wildeman (2010) also finds that paternal incarceration is associated with more physically aggressive behavior by boys. Like Johnson, he cannot establish causality, but uses several methods (propensity scores, fixed effects, and placebo regression) that strongly suggest it.

## 5.4 Prison Gangs

Prisons are dangerous and inhospitable places. Guards cannot enforce peaceful coexistence among prisoners. Prisons contain a higher proportion of psychotic and violent individuals than normal communities do, and offer fewer opportunities for self-protection. In prison, one cannot choose whom to dine, exercise, sleep, or shower with. One cannot carry a mace or a gun, or move to a safer environment. State-sponsored deterrence is also less effective in prisons: prisoners cannot be threatened with immediate loss of freedom or access to possessions or to friends and sexual partners; or with the stigma of being known as convicts; or with the risk of losing a good job. Prisoners cannot buy many goods that they want, and guards will not enforce most agreements among prisoners, especially those dealing with trade in contraband.

Each prisoner's experience then depends on how well he interacts with other prisoners. When prisons were small and uncrowded, they were governed by convict norms that reduced violence and allowed trade in contraband to flourish. These norms broke down as prisons expanded, transfers became more frequent because prison systems were larger, prisoners became younger, the population became more heterogeneous, and as the influx of drug users and drug dealers made the trade in contraband more lucrative. To enforce order, prison gangs replaced prison norms (Skarbek, 2012). Gangs strong enough to protect their members were also strong enough to act as predators toward non-members.

Prison gangs may affect crime outside prison. When prisoners leave prison, they do not necessarily leave the gang. Gang membership provides them with trusted associates and contacts. Since gangs import illicit drugs into prison, these contacts include drug-trafficking organizations. Thus gang membership gives former prisoners a comparative advantage in drug-dealing and other types of crime. For instance, the Mexican Mafia (La Eme), orig-

inally founded in prison, became a drug-trafficking organization outside prison (Fleisher and Decker, 2001). The Drago and Galbiati (2012) finding on peer effects among Italian ex-prisoners is consistent with this interpretation.

Whether encouraging street gang membership increases or decreases crime, especially index crime, is unclear. On one hand, the requirements of gang membership may force individuals who have joined or who want to join only for insurance purposes to commit more index crimes than they otherwise would. On the other hand, gangs, especially large gangs, may create monopolies in illicit drug markets and so reduce the number of disputes that need to be settled violently; La Eme, when it was originally formed, drew on the membership of a large number of street gangs (Skarbek, 2012). How the prison boom altered the organization of criminal activity outside prison is a topic that has not been well studied.

#### **5.4.1 Pre-Prison Effects and Prison Culture**

The influence of prison gangs is not necessarily confined to ex-prisoners; it may affect “pre-prisoners” too. Just as La Eme started as a prison gang and became a street gang, the Crips started as a street gang and became a prison gang. Entering prison without friends or gang connections is probably dangerous and definitely scary. A person who has a high probability of going to prison sometime in his life may be well advised to establish gang ties before that occurs.

Anticipation of prison may also cause people to cultivate personality traits that are dysfunctional outside prison, like the aggression and suspicion that we described in Section 5.3. Another prison trait relevant to crime in the outside world is unwillingness to cooperate with authorities: “Do not snitch. If you see something illegal or violent, walk away and do not divulge any information if questioned later. If you become known as a snitch, other inmates will target you as retaliation.”<sup>52</sup>

A community outside prison filled with people who have internalized these ways of interacting is a dangerous and crime-ridden place, and one where those who do not act like “prisoners” may find it in their best interest to start acting that way, even if they are neither former prisoners nor pre-prisoners. Prison culture—not just prison-inspired fashions—can spread. Standard econometric techniques would not detect a rise in crime caused by a spread of prison culture. Spikes in incarceration would still cut crime, and individuals with actual prison experience would not look or behave much differently from individuals without actual experience.

Cooperation with law enforcement is risky and costly in many communities. Furthermore,

---

<sup>52</sup>How to Deal with Being in Prison (wikiHow): <http://www.wikihow.com/Deal-with-Being-in-Prison>. Accessed on September 20, 2013.

like the willingness to kill discussed in Section 4.5, the willingness to provide evidence or testify in court is characterized by strategic complementarity. Incarceration substantially reduces the ability of a defendant to harm witnesses, and a conviction becomes more likely if multiple witnesses step forward. Since the costs of cooperation to an individual depend on the incidence of cooperation in the community, multiple equilibria can arise: high levels of cooperation may be sustainable, but there may also exist equilibria with *collective silence*: no witness comes forward because none expects others to come forward to corroborate testimony O’Flaherty and Sethi (2010b).<sup>53</sup> Under these conditions the problem of identifying the effects of mass incarceration on crime empirically becomes especially acute.

Because prisoners come from, leave and return to neighborhoods that are spatially concentrated, incarceration is thus likely to have spatial effects. Children growing up may anticipate a different life course and so invest differently, adolescents may encounter young adults who are more aggressive and mistrustful, police may find citizens less cooperation, women may find fewer prospective partners and so lose bargaining power in any relationships that do form, children in the next generation may find their lives disrupted by paternal incarceration and grow more aggressive, and their peers will have to deal with their aggressiveness. In economics, a full spatial model has not been investigated yet, either theoretically or empirically, but criminologists like Clear (2007) are investigating these consequences. Such neighborhood effects might be the reason why some recent studies have found little or no effect of individual imprisonment on earnings or criminality. Loeffler (2013) writes: “If many prisons are simply extensions of high-disadvantage neighborhoods, then the effects of moving between these two environments might be smaller than previously thought.”

## 5.5 Tradeoffs

Although the consensus of studies is that the average effect of incarceration is to reduce crime, and the marginal effect may also be, the current volume of incarceration is probably not the efficient way of reducing crime.

Cook and Ludwig (2010) make this case simply. Suppose early 21st century sentencing and parole practices were scaled back to 1984 levels. Following Raphael and Stoll (2009b), they say that this would reduce state prison population by about 35% of the increase since 1984, and state prison expenditures would fall accordingly.<sup>54</sup> If the federal prison population

---

<sup>53</sup>For a spectacular example of collective silence see Kocieniewski (2007).

<sup>54</sup>The thought experiment that Cook and Ludwig ask for is not the thought experiment that went into calculating Table 1. That table held the crime rate and arrests per crime at 1984 levels, and asked what would happen to steady state imprisonment if time served went to 2002 levels. Cook and Ludwig hold the crime rate and arrests per crime at 2002 levels and reduced time served to 1984 levels. The calculation that would arrive at 35% uses all categories of prisoner, including parole returnees. For index crimes, steady-state

also fell by 35% of the increase since 1984 and expenditures fell accordingly, the government budget savings would amount to \$12 billion a year, but the smaller prison population would raise violent index crimes by 26,000 a year and property index crimes by 186,000 a year in the absence of any compensating policy change. But shifting that \$12 billion in government spending to police, preschool for poor youngsters, or social-behavioral skills programs for troubled adolescents would decrease index crime by substantially more than these amounts. This last claim confuses results on the weak claim of criminogenic characteristics—which has been established for preschool and social-behavioral skills—with the strong claim of criminogenic characteristics—which has not been established for these interventions. Only the strong claim is relevant for this calculation. Still, the comparison for police is sufficient to make the point that prison expansion is not the best use of money, and other interventions for which the strong claim has been established like psychopharmaceuticals could be substituted for preschool and social-behavioral training.

These cost calculations ignore any changes in crime from altered recidivism, pre-prison incentives, or spread of prison culture. They also ignore the benefits that prisoners themselves would receive from not being incarcerated, as well as the benefits to those who are “knitted together with offenders in networks of social and psychic affiliation” (Loury, 2009). The costs to prisoners and their families are probably large, but often ignored, or calculated as loss of wages. Donohue (2009), in his magisterial cost-benefit analysis, devotes 10 pages to the elasticity of crime with respect to imprisonment and another 14 pages to the cost of crime, and cites many studies on these pages; he devotes a paragraph with no citations and part of a footnote to the direct current cost of incarceration to prisoners.

The willingness of those with means to pay large fines and incur large legal expenses to avoid prison suggests that for most people going to prison or jail is much, much worse than losing earnings. Cook (1983) argues for counting the costs to prisoners, but the practice is not widespread. We know of no study that attempts to estimate the cost of prison to prisoners or their families.

When sentencing and parole decisions are based on retribution or deterrence, arguments can be made for ignoring costs to prisoners. But ignoring prisoner costs is much harder to defend when these decisions are based on considerations of incapacitation—that is, crimes not yet committed. Incapacitation, after all, could be achieved just as well by sending likely

---

imprisonment per capita was 201.8 in 1984 and rose to 305.3 in 2002, an increase of 103.5. Holding the crime rate and arrests per crime at 2002 levels and reducing time served to 1984 levels produces an imprisonment rate of 245.0. So the proportion of the increase that would be eliminated is 58.3%. For drug offenders and index crime offenders together, the same sort of calculation implies that going to 1984 time served would reduce the increase by 44.7%. Federal prisons have a higher proportion of drug offenders than state prisons do, and a larger proportion of their increase is due to drug offenders, so the proportion of the federal increase due to greater time served is probably considerably less than that for state prisons.

offenders to Club Med as it could be by sending them to prison.

## 5.6 Race and Mass Incarceration

Many other government policies—agricultural subsidies, for instance—are monumentally inefficient, but few have excited the passion among distinguished intellectuals that mass incarceration has. Economists should understand this passion.

Prisons are profoundly racial places. Even though a substantial minority of prisoners are non-Hispanic whites, the prison population in the U.S. is dominated by minorities. In fact, prisons *make* people black: some individuals who are white outside prison are black inside prisons, both as reported by themselves and reported by others (Saperstein and Panner, 2010). Prisons are also highly segregated; prison gangs, for instance, are organized entirely along racial and ethnic lines. The wikiHow on federal prisons recommends: “It is crucial to your survival to immediately show your allegiance to your race... If you are some white suburbanite 19-year-old that pledged yourself as a crip, and you used to buy the dope you got busted selling from your homeboys in the projects, that doesn’t mean you can link up with them in prison. If you’re white and you walk in slapping high fives with the brothers before you shake hands with the white dudes, you’re going to send a rift through the whole community.”<sup>55</sup>

Physical coercion, dishonor, and loss of freedom—the hallmarks of prison—are central to the long and tumultuous history of race in the United States. Alexander (2010, p. 2) writes: “Today it is perfectly legal to discriminate against criminals in nearly all the ways it was once legal to discriminate against African Americans. Once you’re labeled a felon, the old forms of discrimination—employment discrimination, housing discrimination, denial of the right to vote, denial of educational opportunity, denial of food stamps and other public benefits, and exclusion from jury service—are suddenly legal. As a criminal, you have scarcely more rights, and arguably less respect, than a black man living in Alabama at the height of Jim Crow. We have not ended racial caste in America; we have merely redesigned it.”

Loury (2008) explores the prevailing political reaction to the prison boom—the question of what really determines the level of incarceration. The widespread complacency in the face of stark racial disparities in incarceration rates, according to Loury, has deep historical roots. Following Patterson (1982), he argues that American slavery was “not merely a legal convention but also a superstructure of justifying ideas defining and legitimizing an order of racial hierarchy,” and that the profound “racial dishonor” that was part of this superstructure of ideas could not be eliminated simply by a change in the legal status of slavery. Hence

---

<sup>55</sup>How to Survive in Federal Prison (wikihow): <http://www.wikihow.com/Survive-in-Federal-Prison>. Accessed on September 20, 2013.

there survived “an entrenched if inchoate presumption of inferiority, of moral inadequacy, of threat to public safety, of unfitness for intimacy, of intellectual incapacity” when members of the stigmatized group were viewed by those outside it. Without this contempt, argues Loury, the staggering racial disparities in mass incarceration would not be considered socially acceptable, and would therefore not be politically sustainable.

This perspective also sheds light on the deep ambivalence towards aggressive enforcement that is evident in the inner city communities where victimization is highest. These victims do not share the contempt for young black males, or the “enthusiasm for their debasement” that is felt by those who reside at some distance, both social and geographic, from these communities. Furthermore, it helps explain why significant racial disparities in drug arrests are tolerated, even while disparities in drug use are negligible. And it sheds light on the significant disparities in the sentencing of convicted killers, with defendants considerably more likely to receive a death sentence when the victim is white. Loury argues that vigorous enforcement policies have sometimes been politically popular precisely *because* they have a disproportionate impact on blacks: “Institutional arrangements for dealing with criminal offenders in the United States have evolved to serve expressive as well as instrumental ends.” (Loury, 2009).

As we have discussed at length in this chapter, there are many instances in which membership of a visibly identifiable group affects the incentives faced by offenders and victims engaged in a criminal interaction. Black offenders may face less resistance for instance, if they are perceived to be more desperate. This makes robbery more lucrative, and affects the relative rates of offending across different identity groups (see Section 4.3). The disparity in this case is driven by different incentives, rather than differences in nature or deep cultural characteristics. But these incentives remain hidden from most observers, which can result in what Loury calls “essentialist causal misattributions.” That is, the disparities are attributed to the prevalence of largely immutable criminogenic characteristics in a population, rather than the recognition that they result from structure of incentives and interactions. As a result, the disparity does not result in urgent calls for corrective action.<sup>56</sup>

---

<sup>56</sup>Loury (2002) illustrates this point by comparing gender disparities in two domains: science classes and prisons. Males are heavily overrepresented in both domains but only in the former is there a sense that corrective action is required, because “it offends our basic intuition about the propriety of underlying social processes that boys and girls have different levels of achievement in the technical curriculum of our schools.” The fact that racial disparities in incarceration rates does not offend our intuitions in the same manner is attributed to the legacy of racial dishonor.

## 6 Big Swings in Crime

Several times in recent memory—that is, in the era of reasonably reliable data—rates of almost all kinds of crime have moved up or down together over large geographic areas for a decade or so, as if they were all moved by a single gigantic hand. The best known and best studied such incident was the great American (and Canadian) crime decline of the 1990s. Other incidents are the great American crime rise from the mid 1960s to the mid 1970s, and the crime declines in the U.S. and most other rich countries in the early 2000s.

These swings are large; changes of more than 50 log points are common. They are thus typically much larger (though maybe less frequent) than the swings in output or employment that macroeconomists concentrate on (and timed considerably differently). They are no less worthy of study.

The synoptic literature on these events is limited to the 1990s American crime decline: papers by Levitt (2004) and Blumstein and Wallman (2006b), and books by Blumstein and Wallman (2000, 2006a), and Zimring (2007). Levitt and Zimring do, however, discuss the great American crime rise. Many other papers attempt to explain pieces of the American 1990s; at least one of them, Reyes (2007), says something about the crime rise and the 21st century.

In this section, we will first establish some stylized facts about the four big swings, and then review the explanations for the 1990s American crime decline. We will then look at the other three big swings, and try to extend those explanations. We begin with the 1990s because this episode has received the most study. Then we look at the 2000s because they appear to be related to the 1990s.

Our conclusion is that we do not know now what caused most of these big swings, and we should. This does not mean that the factors traditionally studied—police, prisons, the macroeconomy, and demographics—are impotent or that studying them is useless. Something (probably several things) is causing these big swings, we do not know what it is yet, and it is more powerful than the traditional factors.

### 6.1 Stylized Facts

Figure 1 shows U.S. rates for reported offenses for four crimes from 1960 to 2012: murder, robbery, burglary, and motor vehicle theft. We set 1986, the midpoint, equal to 100 for each crime. Murder and motor vehicle theft are quite well reported in the U.S.. Rape, aggravated assault, and larceny-theft, the index crimes we have omitted from this figure, suffer from particularly large reporting problems, especially over a long period of time.

The great rise and the great decline are both easily evident in Figure 1, as is the contin-

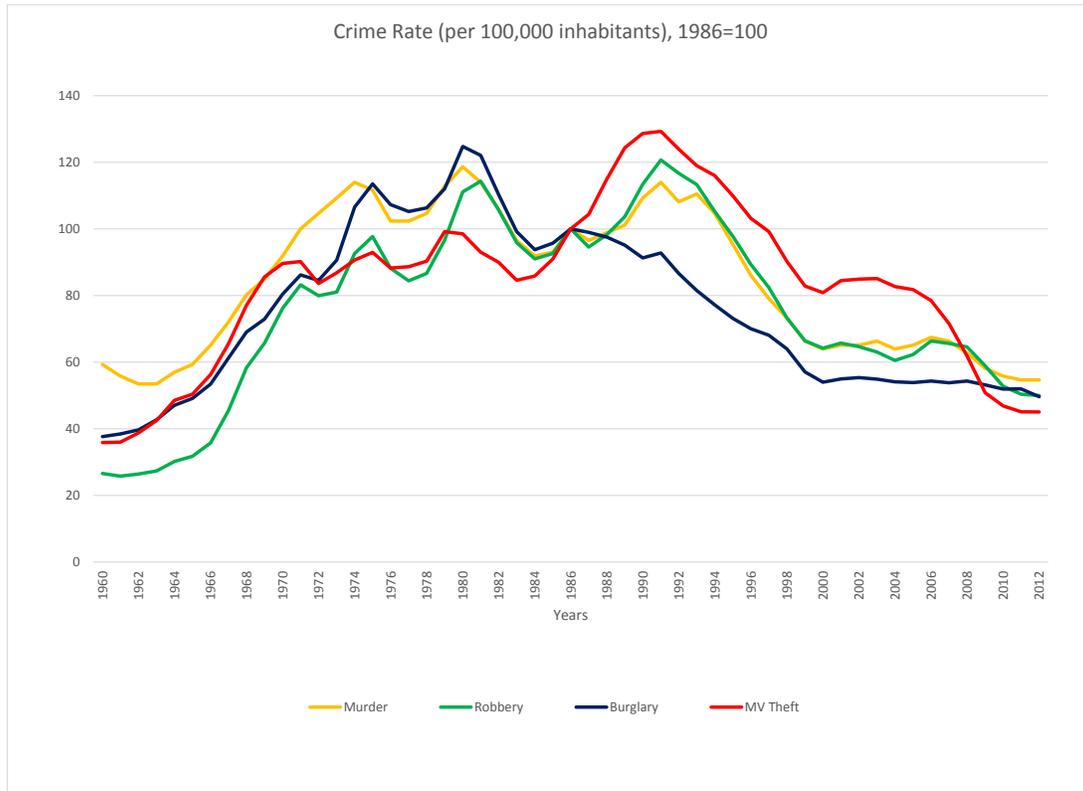


Figure 1: Historical Swings in Crime Rates

ued decline in the 21st century. The great rise and the great fall are of roughly the same magnitude, although, of course, the great rise is much bigger relative to its starting point. The 21st century decline is not as dramatic as its predecessors (except for motor vehicle theft), but is still a noteworthy event.

Figure 1 deals with reported crimes, but when available, victimization statistics follow the same pattern. The National Crime Victimization Survey (NCVS) did not begin until the end of the great crime rise, and so cannot be used as a comparison for that event; and the NCVS never gives data on murder (for obvious reasons). But otherwise, the NCVS and the Uniform Crime Reports (UCR) both show across-the-board declines in the 1990s and 2000s.

What about other developed countries? Zimring (2007) compared the U.S. experience in the 1990s to that in other G-7 countries (he omitted Germany because reunification was ongoing in 1990). Canada mirrored the U.S., but the other countries he looked at—France, Italy, Japan, and the U.K. (England and Wales)—did not. He concluded that there was no typical pattern, and Levitt (2004) reaches a similar conclusion.

But the 21st century has a trend, and it is downward. This is evident in Table 2, where

Table 2: Rates of Change for Four Reported Crimes Per Capita in the 2000s

	Murder	Robbery	Burglary	MV theft
Australia	-31.3%	na	-45.9%	-50.6%
Austria	-20.0%	-17.6%	-40.3%	-49.8%
Belgium	-14.3%	-14.4%	1.2%	-54.2%
Canada	-6.3%	-14.7%	-41.6%	-56.5%
Denmark	-27.3%	-0.7%	-11.1%	na
Finland	-4.3%	-23.2%	-33.1%	na
France	-33.3%	-8.0%	-20.0%	-3.7%
Germany	-33.3%	-19.4%	-6.7%	-28.2%
Greece	128.6%	178.9%	172.6%	103.2%
Iceland	-50.0%	-4.4%	-41.3%	na
Ireland	-10.0%	51.3%	-2.8%	-25.4%
Israel	-16.7%	-1.4%	-53.0%	na
Italy	-30.8%	32.9%	na	-14.6%
Japan	-40.0%	-50.0%	-62.2%	-50.1%
Korea	30.0%	-46.8%	na	na
Luxembourg	-11.1%	na	na	na
Netherlands	na	-28.0%	na	-24.8%
New Zealand	-30.8%	na	na	-19.0%
Norway	109.1%	5.4%	-45.9%	-49.6%
Slovenia	-55.6%	13.1%	-22.7%	-30.9%
Spain	-42.9%	-22.8%	na	-53.7%
Sweden	-10.0%	7.2%	-27.3%	-51.5%
Switzerland	-40.0%	14.5%	-9.8%	-89.3%
U.K.	-37.5%	-32.2%	-42.5%	-70.3%
U.S.	-14.5%	-20.4%	-5.5%	-47.2%
Observations	24	22	19	19
Number increasing	3	7	2	1
Median	-23.6%	-11.2%	-27.3%	-49.6%

Source: United Nations Office on Drugs and Crime.

we look at a wider set of countries—OECD members with 2010 gross national income per capita above \$25,000 (PPP)—for the four crimes in the early 21st century.<sup>57</sup> Among the G-7 countries in this period, almost every crime in every country went down, and sometimes by spectacular margins. The only exception in the G-7 may be robbery in Italy, but reporting issues make even this exception unclear.<sup>58</sup> Over the longer period, the U.S. appears not as an outlier, but as a precursor.

<sup>57</sup>In Table 2 the period for murder is 2000-2011. The period for all other crimes is 2003-2011. The countries are the OECD member states with gross national income per capita exceeding \$25,000 in 2010 (source: OECD). Exceptions: For Austria, Spain, France, Greece, and the Netherlands, 2004 MV theft is substituted for 2003. For Italy, New Zealand, Sweden, and the Netherlands, 2005 MV theft is substituted for 2003. For Canada, 2010 MV theft is substituted for 2011. For Austria, Japan, and Israel, 2004 robbery is substituted for 2003. For Spain, 2005 robbery is substituted for 2003. For Austria and Israel, 2004 burglary is substituted for 2003. U.K. is England and Wales; population for crimes other than murder is from U.K. Office for National Statistics, Statistical Bulletin, Population Estimates for England and Wales Mid-2002 to Mid-2010 Revised (National), 13 December 2012.

<sup>58</sup>Italy introduced a new system of crime reporting in 2004 and progressively implemented it. The European Sourcebook of Crime and Criminal Justice Statistics (2010, p.140) states: “This change implies a risk in comparing police statistics among 2004, 2005, and 2006.” In the United Nations Office on Drugs and Crime (UNODC) statistics, robbery rises tremendously in 2004, and the burglary category disappears.

## 6.2 Explaining the 1990s American Crime Drop

It is convenient to think of two classes of explanatory variable for any change in crime rates: traditional, and non-traditional. The traditional category is composed of criminal justice variables (police and prisons), demography, and macroeconomics. Non-traditional refers to everything else. The consensus is that police and prisons by themselves are insufficient to explain the 1990s crime drop. Most papers conclude that all the traditional variables together are also insufficient, although a few papers maintain that this combination can explain a large proportion of the 1990s drop in property crime. Papers that claim to explain all or most of the 1990s crime drop—these are generally in economics—appeal to a variety of non-traditional explanations, while synoptic works in criminology usually are content to leave a great deal of the crime drop unexplained.

In this section, we will start with the traditional variables, and add up plausible estimates of the size of their impacts. Then we will look at a variety of non-traditional variables. The latter discussion will be considerably more speculative than the former.

### 6.2.1 Traditional Explanations

**Police force size** Levitt (2004) states that the number of police per capita rose 14 percent over the period 1991-2001. As Chalfin and McCrary (2013) point out, police are hard to count on a local basis, and national estimates yield new problems with the classification of agencies and broad geographical reach. But there is little question that U.S. police force size grew substantially during this decade.

How much police force size mattered is controversial. Criminologists generally cite earlier studies and argue for little or no effect; Eck and Maguire (2000) is a good survey of this literature. Economists work with later papers with good identification strategies. Levitt uses his 2002 paper, from which he interprets an elasticity of  $-0.4$  for all types of crime with respect to number of police.

This estimate seems outdated. Chalfin and McCrary (2013) provide a helpful review of estimates from several more recent papers. For murder, it seems clear that an elasticity over  $-0.4$  is appropriate; estimates for post-2002 papers range from  $-0.50$  to  $-2.73$  with a median of  $-0.87$ . For violent crime, the elasticities range from  $-0.34$  to  $-1.13$  with a median of  $-0.66$  (elasticities for robbery are much higher than those for rape or assault). Property crime elasticities, on the other hand, are probably somewhat smaller than Levitt used; the literature ranges from  $+0.11$  to  $-2.18$  with a median of  $-0.26$ . The median estimates imply a decrease in murder of 11 log points, in violent crime of 9 log points, and in property crime of 3 log points.

**Prison** The prison population rose 36 percent during the period examined by Levitt, and he uses an elasticity of  $-0.3$  for murder and violent crime and  $-0.2$  for property crime to attribute a 12 percent decrease in murder and violent crime to this cause (in log points, the contribution is 9), and a 7 percent decrease in property crime (6 log points). The elasticity is high relative to estimates in the literature; Donohue (2009), for instance, concludes from his survey that a figure half as high would be more reasonable; this would imply log point decline for murder and violent crime of 4 or 5.

These estimates are primarily a current incapacitation effect; as we noted in Section 5, they ignore the possibility of heightened offending by former prisoners. By the 1990s, the prison boom had been going on for long enough that the stock of former prisoners was high and it grew during the decade.

**Demographics** The consensus is that changing age composition contributed modestly to the 1990s crime decline. The proportion of the resident population aged 15-24 fell from 14.9 percent in 1990 to 13.9 percent in 2000; the proportion 15-29 fell from 23.5 percent to 20.8 percent (Zimring, 2007, p. 61). Based on a Blinder-Oaxaca decomposition of changes in the distribution of population by five-year age groups and correction for racial changes, Levitt (2004) estimated that changing demography decreased property crime by 5 log points and violent crime by 2 log points. He estimated a zero effect on murder.

Zimring (2007) suggests that demographics may have had a bigger effect than this, but he puts no number on his conjecture. His argument is based on a process of elimination: Canada experienced a crime decline similar to that in the U.S., but did not add police or prisoners. That Canada had a demographic experience similar to that of the U.S. suggested to Zimring that demography might be more powerful than other analysts thought.

The idea of a nonlinear demographic effect—essentially, that big cohorts have higher age-specific crime rates—was first posited by Easterlin (1973). Steffensmeier et al. (1987), O'Brien (1989), and Levitt (1999) all argue that historical evidence does not support the existence of a cohort-size effect.

**Prosperity** As far as macroeconomic performance is concerned, the 1990s are remembered as a good decade: unemployment fell and wages rose. Prosperity decreases crime (notice that the effect of prosperity on crime is a simpler question than the one we tackled in Section 3.3, concerning the effects of unemployment and wages on crime), except murder, and macroeconomic events almost certainly contributed to the 1990s crime decline. There is no consensus, however, about how much.

Table 3: **Estimated Log Point Changes in Crime Due to Traditional Variables, 1991-2001**

	Murder			Violent Crime			Property Crime		
	Levitt	Smaller	Bigger	Levitt	Smaller	Bigger	Levitt	Smaller	Bigger
Police size	-5		-11	-5		-9	-5	-3	
Prison	-12	-6		-12	-6		-8	-4	
Demography	0			-2		-3	-5		-7
Macroeconomy	0		0	0			-2		-8
Total	-17	-11	-23	-19	-13	-24	-20	-14	-28
Actual (UCR)	-56	-56	-56	-42	-42	-42	-34	-34	-34
Residual	-39	-45	-33	-23	-29	-18	-14	-20	-6

Levitt (2004) concentrates on unemployment and summarizes his understanding of the extant literature as implying that a one percent change in the general unemployment rate leads to a one log point change in property crime (in the same direction), and no change in violent crime. This implies a 2 log point decrease in property crime from prosperity in the 1990s (the general unemployment rate fell from 6.8 percent in 1991 to 4.8 percent in 2001).

By contrast, Freeman (2001) reviews the literature on prosperity and property crime, and explains how some of these papers differ in two ways from Levitt's approach. First, since most index crime is the province of low-skilled men, the relevant unemployment rate is the rate for that group, not the general rate. Second, wages matter as well as unemployment rates, and the wages that matter are those for low-skilled men.

The papers that Freeman uses do not consistently find an effect on violent crime or murder, but the implied estimates for property crime are considerably larger than the one Levitt used. Gould et al. (2002) probably gives the largest impact estimate (they do not have prison controls and do not compute IV estimates with police variables as controls; hence we use their OLS estimate with police controls). From this paper, we calculate an 8 log point decrease in property crime due to lower unemployment and higher wages for low-skilled workers.

**Residual** The traditional variables do not explain all or even most of the 1990s crime decline. Table 3 summarizes our analysis so far. For each type of crime we start with Levitt's estimated impacts, and then columns for bigger or smaller estimates based on the discussion so far in this section. Unlike Levitt, we use log points rather than percentages to be consistent with the equations in the original papers.

Thus only for property crime, and only for the high estimates, do the traditional variables come close to explaining the 1990s crime decline. (This is somewhat consistent with Imrohoroglu et al. (2004), who claimed that they could explain the property crime decline

over a longer period with enforcement and wage variables.) Otherwise, traditional factors always explain less than 60 percent of the crime decline, and maybe less than a third. The unexplained residual is over 30 log points for murder, over 20 log points for violent crime, and around 10 log points for property crime.

Economists are used to seeing unexplained residuals, and often are quicker to label them than to explain them—thus, for instance, “technological progress” in growth regressions, and “discrimination” in Blinder-Oaxaca decompositions for racial or gender differences. In the case of crime, however, no handy label has appeared for the unexplained residual, and instead attention has turned to non-traditional explanations.

### 6.2.2 Non-Traditional Explanations

In this subsection, we will review many non-traditional explanations. Some of them appear to have merit, while others do not, and still others remain to be tested.

**Capital punishment** Executions increased during the 1990s, although the number remained small relative to aggregate incarceration. Levitt (2004) takes the highest estimate in the literature of murders averted per execution and multiplies it by the decadal increase in executions; the result is a 1.5 log point decrease in murder. There is much reason to be skeptical of even this small impact, as no consensus exists on the effect of capital punishment on murder.

**Abortion** Levitt (2004) attributes a 10 percent (11 log point) decline in crime across the board to the legalization of abortion (on top of demographic changes). As we concluded in Section 2.1.5, this attribution is probably misplaced. There is an interesting correlation between events and dispositions in the early 1970s and crime in the 1990s, but that correlation does not appear to be acting through abortion. Part of the 1990s crime decline is due to this “Donohue-Levitt factor,” but we do not know yet what this factor is.

**Crack** Crack appeared in U.S. cities around 1985, and its introduction set off a round of violence, especially murders among young black men, that substantially raised crime rates (Fryer et al., 2013). The violence subsided in the early 1990s. Two stories have been told about why the violence subsided: either crack markets were cartelized and wars became less likely to break out among competing sellers, or demand fell when young generations saw the harm that crack had wrought on their older brothers and sisters.

Levitt (2004) and Blumstein and Wallman (2006b) attribute a large portion of the decrease in violent crime, especially murder, to the evolution of crack. In an accounting sense,

this attribution is correct. Had the crack epidemic not occurred, or had it started in 1995 rather than 1985, the 1990s crime decline in the U.S. would have been smaller.

This accounting explanation, however, fails to address the fundamental question of why the crack epidemic occurred when it did, and why no similar epidemic has occurred since, either in the U.S. or in another developed country. Crack was a technological innovation in recreational drugs; surely it did not exhaust all possible technology in this field. Many innovations, like methamphetamines, have spread in the world of recreational drugs since crack, and even more could have spread if the payoffs were large enough, but none has had anywhere near the impact on violent crime that crack had.

The U.S. experienced two recreational drug epidemics that apparently had large effects on criminal offending—crack in the late 1980s and heroin in the early 1970s. Both were centered in African American city neighborhoods, and both occurred when most varieties of index crime were close to their peak, as far as recorded history is concerned. Was this just an unfortunate coincidence, and the fact that no such shocks occurred in the forty years preceding 1970 or the twenty years following 1990 just good luck?

For a day-to-day weather forecaster, hurricanes are random shocks, too. But they do not often occur in the winter and they do not often strike Nebraska. Meteorology explains these regularities about hurricanes. That crime-inducing recreational drug epidemics were concentrated in African American neighborhoods of U.S. cities during a particular twenty year period is likewise a regularity that cannot simply be attributed to chance. Crack is something that needs to be explained; it is not an explanation.

**Police productivity** Although improved high-profile police tactics are probably the most popular explanation for the crime decline, both criminologists and economists agree that they probably played at best a minor role. Levitt (2004) assumes that they are responsible for a 1 log point across the board decrease in crime, but he assigns this value without much conviction. Criminologists, except possibly Zimring (2011) on New York City, would be less generous.

The main reason for this skepticism is that there is no evidence of more effective police tactics being widely adopted. Section 3.2 shows that hot-spots policing and terrorism-induced police presence reduce crime. There is no evidence that hot-spots policing became more common in the 1990s. The tactics the terrorism studies focus on—for instance, standing around in front of synagogues—are hardly innovative, and they probably did not proliferate more in the 1990s. During this period, many cities that adopted wildly different high-profile policing tactics simultaneously experienced large crime decreases.

Two innovations that have received considerable public attention have also failed to

convince experts of their contribution to the crime decline—“broken windows” (BW) policing and Compstat. BW policing grows out of a famous *Atlantic* article by Wilson and Kelling (1982) that hypothesized that general disorder in a neighborhood—broken windows that are not repaired—signaled to criminals that they could take over because nobody cared. Police could therefore reduce crime by combating disorder.

There are two reasons to believe that BW policing did not contribute significantly to the crime decline. First, the consensus is that it is ineffective: “There is widespread perception among policy makers and the public that enforcement strategies (primarily arrests applied broadly against offenders committing minor offenses) lead to reductions in serious crime. Research does not provide strong support for this proposition.” (Skogan and Frydl, 2004, p. 229). Second, BW was probably little applied. New York City is supposed to be the poster child for BW policing, but Zimring (2011) shows that it did not actually adopt this strategy: the vice squad was shut down, arrests for prostitution—one of the main examples Wilson and Kelling (1982) use—went down, and arrests for gambling went down after a brief rise in the early 1990s. Marijuana arrests rose, but only among men. The New York Police Department made pretextual arrests, not order-enhancing arrests.

By contrast, the problem with Compstat is that it has never been evaluated. Compstat is a management practice where top-level officials use real-time, small-area crime data to hold precinct commanders responsible for crime in their areas. It is a combination of hot-spots and slack-reduction. Zimring (2011, pp. 143-144) argues that Compstat was probably successful in New York City because the New York crime drop was unusually large, and there is no independent evidence elsewhere that Compstat does not work. He acknowledges that this argument is weak.

Hence it is likely that no high-profile policing innovation was responsible for a significant portion of the crime drop. But could police have improved their performance in the 1990s by many small, widespread innovations—better communications, for instance, better use of data, more educated officers, more ambitious superiors, and so on? Productivity increases are accepted in the private sector without demonstration of the effectiveness of particular innovations.

If productivity increased in this fashion, then researchers who estimated the effect of police on crime would find a larger elasticity with data from the 1990s than with earlier data. No clean test like that is available. However, Evans and Owens (2007) used data only from 1990 to 2001, and so when Chalfin and McCrary (2013) compared their results to those of Evans and Owens, they re-ran their specification with data restricted to that period. Their main results are for the period 1960 to 2010. For violent crime, they estimated an elasticity of  $-0.34$  for the full period,  $-0.63$  for the 1990s. For property crime, their estimates

were  $-0.17$  for the full period,  $-0.31$  for the 1990s. The 1990s police were more effective on average, as would be the case if productivity were rising. The differences, however, are probably not statistically significant.

If police productivity were increasing over this period at anything like the rate at which private sector productivity was increasing, it would be responsible for a large drop in crime. Of course, police may not be like the average private sector worker: the public sector may provide smaller rewards to innovation, reallocation of resources from less productive to more productive establishments is hard, and reallocation across sectors is by definition impossible. Increases in criminal productivity, moreover, may offset increases in police productivity. On the other hand, the federal government invested heavily in police-related research, starting in the 1970s, and much defense technology is transferable to policing. Police agencies were under considerable pressure to improve performance, and police executives under whom crime declined were rewarded well. Many police officers worked part-time in the private sector, and most prepared for a job in the private sector after retirement; they were not cut off from private sector advances. Television shows and movies continued to treat police officers as heroes. By how much could this sector lag behind the rest of the economy?

**Leaded gasoline** As we saw in Section 2, exposure to lead *in utero* and in childhood causes impulsiveness, aggressiveness, and low IQ in young adulthood, which plausibly cause violent crime. Lead in gasoline was phased out in the U.S. between 1975 and 1985. Reyes (2007) argues that this phaseout caused violent crime to fall in the 1990s. It had no measurable effect on murder and property crime.

This hypothesis is plausible and has some other implications that are borne out by the data. For instance, it implies bigger crime drops in areas where lead had been most pervasive in the atmosphere—large dense cities. Indeed, violent crime fell more in the largest cities than in less densely populated places. Thus removal of lead from gasoline explains part of the residual in the 1990s violent crime drop.

How much it explains is a more complex issue. Reyes runs regressions that imply that changes in the lead content of gasoline caused a 56 percent decline in violent crime between 1992 and 2002 (almost the same period that Levitt uses)—more than the entire actual decline in violent crime. Taken at face value, the result means that powerful forces were at work in the 1990s to raise the violent crime rate, but we do not know what these forces were. It replaces one hard question (what moved violent crime down?) with an even harder question (what would have moved violent crime up were it not for the phase-out of leaded gasoline?).

The leaded gasoline hypothesis is like the abortion hypothesis in many ways. Events at the beginning of a cohort's life alter the distribution of criminogenic characteristics in

that cohort; nothing happens for a decade or more; and then the effect bursts forth in lower crime rates when the cohort reaches crime-committing age. Reyes makes the analogy closer by using the same specification that Donohue and Levitt (2001) used and running it on almost the same set of years. (Reyes also includes the Donohue-Levitt “abortion rate” in her regressions and finds that this variable accounts for an additional 29 percent violent crime decrease—but no significant change in murder or property crime.)

The variable that Reyes uses for a state-year is the lead content of the average gallon of gasoline sold. This depends on the proportion of premium gas sold, and on the oil companies that dominate in that state and their relationship with the Environmental Protection Agency. The actual exposure of poor children to lead from that gasoline depends on the number of gallons used, the proportion of young children in the population, and the distance between young children and traffic. For four years, 1976-1979, Reyes has data on lead in children’s blood, and finds a correlation between that and the lead content of the average gallon, her independent variable. But the relationship is not tight: even with several covariates and multiple fixed effects,  $R^2$  is only 0.27 (Reyes, 2007, Table 3, Column 3).

Like the abortion hypothesis, the leaded gasoline hypothesis implies that the crime decline should be a cohort phenomenon, while it was in fact a year phenomenon: arrest rates for all cohorts turn around at about the same time. Unlike the abortion hypothesis, however, the leaded gasoline hypothesis is supported by some evidence that changes in lead exposure in the 1970s and 1980s altered behavior in dimensions other than crime. Reyes (2012) uses individual-level data to show that lead exposure *in utero* and in early childhood among cohorts born in the late 1970s and early 1980s led to increased behavior problems in childhood and in adolescence.

The individual-level data, however, do not imply changes in behavior problems as large as those that the state-level data implied for violent crime. For instance, the elasticity of “hitting and hurting someone” with respect to lead exposure is about half the elasticity of violent crime with respect to lead exposure. The leaded gasoline hypothesis thus probably explains a part of the violent crime residual. It is hard to evaluate because the relevant lead exposure has so far been only roughly approximated. For a variety of reasons having little to do with scientific merit, the lead hypothesis has attracted neither the attention nor the rigorous probing that the abortion hypothesis has had. That is unfortunate.

***In utero* exposure to tobacco and alcohol** We noted in Section 2.2.3 that people whose mothers smoked or drank alcohol during pregnancy were more likely to commit crimes, especially violent ones. Declines in maternal smoking and drinking might then cause crime declines fifteen to twenty years later. This possibility has not been systematically investi-

gated, to our knowledge, but it deserves serious consideration.

Smoking among pregnant women in the U.S. was once common. In 1964, in a large but not completely representative sample, nearly half of pregnant women in the third trimester smoked, with half a pack a day being the average consumption among smokers (Aizer and Stroud, 2011, pp.10-11). We do not have a time series on smoking by pregnant women. Smoking by educated women began to fall almost immediately after the Surgeon General's report on smoking in 1964, but less educated women did not react as quickly as more educated women did. The educational gradient in smoking became steeper between the 1960s and 1980, and so did the educational gradient in newborn health. After that, the gradients flattened, and returned to 1960s steepness in the early 21st century. Aizer and Stroud (2011) interpret this record as an indication that information about the baleful effects of smoking diffused more slowly among less educated women than among more educated women.

For crime, the behavior of less educated women may be more relevant. The Aizer-Stroud record thus suggests that maternal smoking in this group may have started to fall in the 1970s, and thus like legalized abortion and the leaded gasoline phase-out, produced less criminogenic cohorts coming of age in the 1990s.

Drinking by pregnant women was similarly unmeasured during the 1970s and 1980s. Drinking in general, though, seems to have peaked in the late 1970s, and so if pregnant women mirrored the general population, cohorts coming of crime-committing age in the mid to late 1990s would have had fewer criminogenic characteristics. In both government and private data, 1978 is the peak year for the proportion of the adult population who drank alcohol in the past month (U.S. Department of Health and Human Services, 1991; Newport, 2010). Fetal alcohol syndrome was identified and named in the medical literature in 1973 (Jones and Smith, 1973), and in 1981 the Surgeon General recommended that women abstain from alcohol while pregnant or planning a pregnancy. So awareness of the dangers of alcohol during pregnancy may have been rising before alcohol consumption in the general population peaked.

As with the other two cohort explanations (abortion and leaded gasoline), any attempt to demonstrate that changes in maternal smoking and drinking behavior caused part of the 1990s crime decline faces two hurdles. First, finding those changes will be hard. Second, cohort stories are not congruent with the almost simultaneous turn down in arrest rates for all age groups in the early 1990s.

**Psycho-pharmaceuticals** As we saw in Section 2, greater use of psycho-pharmaceuticals causes a reduction in violent crime (Cuellar and Markowitz, 2007; Marcotte and Markowitz, 2011). During the 1990s, the prevalence of mental illness did not increase, but the proportion

of mentally ill people receiving treatment grew by almost half (Marcotte and Markowitz, 2011). Most of the expansion of treatment used psycho-pharmaceuticals, and treatment in general shifted in that direction, with a number of new drugs coming on the market.

Marcotte and Markowitz find that “new generation anti-depressants” (NGAs) and stimulants reduced violent crime when they study the 1997-2004 period. The NGAs, Trazodone and Wellbutrin, were approved by the FDA only in 1988 and 1985 respectively. They estimated that increased prescription of NGAs was responsible for about 5 percent of the decline in violent crime between 1997 and 2004. If the same ratio held for 1991-2001, it would be responsible for about a 2 log point decrease.

**Interactions** As discussed in Section 4.5, the distribution of individuals across space and social networks matters when peer effects can influence crime (Glaeser et al., 1996). A change in the proportion of violent or desperate individuals in a community, for instance, can induce changes in the behavior of others. These effects are highly nonlinear: for instance, an even distribution across space of those most prone to violence is likely to result in a very different rate of homicide than one where such persons are concentrated in a few locations (O’Flaherty and Sethi, 2010c). In this case, responses to the many large changes in crime-relevant variables would be nonlinear, and attempts to find linear effects for smaller changes would fail to predict what happened in the 1990s.

**Private protection** Cook and MacDonald (2011, p.333) write about the attempts to explain the 1990s crime decline: “A surprising feature of this speculation has been the absence of attention to the role of private actions to prevent and avoid crime.” Anderson (1999) finds that private spending on crime prevention is of the same magnitude as public, and with fewer principal-agent problems it may be more effective. As we have seen in Section 4, the few private security initiatives that have been rigorously evaluated have been shown to be highly efficacious.

To the extent that private protection efforts have been measured, they expanded rapidly in the 1990s, and their productivity may have increased at least at the same rate as the average private sector activity. Cook and MacDonald (2011, p.335-336) show that security guards were already more numerous than police officers at the start of the decade, and their employment grew at approximately the same rate. The proportion of crimes reported to the police also grew; reporting a crime is an indispensable form of aid that private parties must provide if perpetrators are to be apprehended.<sup>59</sup>

---

<sup>59</sup>The rise in the reporting rate, however, may be a figment of selection. Within any category of crime, the more serious offenses are more likely to be reported. If crime fell selectively, with greater decreases in less serious crimes than in more serious ones, then the reporting rate would go up with no change in the

Business improvement districts (BIDs) also became more numerous in the 1990s. Although the first BID was established in 1970 (Bloor Street in Toronto), the major growth in the U.S. appears to have started in the 1980s. New York City has a good consistent history of BIDs. The first BIDs were established in the 1970s, usually in connection with specific attempted malls. In the 1980s, they spread quickly. In all, 31 of NYC's 67 BIDs were founded between 1980 and 1995. Weighting by size would make this concentration even more apparent. Of the four largest BIDs, those with annual assessments over \$9 million now, three were founded in the early 1980s (34th Street, Times Square Alliance, Grand Central Partnership), and one (the Downtown Alliance) was founded in 1988. The Furman Center for Real Estate and Urban Policy (2007) also suggests that the larger BIDs are more effective at reducing crime, since many of the smaller ones have almost no budget for security.

Houses also became safer, in part through the spread of gated communities (Helsley and Strange, 1999). The American Housing Survey (AHS) first collected information on "secure communities" in 2001; it found 7 million households in these communities. A more restrictive class in the AHS, secure communities with special entry systems, contained 4 million households. The number of people living in gated communities, and the proportion of people living in these communities, probably rose in the 1990s. So did the proportion of households with garages or carports—a deterrent to motor vehicle theft—even as the vehicles themselves became harder to steal.

Burglar alarms became cheaper, more effective, and more popular: the proportion of homes with alarm systems rose from 1 percent in 1975 to 25 percent in 2003 (Lee, 2008). Surveillance cameras also proliferated in the 1990s. These devices, more properly known as closed-circuit television (CCTV) systems, became practical in the 1970s when videocassette technology allowed pictures to be stored easily and recovered later; before that, CCTV required constant monitoring. The major technological breakthrough of the 1990s was the digital multiplexer, which allowed motion recording and permitted the output from several cameras to be recorded at the same time and stored cheaply and accessibly. The weight of research indicates that CCTV systems probably reduce property crime and possibly robbery, both to a modest degree; see Welsh and Farrington (2009) for a meta-analysis.

Electronic article surveillance—the tags placed on clothing and other merchandise that activate alarms or spill ink if they are removed from the store—also developed at about the same time. The first systems appeared in the 1970s, major technical advances were first made in the 1980s, and the technology has continued to improve. While these devices may have reduced actual shoplifting, their effect on reported shoplifting is ambiguous, since they

---

public disposition to report. O'Flaherty and Sethi (2008) show that for robberies, the average seriousness increased as the number fell.

cause a higher proportion of thefts to be detected.

**Electronic banking** The 1990s also saw the dissemination of electronic banking techniques. Although ATMs were invented in the late 1960s there were only 80,200 terminals processing 5.75 billion transactions in 1990. By 1999 these numbers had risen to 227,000 terminals and 10.89 billion transactions (Statistical Abstract, 2001, Table 820). ATMs allow consumers to make smaller and more frequent cash withdrawals, and allow businesses to make more frequent cash deposits. Thus both consumers and businesses can carry less cash and be less inviting targets for robbery, larceny, and burglary.

Other banking innovations allowed businesses and consumers to dispense with cash entirely. The proportion of households with at least one general purpose credit card rose from 56 percent in 1989 to 73 percent in 2002 (Statistical Abstract, 2012, Table 1189). Debit cards were used sparingly before 1990, but the number of point-of-sale (POS) terminals rose from 53,000 in 1990 to 2.35 million in 1999, and the number of POS transactions rose from 191 million in 1990 to 2.48 billion in 1999 (Statistical Abstract, 2000, Table 820). The proportion of households using debit cards rose from 20 percent in 1995 to 50 percent in 2001 (Statistical Abstract, 2012, Table 1185). Direct deposit also grew: 53 percent of households used direct deposit in 1995 and 71 percent in 2001 (Statistical Abstract, 2012, Table 1185).

Electronic banking also affected how governments disbursed benefits, especially to low-income, often unbanked households who were disproportionately victims of robbery and larceny. In the 1990s, the primary focus was on food stamps, a large program that gave low-income households a monthly allotment of paper stamps that they could exchange for food (and only food) at the stores of participating retailers. Food stamps were essentially cash, and could be exchanged reasonably easily in black markets. They were worth stealing. During the 1990s, most states, with federal assistance and urging, replaced paper food stamps with “electronic benefits transfer” (EBT) (Pirog and Johnson, 2008). Under EBT, recipients use debit cards or smart cards to purchase food, rather than stamps; they do not need bank accounts, and the cards are PIN-protected.

Other transfer programs lagged behind food stamps, but still reduced their reliance on paper. Temporary Assistance for Needy Families (TANF) provides income on a monthly basis for eligible families; in many states checks were all delivered on the same day, and recipients had to negotiate them and hold cash for the rest of the month. By 2003, 33 states delivered TANF benefits by debit or smart cards, and a few other states offered a direct deposit option. By 2001, 13 states delivered general assistance by EBT, 12 states delivered refugee assistance, and 9 states delivered Supplemental Security Income (SSI) (Stegman et al., 2003).

Social security payment systems also changed during the 1990s. The proportion of families using direct deposit was 50 percent in 1990; it was 75 percent in December 1998 and probably rose another several points by 2001. The Social Security Administration also started to spread the day of the month on which recipients received their benefits. Before 1997, all benefits were issued in the first week of the month; beginning in that year, the benefit days for new recipients were spread throughout the month (U.S. Social Security Administration, 2000, Chapter 5).

The effect of this revolution on crime has been little studied. The best recent paper is Wright et al. (2014), which examines the phase-in of EBT for food stamps and welfare payments in Missouri. EBT came to different counties at different times, and this variation allows the authors to identify changes in crime. EBT reduced assault, burglary, and larceny by about 10 percent in the average (population-weighted geometric mean) county. It did not have a significant effect on robbery, rape, or motor vehicle theft.

The results on assault and robbery are perhaps surprising, since robbery is an acquisitive crime and assault is not. Robbery in Missouri is heavily concentrated in a few counties, and so the authors believe that they do not have enough variation to see an effect at the county level. Why EBT should affect assault is a harder question. Perhaps the presence of cash leads to more frequent and more serious disputes, but we do not know what kind of disputes these are (for instance, whether they are over drugs or criminal activities or love or domestic responsibilities).

**Online shopping** Amazon customers cannot shoplift. Nor are they likely to be accosted while walking to the store, or to have their cars broken into in the store parking lot, or to leave their homes and allow a burglar to enter. Internet commerce is far from crime-free, but it probably reduces the exposure of both merchants and customers to traditional index crimes. Retail e-commerce rose from essentially nothing in 1991 to \$34.6 billion in 2001 (Statistical Abstract, 2012, Table 1055).

In all, during the 1990s people's lives changed in many ways that reduced index crime. Better cars, more security guards, BIDs, stronger houses, more garages, more secure communities, burglar alarms, surveillance cameras, ATMs, credit and debit cards, direct deposit, EBT, online shopping, and mobile phones—in all these ways safety increased. Property crime was probably affected the most, but robbery, a violent crime was also affected; O'Flaherty and Sethi (2009a) infer from rates of resistance and violence that "victim hardening" was part of the story of declining robbery, but the size of the contribution remains to be estimated.

### 6.2.3 Wrapping Up: The Great American Crime Decline of 1991-2001

After the traditional explanations were accounted for, we found yet-to-be-explained residuals of about 30 log points for murder, 20 for violent crime, and 10 for property crime. Unobserved net increases in police productivity should operate across the board, changes in how potential offenders grow up and their minds operate should affect mainly violent crime, changes in how potential victims live should affect mainly property crime, and interaction effects should affect mainly murder. The fall in murder seems to have the least explanation, but improvements in emergency medical treatment may play a role (however, offenders may offset these technological improvements with improvements of their own, like semi-automatics and high-caliber weapons). We probably could explain more of the murder decline, too, if we could explain why the crack epidemic happened in the 1980s and nothing like it recurred in the 1990s. The great American crime decline of the 1990s is not a mystery; we just do not know enough about the non-traditional explanations yet to tell the whole story.

## 6.3 The Modest American Crime Decline of the 21st Century

The American crime decline continued into the first decade of the 21st century, although the rate of decline slowed. While all four traditional explanatory variables moved in the direction of lower crime in the 1990s, only imprisonment moved in that direction in the 2000s, and the movement of imprisonment was small. Hence the residuals did not shrink much.

For comparability, we will continue to use the format Levitt (2004) adopted and follow murder, violent crime, and property crime for the period 2001-2011. During this period, UCR murder fell by 17.5 log points, violent crime by 26.5 log points, and property crime by 23 log points (within that category, motor vehicle theft fell by 62.7 log points).

On demography, the proportion of residents who were male and between 15 and 25 and 15 and 30 did not change between 2000 and 2010; so demography plays essentially no role in this decade. Per capita police fell by 2.9 log points, from 2.45 to 2.38. This should have increased crime slightly. The general unemployment rate rose from 4.2 percent in 2001 to 9.1 percent in 2011; this should also have increased property crime. The imprisonment rate rose only slightly, by 3.5 log points.

Table 4 redoes Table 3 for the period 2001-2011, following the same parameters. (“LP” means we use parameters from Levitt (2004), since he did not follow this decade.)

For murder and property crime, the traditional variables explain essentially none of the crime decline; it does not matter which parameters are used. The traditional variables project an increase in property crime, with the Levitt parameters projecting a smaller increase. In

Table 4: **Estimates of Log Point Changes in Crime Due to Changes in Traditional Variables, 2001-2011**

	Murder			Violent Crime			Property Crime		
	LP	Smaller	Bigger	LP	Smaller	Bigger	LP	Smaller	Bigger
Police size	+1		+2	+1		+2	+1	+0.5	
Prison	-1	-0.5		-1	-0.5		-1	-0.5	
Demography	0			0		0	0		0
Macroeconomy	0			0			+5		+10.5
Total	0	+0.5	+1	0	+0.5	+1	+5	+5	+10.5
Actual (UCR)	-17.5	-17.5	-17.5	-26.5	-26.5	-26.5	-23	-23	-23
Residual	-17.5	-18	-18.5	-26.5	-27	-27.5	-28	-28	-33.5

either case, the message is the same: the 2001-2011 crime decrease was entirely (or more than entirely) in the residual. The violent crime residual is about the same as the residual we estimated for the 1990s; the murder residual is smaller and the property crime residual is larger.

This result is encouraging for the speculation about the residual in Section 6.2.2, because many of the processes we thought might be producing the residual in the 1990s continued or intensified in the 2000s.

The data that Marcotte and Markowitz (2011) employ on the increased use of psychopharmaceuticals, for instance, extend to 2004. Labor productivity grew in the non-farm business sector at about the same rate (2.7 percent per year from 2000 to 2007, 1.9 percent a year from 2007 to 2012; versus 2.2 percent for 1990-2000), and defense and anti-terrorism research and investment were significant; hence there is no reason to expect a fall-off in police productivity growth. BID growth in New York City slowed but did not stop, and the rest of the country may have lagged behind New York.

Housing continued to become more secure. Surveillance cameras continued to spread, spurred in part by concern over terrorism; newspaper stories in 2013 about surveillance cameras in New York City apartment buildings asked not whether they would have them, but how many (Kaufman, 2013).

ATM and debit card usage continued to grow. From 2001 to 2007 the proportion of households using ATM cards rose from 57 percent to 76 percent, debit cards from 50 percent to 71 percent (Statistical Abstract, 2012, Table 1185). The volume of purchases with debit cards rose from \$311 billion in 2000 to \$1.45 trillion in 2009 (Statistical Abstract, 2012, Table 1187).

On the other hand, several processes that may have contributed to the 1990s residual were probably less important. There were 23 fewer executions in 2011 than 2001; on the

maximum estimates of the deterrent effect of capital punishment, this would have increased murders by one log point. Security guard employment grew, but not as fast as population, and the number of security guards per capita fell by 5 log points (U.S. Bureau of Labor Statistics, 2013b). The cohort effects from leaded gasoline and *in utero* exposure to tobacco and alcohol were still operating in the early 2000s, but not as strongly. Burglar alarms probably did not spread as quickly. Direct deposit reached 71 percent of households in 2001, and grew only to 80 percent by 2007 (Statistical Abstract, 2012, Table 1145). Although California was one of the few states that was late to switch to food stamp EBT, most (but not all) of the conversions took place before the turn of the century. (Social security added a debit card in 2008 to convert unbanked stragglers away from paper checks.) Similarly, credit card usage grew, but the rate of growth tapered off.

But other trends that reduced crime strengthened in the 21st century. Cars became much harder to steal, and older, easier-to-steal models disappeared from the streets. Online shopping volume rose from \$34.6 billion in 2001 to \$194 billion in 2011. Cell phone subscriptions rose from 128.4 million in 2001 to 300.5 million in 2011. Sophistication also grew. Cell phones became ubiquitous surveillance cameras, with everyone ready to take a picture anywhere any time. They also became sources of information; fewer people became lost, and even when they were lost they did not appear to be so. On the other hand, smart phones became attractive targets for robbery and theft, although technological solutions to this problem are likely before this paper is published (Chen, 2014).

Online shopping may also have extended to vice, most notably pornography and prostitution, probably with gains in security. (Prostitutes who do not solicit in public may still be victims of pathological murderers, but they and their customers are less likely to be victims of petty robbers.) It is possible that this trend has also affected the anonymous sale of illicit drugs. For instance, according to a federal indictment, the website Silk Road operated between 2011 and 2013 and “was used by several thousand drug dealers and other unlawful vendors to distribute hundreds of kilograms of illegal drugs and other illicit goods and services to well over a hundred thousand buyers” (U.S. District Court, Southern District of New York, 2013). Zimring (2011) argues that open-air drug markets have disappeared from New York City, but drug consumption has not fallen.

The spread of the internet per se may also have reduced index crime. To the extent that young men spent more time at home playing video games and chatting with friends, they may have spent less time outside where they could be either victims or offenders. Rational acquisitive criminals may have decided that the expected return from running online scams exceeded the expected return from stealing pocketbooks, and so redirected their attention. Cybercrimes are not index crimes, and the data show only that index crimes decreased in

this decade.

Thus the residuals in the 2000s are similar in size to the residuals in the 1990s, and so are the candidates to explain them.

## 6.4 Developed Countries in the 21st Century

Most of the candidates for explaining the residuals in the U.S. are varieties of technological change, either currently (electronic banking, for instance) or in the recent past (leaded gasoline, for instance), and so one would expect that other developed countries would experience similar trends. This does not imply that crime should actually fall in all developed countries, since the traditional factors can move in different directions; it implies only that the residuals should generally be negative.

As we saw in Table 2, the overwhelming direction of change in the four best-reported crimes has recently been negative in most OECD countries. This is despite the Great Recession and austerity programs, which have put pressure on police and prison budgets. Greece is an outlier: not surprisingly, crime rose in all categories there. Otherwise, the trend is clear and consistent. Aside from Greece, homicide went down in 21 of 23 countries, robbery in 15 of 21 countries, burglary in 17 of 18 countries, and motor vehicle theft in 18 of 18 countries. The median change (including Greece) was a decrease larger than the U.S. decrease in all crimes but robbery. The huge decrease in motor vehicle theft in high income countries is especially strong evidence for technological change.

We have not calculated residuals for all these countries, but doing so would be a valuable exercise.

## 6.5 The Great American Crime Rise, 1965-1975

Between 1965 and 1975, reported index crime in the U.S. basically doubled. Part of this increase probably came from better reporting (murder and motor vehicle theft showed slightly smaller increases than the other index crimes). As Table 5 shows, the rise was general throughout the country, although somewhat smaller in the South.

The rise also affected all types of communities, although it was greater in large (and medium-sized) cities. Sometimes the rise is thought of as occurring primarily among African Americans, but to the extent that arrests reflect actual offending, this does not appear to be the case, except possibly for motor vehicle theft. Table 6 shows the proportion of arrestees who were black for the various index crimes in 1966 and 1975. For the more serious crimes, this proportion generally declines by small amounts, and only for motor vehicle theft was there a substantial increase. Crime by whites almost certainly doubled in this decade, too.

Table 5: **Change in Murder and Motor Vehicle Theft, by Region, 1965-1975**

	Murder per capita			Motor theft per capita		
	1965	1975	75/65	1965	1975	75/65
New England	3.6	7.6	1.11	299.4	652.8	1.18
Mid Atlantic	4	8.9	1.23	282.6	534.1	0.89
North Central	3.7	8.1	1.19	244.5	431.4	0.76
WNC	3.1	5.5	0.77	176.4	328	0.86
South	8	12.7	0.59	175.7	329.8	0.88
ESC	8.4	12.7	0.51	130.6	273.3	1.09
WSC	7	12.4	0.77	178.5	351	0.97
West	4.2	9	1.14	351.5	539.1	0.53
Pacific	4.3	9.4	1.19	388.3	585	0.51
U.S.	5.1	9.6	0.89	254.4	469.4	0.85

Source: Uniform crime reports, 1966, 1975.

Table 6: **Proportion of Arrestees Who Were Black, 1966 and 1975**

	1966	1975
Murder	57.2%	54.4%
Rape	46.8%	45.4%
Robbery	57.7%	58.8%
Aggravated Assault	48.9%	39.5%
Burglary	31.4%	28.4%
Theft	29.7%	30.6%
Motor Vehicle Theft	19.6%	26.4%

Source: Uniform Crime Reports, 1966, 1975.

The traditional variables do not explain this crime rise. Police officers per 10,000 population rose from 1.7 to 2.1 (UCR), and prisoners per 100,000 rose from 108 to 111. These two changes should have decreased crime. On the other hand, unemployment rose from 4.6 percent in June 1965 to 8.8 percent in June 1975, which should have increased property crime, and much of the baby boom cohort came of crime-committing age. Zimring (2007), in analyzing a slightly different period (1960-1970) offers an estimate that changes in age-structure in that period would have increased index crime 13 percent. (We will use this figure for our table.)

Table 7 shows Levitt-style estimates for the traditional factors for the 1965-1975 period (along with Zimring's demographic estimate). The residuals are huge, and call for an explanation. Leaded gasoline is one possible factor. After World War II, driving increased and so did the lead content of gasoline. Cohorts who came of age in the 1960s and 1970s suffered from increasing exposure to lead *in utero* and in childhood. One strength of the lead hypothesis for the 1990s is that it also says something about the 1960s and 2000s.

Table 7: Estimates of Log Point Changes in Crime Due to Changes in Traditional Variables, 1965-1975

	Murder	Violent crime	Property crime
Police size	-8	-8	-8
Prison	-1	-1	-0.5
Demography	+13	+13	+13
Macroeconomy	0	0	+4
Total	+4	+4	+8.5
Actual change (UCR)	+63	+89	+76
Residual	+59	+85	+67.5

Aside from lead, no obvious hypotheses present themselves. Miron (1999) argues that the War on Drugs, which was declared in 1971, was responsible for much of the rise but the argument has not gained traction. A popular view is that crime rose among African Americans as a natural continuation of the 1960s riots, but whites did not riot in the 1960s and crime rose among them in parallel. The combination of a draft and an unpopular war may have reduced the threat of prison in the mid-1960s—how much worse was San Quentin than Khe Sanh?—but the draft was over by 1972. The completion of the interstate highway system and the expansion of air travel may have increased mobility and productivity among criminals with no corresponding gains in law enforcement productivity, but no serious research has been done on this topic.

Becker’s seminal article that launched the modern economics of crime was published in the midst of the great crime rise. Looking at residuals from this period is a good way of understanding why criminologists of that era were not impressed by what economists were doing. The economics of crime at this time was really about arranging the deck chairs on the Titanic. But no one has identified the iceberg yet. The great American crime rise remains a mystery, and a great topic for research.

## 7 Where are Crimes Committed?

Just as the traditional factors account for little of the interesting variation in index crime over time, they also seem to account for little of the interesting variation in crime over space. This is not to argue that a jurisdiction that abolished its police department or adopted capital punishment for jaywalking would look the same as the rest of the world. There just are no such jurisdictions.

Table 8: **Geographic concentration indices for crime and other phenomena**

	States	Intra-metropolitan (Newark)
Murder	0.0044	0.262
Rape	0.0031	0.073
Robbery	0.0028	0.181
Aggravated assault	0.0024	0.111
Burglary	0.0028	0.033
Larceny-theft	0.0013	0.010
Motor Vehicle theft	0.0156	0.188
Poverty (individuals)		0.077
Black population		0.095
Automobile mfg	0.127	
Automobile parts	0.089	
Photo equip.	0.174	
Carpet mfg.	0.378	
Soft drinks	0.005	
Manufactured ice	0.012	
Newspaper	0.002	
Misc. concrete	0.012	

## 7.1 Inter-Metropolitan Variation

Index crime, for the most part, is a non-tradable activity and so we do not expect to see specialization by metropolitan area. (Exceptions may be tied to the import of illicit drugs, but this is indirect; and for reasons of evasion, the dispersion of import facilities may be greater than that for legal and bulky commodities like automobiles.)

We computed the Ellison-Glaeser concentration index for each index crime on the state level from the 2012 Uniform Crime Reports. The values were in the same range as those for industries that Ellison and Glaeser (1997, p. 902) described as “industries that one could not imagine to be concentrated... the bottled and canned soft drink (SIC 2086), manufactured ice (SIC 2096), newspaper (SIC 2711), and miscellaneous concrete products (SIC 3272) industries.” Table 8 provides more detail.

In the U.S., crime is only weakly associated with larger metropolitan areas. Following Glaeser and Sacerdote (1996), we regressed the logarithm of crime per capita (from the 2012 Uniform Crime Reports), on the logarithm of population and a vector of region dummies (nine regions). Table 9 reports the results.

Rape, burglary, and larceny do not appear to be correlated with population size at all, while the elasticity of aggravated assault is small. But robbery, motor vehicle theft, and murder are considerably more prevalent in larger metropolitan areas.

In Canada, the relationship is weaker. Canada uses a “crime severity index,” which weights crimes by average sentence. The elasticity of the violent crime severity index with

Table 9: **Elasticities of Crime Rates with Respect to Population: U.S. Metropolitan Statistical Areas, 2012**

Murder	.16* (5.01)
Rape	-.02 (-0.79)
Robbery	.33* (13.28)
Aggravated assault	.08* (2.92)
Burglary	.01 (0.26)
Larceny-theft	.01 (0.55)
Motor Vehicle Theft	.23* (10.90)

Region fixed effects.

Number of observations: 353.  $t$ -values in parentheses. \*Significant at the 5% level.

Source: FBI, Crime in the United States, 2012, Table 6.

respect to population is an insignificant 0.05, and the elasticity of the total crime severity index is an insignificant  $-0.03$ ; the data are from Perreault (2013, Table 4).

Why robbery and motor vehicle theft should be strongly correlated with metropolitan area size in the U.S. is an open question that has not been investigated. For both crimes, the search for a suitable victim may be a large part of the cost of commission, and larger (and denser) metropolitan areas may be more attractive places to search. Murder and assault may be more prevalent in larger metropolitan areas because of historically higher levels of atmospheric lead, or because encounters between people that could escalate into conflicts are more common.

## 7.2 Intra-Metropolitan Variation

Intra-metropolitan concentration of crime seems to be greater than inter-metropolitan concentration.

We use the New Jersey part of the Newark metropolitan area as an example.<sup>60</sup> Six municipalities that have reputations as “rough towns” account for 24.9% of metropolitan area population and occupy 2.6% of the land, but in 2011 they were the location of 85.6% of

<sup>60</sup>The subparts of the Newark metropolitan area are: Newark, East Orange, Irvington, Orange, the balance of Essex County; Elizabeth, Plainfield, the balance of Union County; Hunterdon County; Morris County; Somerset County; and Sussex County. We omit Pike County, Pennsylvania, which represents less than 3 percent of the metropolitan area.

murders, 79.9% of robberies, 77.4% of motor vehicle thefts, and 73.4% of aggravated assaults. Burglary and larceny were not so heavily concentrated: only 51.8% of burglaries and 34.9% of thefts were reported in the six towns.

More formally, we computed Ellison-Glaeser concentration indices for crimes in the Newark metropolitan area. These are shown in Table 8.<sup>61</sup> Intra-metropolitan concentration, especially for murder, robbery, and motor vehicle theft, is much greater than inter-metropolitan concentration. We also computed concentration indices for poverty and for African-American population. Murder, robbery, and motor vehicle theft are more concentrated than these residential characteristics, but burglary and theft are not. (Aggravated assault is slightly more concentrated.)

Theft is by far the most numerous index crime—burglary is the second most numerous—and is also the least concentrated geographically. Hence analyses that focus on aggregate index crimes miss a great deal of concentration.

It is important to realize that these data are about where crimes are committed (or, in the case of murder, where bodies are found), not where criminals or victims live. In a metropolitan area, people cross municipal and neighborhood boundaries easily and often. Paramus, New Jersey, for instance, has one of the highest rates of theft in the state—not because its residents are disproportionately felonious or disproportionately easy marks, but because it is the home of several large malls. People go to Paramus from throughout the metropolitan area to shop, to work, to steal, and to be stolen from. Similarly murder in Newark is not restricted to Newark residents, on either side of the gun.

Finer partitions of geography also show great concentrations of crime. Within a city, a small number of “hot spots”—intersections or addresses—are sites of a disproportionate amount of crime, especially robbery and motor vehicle theft. Sherman et al. (1989) examined police calls for service during a year in Minneapolis. If calls were Poisson distributed with equal probability in all places, only 6854 places would have had no calls, and almost none would have had more than 14. But in fact, 45,561 places had no calls, and 3,841 had more than 15 calls. Those 3,841 places—3.3% of all the places in the city—generated 50.4% of all calls. Similarly, independent Poisson distributions imply that almost no place should have

---

<sup>61</sup>All measurements in Table 8 use the Ellison-Glaeser (1997) index of geographic concentration. For crimes and population characteristics, the index is  $G$ ; for industry employment the index is  $\gamma$ . Crime data reflects concentration of reported crime relative to total population. Crime and population data for states is from the 2012 Uniform Crime Reports. Crime and population for subparts of Newark metropolitan area are from 2011 annual report of the New Jersey State Police. Poverty data reflect persons in poverty relative to persons for whom poverty status is determined. The data source is the 2010-2012 American Community Survey, except for Irvington and Orange, for which the data source is the 2007-2009 American Community Survey. Race data reflects persons who identify as a member of one race, black or African-American, relative to total population. Data are from the 2007-2009 American Community Survey. Industry data reflect concentration of employment relative to total employment. These data are from Ellison and Glaeser (1997, p. 902).

seen more than two robbery calls or three motor vehicle theft calls, but 293 places had more than two robbery calls (one place had 28) and 541 places had more than three motor vehicle theft calls (one place had 33) (Sherman et al., 1989, Table 2).

What makes particular locations magnets for crime is a question that has received considerable attention. The traditional explanations for temporal variation probably cannot explain a large proportion of intra-metropolitan spatial variation (poverty is a possible exception, but we have already seen that serious crimes are more spatially concentrated than poverty). In the Newark metropolitan area, the towns with high crime are not conspicuous as magnets for young men, the prison system is the same for the entire metropolitan area (as we have defined it), and police strength works in the opposite direction (with 24.9% of population, the six towns employ 35% of the metropolitan area's non-civilian police employees).

### 7.3 Explaining Intra-Metropolitan Variation

The analysis of Sherman et al. (1989) suggests that crime ought to be viewed as being concentrated at *places*—defined as intersections or addresses—rather than neighborhoods. Even in high-crime neighborhoods the vast majority of places are crime free over substantial periods. Given the ability of victims to respond to criminal activity through avoidance or other precautions, this extreme concentration at places appears puzzling. For instance, consider the Minneapolis bar with the highest raw frequency of calls to police for predatory crimes in their data: “With 25 robberies in 1 year, and an estimated mean daily population of no more than 300, Moby Dick’s Bar had a robbery call rate of 83 per 1,000 persons—seven times higher than the call rate of 12 per 1,000 for the city’s entire 1986 estimated population of 362,000” (Sherman et al., 1989, p. 44).

It is important to bear in mind that this concentration is stable over time, and occurs even in the face of any adjustments in behavior by victims, police, or local business owners. Since potential victims tend to avoid places with a reputation for violent crime, and law enforcement officials tend to divert resources to such locations, the intra-metropolitan concentration of crime would be greater—perhaps substantially greater—in the absence of these mitigating effects. Accordingly, there must exist powerful forces that give rise to concentration.

Sherman et al. (1989) argue that some places—bars, liquor stores, adult theaters, or poorly lit parks—are *generators* rather than simply *receptors* of crime. Once establishments such as bars are in place, they cannot easily be moved in response to changes in the incidence of crime, nor can they easily alter the pool of individuals who congregate there. This can allow for concentration to persist even in the face of adjustment by potential victims.

Incapacitation of such places through better enforcement then need not lead to complete displacement to other locations.

While certain types of places may indeed be potential generators of crime, there remains the question of why they act that way in some neighborhoods but not in others. Bars and liquor stores may be overrepresented on the list of high crime establishments in a metropolitan area, but most bars and liquor stores are not high crime establishments. The neighborhood in which the establishments are located clearly matters. In particular, concentrated poverty and residential instability are known correlates of violent crime at the neighborhood level. Sampson et al. (1997) argue that this link operates through *collective efficacy*, understood as a combination of social cohesion and informal social control; these ideas were anticipated in Jacobs (1961). Social cohesion refers to shared values and mutual trust in a neighborhood, while informal social control refers to a willingness to interfere in the face of local activities that are potentially damaging to the neighborhood if left unchecked—painting graffiti, loitering on corners, and physical altercations, for instance. The authors use survey evidence to measure collective efficacy at the level of Chicago neighborhood clusters, and find it to be strongly correlated with measures of violent crime. They argue that the well established association between crime and neighborhood characteristics such as poverty and residential instability operates in part through the channel of collective efficacy. They do not test for causality.

Understanding the spatial distribution of index crimes within cities requires us to broaden our focus to consider street vice—prostitution, illegal gambling, and drug selling. These are transactions with diffuse demand that spans geographic areas, income levels, and identity groups, but highly concentrated supply, much of it in central city neighborhoods. Well developed theories of spatial competition descended from Hotelling (1929) and Salop (1979) can shed light on the concentration of street vice, and this in turn can help us understand the geographic distribution of index crimes. We consider here the case of drug selling, although similar arguments apply to other categories of street vice.

The sale of drugs involves fixed costs of protection, from rivals as well as from authorities. Sellers also use relatively unskilled, low wage labor. Buyers are thinly spread over a large area and face significant risks when transporting large amounts of cash or contraband. Accordingly they tend to make frequent small purchases. Under these conditions, the Salop (1979) model of spatial competition implies that areas with greater demand density will have more sellers per unit distance, as well as lower prices. Even if demand per unit population is uniform across locations, greater population density implies greater demand density, and hence inner cities will have lower prices and higher seller density than more sparsely populated suburbs. If trade between city and suburb is possible, competition from the city lowers

suburban prices and reduces suburban seller density. If this effect is sufficiently strong then all trade moves to the city, raising seller density and lowering prices there (O’Flaherty and Sethi, 2010a).

These considerations suggest that street vice will be most prevalent in centralized locations with high population density and low wages. But they do not account for the fact that at least in the United States, street vice is most prevalent in neighborhoods that are predominantly black. This is not a recent phenomenon. A century ago, Booker T. Washington (1915) spoke of vice being openly paraded in black neighborhoods, next to schools and churches, attracting white customers from well beyond the immediate vicinity. Decades later Myrdal (1944) described the concentration of speakeasies in black neighborhoods during the prohibition era, along with gambling dens, cabarets, and the sale of narcotics, all catering to a clientele that included whites from far flung locations. This racial character of the geography of vice requires explanation.

Unlike ordinary retail establishments, street vice imposes significant costs on local non-users. Drug sellers and their customers are attractive targets for robbers, since they are likely to be carrying cash or valuable contraband, and are not inclined to approach law enforcement if victimized. Disputes between sellers cannot be settled in courts, so the threat of violence is pervasive. The marginal penalties associated with killing are lower for those already engaged in an activity that carries heavy sentences. This makes drug sellers more likely to kill, and for reasons discussed in Section 4.5, also makes them more likely to be killed preemptively. Hence rates of robbery and homicide are liable to be high where street vice is prevalent. Illegal markets in general, and open-air markets in particular, are “high risk settings for violence” (Reiss and Roth, 1993, p. 18).

These negative externalities make departure from afflicted neighborhoods attractive for those who can afford to leave, at least among the population of non-users. Vice will be prevalent in neighborhoods with low incomes and low property values. Even modest preferences over neighborhood racial composition can then lead to the exodus from such neighborhoods of low income whites. This process is self-reinforcing: if most whites leave, then the few who remain will be stereotyped as buyers from outside the neighborhood, and may themselves be victimized more frequently than blacks of similar income. As a result street vice can come to be correlated with race, not because vice originates in or moves to black neighborhoods, but because its presence sets in motion movements of people that transform the racial character of residential locations (O’Flaherty and Sethi, 2010a).<sup>62</sup>

As with any retail operation, street vice requires coordinated expectations between buyers

---

<sup>62</sup>This dynamic reinforces the segregating effect of racial stereotypes discussed in Section 4.3; whites exit from high crime neighborhoods more readily than blacks of comparable income because the former are stereotyped as being more compliant, and are therefore targeted by robbers at greater rates.

and sellers regarding what can be found at which prices and locations. Two street corners that are otherwise quite similar may come to be very different over time with respect to their respective customer pools. More generally, locations will differ with respect to how lucrative they are for those who occupy them. The most desirable locations will tend to be occupied by the best protected sellers, who can fend off attempts at displacement. With well settled expectations regarding turf, drug selling can proceed without frequent or extreme violence. But a disruption in these expectations can cause homicide levels to spike.

Sometimes such disruptions can come from the activities of law enforcement agents. If the police successfully target the most active and lucrative location and incapacitate the incumbent sellers there, competition for the vacated spots can result in violence. Bearing this in mind, a better strategy for law enforcement might be to target the *least* lucrative locations first, and ratchet upwards towards more active and better protected areas. This strategy may take longer to have an impact on drug sales, but is less likely to precipitate a spike in homicide.

Evidence for the importance of this effect is provided by Dell (2012), who uses the outcomes of close municipal elections in Mexico as an identification strategy. In jurisdictions that narrowly elected mayors belonging to the conservative PAN party, enforcement actions increased significantly (relative to jurisdictions in which PAN party candidate narrowly lost). The proposed mechanism was greater cooperation between local authorities and the federal administration of Felipe Calderón of the PAN party over the 2006-2012 period. Greater enforcement at these locations diverted drug trafficking to less heavily monitored routes to the lucrative U.S. market. Working with a network model that predicts these alternative pathways, Dell finds significant increases in violence at these newly contested locations, and plausibly interprets these increases as arising from competition among rival organizations for “control of territories after crackdowns... have weakened the incumbent traffickers.”

## 7.4 Inter-Jurisdiction Variation

Economists have also looked at whether crime is greater in larger jurisdictions (it is) and why. Glaeser and Sacerdote (1999) is the major paper exploring this question. They concentrated on total index crime, a number dominated by theft and burglary, and we have seen that spatial variation in these crimes differs from spatial variation in the other index crimes. They also use crime data for 1982, after the great American crime rise occurred but before the great American crime decline began, and that crime decline was especially strong in the two largest jurisdictions, New York City and Los Angeles. (Some high-crime cities like Detroit and Philadelphia have also lost population since 1982, while some low-crime cities

Table 10: **Elasticities of Crime Rates with Respect to Population: U.S. Police Jurisdictions with over 25,000 people, 2012**

	Observations	Elasticities
Murder	951	.07* (2.25)
Rape	1474	.14* (5.76)
Robbery	1571	.59* (18.67)
Aggravated assault	1578	.38* (13.27)
Burglary	1580	.20* (9.01)
Larceny-theft	1581	.10* (7.08)
Motor Vehicle Theft	1581	.43* (14.82)

Region fixed effects. Number of observations differs because of zeroes and missing values.  $t$ -values in parentheses. \*Significant at the 5% level. Source: FBI, Crime in the United States, 2012, Table 8.

have grown.)

In Table 10 therefore, we roughly redo the Glaeser and Sacerdote analysis with 2012 UCR crime data. (They restricted their sample to cities over 25,000 population for which complete information was available in the City and County Data Book, but the City and County Data Book was no longer published in 2012.)

The elasticities are somewhat larger than those for metropolitan areas (except for murder, where the exclusion of jurisdictions with zero murders may be affecting the coefficient), but follow the same basic pattern: location matters more for robbery and motor vehicle theft, less for larceny-theft and burglary. Glaeser and Sacerdote offer some theories on why these elasticities should be positive, and test them. The most powerful variable for explaining the positive elasticity of total index crime is the proportion of mothers without partners living in the jurisdiction. Something about larger jurisdictions attracts (or propagates) single mothers (or drives married mothers out), and single mothers attract (or propagate) crime.

What is missing from this analysis is an economic theory of jurisdictions. The theories that Glaeser and Sacerdote offer are in fact theories about metropolitan areas. There are several good economic theories about what determines the size of metropolitan areas, and how big metropolitan areas differ from small ones. There are no comparable theories about jurisdictions. This makes it hard to interpret their results.

## 8 Conclusions

Crime, as we have seen, is a rich and complex object of study. Its incidence depends not just on police and prisons, but on the air we breathe (or breathed when we were children), what our mothers drank, what our windows are made of, how we enter our cars, how we pay our bills, whether the home football team won, and so on. The topic is rich because crime covers a wide array of activities—from poisoning a former lover’s goldfish to robbing a bank to joyriding in a borrowed car to assassinating a rival drug dealer—that are joined together only by being proscribed. But it is also rich because of the complexity of modern urban life. General equilibrium, rather than incentives, may turn out to be the big idea that economics brings to the study of crime.

Because crime is tightly integrated with the rest of life, crime changes when technology changes. We emphasized a positive role for technology when we discussed the last two decades’ drops in victimization. But if we leave aside the restriction to index crimes, it is not absurd to argue that we are currently experiencing the worst crime wave ever. For 2012, the NCVS found that 26.5 million index crime victimizations occurred in the U.S., but in just a few weeks from November 27 to mid-December 2013, between 70 and 110 million people had valuable financial information stolen from them at a single source (Harris and Perlroth, 2014). Phishing emails and online scams can target millions of potential victims at a stroke, while cyberstalking and cyberbullying can be as devastating to a victim as larceny or assault.

What the future brings we have no idea. Civilian drones may help some police departments, but they can also transport drugs, enter houses and steal jewelry, and spy on police and security guards. The first civilian murder by drone may very well occur before this volume is published. Autonomous cars similarly open up exciting new opportunities for carjacking. Technology is a horse race between those who want to commit crimes and those who don’t want them to, and we are not placing any bets.

The character of crime will change, and with it will change the nature of the questions that economists are called upon to answer. We cannot predict these developments with much confidence, but of one thing we can be sure: the conflict between Lombroso and Beccaria, between incapacitation and deterrence, between prediction and detection will remain central to our understanding of crime and punishment.

## References

- Alberto Abadie and Sofia Dermisi. Is terrorism eroding agglomeration economies in central business districts? lessons from the office real estate market in downtown chicago. *Journal of Urban Economics*, 64(2):451–463, 2008.
- Anna Aizer and Joseph J. Doyle, Jr. Juvenile incarceration, human capital and future crime: Evidence from randomly-assigned judges. National Bureau of Economic Research, 2013.
- Anna Aizer and Laura Stroud. Education, knowledge, and the evolution of disparities in health. Working Paper, Brown University, 2011.
- Omolara Jean Akinbami, Xiang Liu, Patricia N Pastor, and Cynthia A Reuben. *Attention deficit hyperactivity disorder among children aged 5-17 years in the United States, 1998-2009*. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, 2011.
- Michelle Alexander. *The new Jim Crow: Mass incarceration in the age of colorblindness*. The New Press, 2010.
- Joseph G. Altonji and Ulrich Doraszelski. The role of permanent income and demographics in black/white differences in wealth. *Journal of Human Resources*, 40(1):1–30, 2005.
- Elizabeth O. Ananat, Jonathan Gruber, Philip Levine, and Douglas Staiger. Abortion and selection. *National Bureau of Economic Research working paper 12150*, 2006.
- Elizabeth O. Ananat, Jonathan Gruber, Philip Levine, and Douglas Staiger. Abortion and selection. *Review of Economics and Statistics*, 91(1):124–136, 2009.
- David A. Anderson. The aggregate burden of crime. *Journal of Law and Economics*, 42: 611–642, 1999.
- Heather Antecol and Kelly Bedard. Does single parenthood increase the probability of teenage promiscuity, substance use, and crime? *Journal of Population Economics*, 20(1): 55–71, 2007.
- Shamena Anwar and Hanming Fang. An alternative test of racial prejudice in motor vehicle searches: Theory and evidence. *American Economic Review*, 96(1):127–151, 2006.
- Yuval Arbel, Danny Ben-Shahar, Stuart Gabriel, and Yossef Tobol. The local cost of terror: Effects of the second palestinian intifada on jerusalem house prices. *Regional Science and Urban Economics*, 40(6):415–426, 2010.

- Ian Ayres. *Pervasive Prejudice? Unconventional Evidence of Race and Gender Discrimination*. University of Chicago Press, Chicago, 2001.
- Ian Ayres and Steven D. Levitt. Measuring positive externalities from unobservable victim precaution: An empirical analysis of lojack. *The Quarterly Journal of Economics*, 113(1): 43–77, 1998.
- Sandeep Baliga and Thomas Sjöström. Arms races and negotiations. *Review of Economic Studies*, 71(2):351–369., 2004.
- Alessandro Barbarino and Giovanni Mastrobuoni. The incapacitation effect of incarceration: Evidence from several Italian collective pardons. *American Economic Journal: Economic Policy*, 6(1):1–37, 2014.
- Patrick Bayer, Randi Hjalmarsson, and David Pozen. Building criminal capital behind bars: Peer effects in juvenile corrections. *The Quarterly Journal of Economics*, 124(1), 2009.
- Cesare Beccaria. *On Crimes and Punishments (Dei Delitti e Della Pene)*. James Donaldson, Edinburgh, 1764. English translation, 1788.
- Gary Becker. Crime and punishment: An economic approach. *Journal of Political Economy*, 76(2):169–217, 1968.
- Gary S. Becker. *The Economics of Discrimination*. Chicago: University of Chicago Press, 1957.
- Richard A. Berk and David Rauma. Capitalizing on nonrandom assignment to treatments: A regression-discontinuity evaluation of a crime-control program. *Journal of the American Statistical Association*, 78(381):21–27, 1983.
- David Bjerk. Racial profiling, statistical discrimination, and the effect of a colorblind policy on the crime rate. *Journal of Public Economic Theory*, 9(3), 2007.
- Francine D. Blau and John W. Graham. Black-white differences in wealth and asset composition. *Quarterly Journal of Economics*, 105(2):321–339, 1990.
- S. Brock Blomberg and Stephen Sheppard. The impacts of terrorism on urban form. *Brookings-Wharton papers on urban affairs*, pages 257–290, 295–296, 2007.
- Charles Blow. The whole system failed Trayvon Martin. *New York Times*, July 15, 2013.
- Alfred Blumstein and Joel Wallman, editors. *The Crime Drop in America*. New York: Cambridge University Press, 2000.

- Alfred Blumstein and Joel Wallman, editors. *The Crime Drop in America, Revised Edition*. New York: Cambridge University Press, 2006a.
- Alfred Blumstein and Joel Wallman. The crime drop and beyond. *Annual Review of Law and Social Science*, pages 125–146, 2006b.
- Anthony Braga. *Crime Prevention Research Review No. 2: Police Enforcement Strategies to Prevent Crime in Hot Spot Areas*. U.S. Department of Justice, Office of Community Policing Strategies, Washington, D.C., 2008.
- Paolo Buonanno and Leone Leonida. Education and crime: evidence from italian regions. *Applied Economics Letters*, 13:709–713, 2006.
- Paolo Buonanno and Steven Raphael. Incarceration and incapacitation: Evidence from the 2006 italian collective pardon. *American Economic Review*, 103(6):2437–2465, 2013.
- Bureau of Justice Statistics. Sourcebook of Criminal Justice Statistics, Various Years.
- Shawn Bushway and Raymond Paternoster. The impact of prison on crime. *Do prisons make us safer? The benefits and costs of the prison boom*, 2009.
- Shawn D. Bushway, Michael A. Stoll, and David Weiman, editors. *Barriers to Reentry? The Labor Market for Released Prisoners in Post-industrial America*. Russell Sage Foundation, New York, 2007.
- David Card, Alexandre Mas, and Jesse Rothstein. Tipping and the dynamics of segregation. *Quarterly Journal of Economics*, 123(1):177–218, 2008.
- P. Carneiro and R. Ginja. Preventing behavior problems in childhood and adolescence. *University of Pennsylvania working paper*, 2008.
- Aaron Chalfin and Justin McCrary. The effect of police on crime: New evidence from U.S. cities, 1960-2010. National Bureau of Economic Research Working Paper 18815, 2013.
- Kerwin Kofi Charles, Erik Hurst, and Nikolai Roussanov. Conspicuous consumption and race. *The Quarterly Journal of Economics*, 124(2):425–467, 2009.
- Brian X. Chen. Smartphones embracing theft defense. *New York Times*, June 20, 2014.
- M. Keith Chen and Jesse M. Shapiro. Do harsher prison conditions reduce recidivism? a discontinuity-based approach. *American Law and Economics Review*, 9(1):1–29, 2007.

- Cheng Cheng and Mark Hoekstra. Does strengthening self-defense law deter crime or escalate violence? evidence from castle doctrine. National Bureau of Economic Research Working Paper, 2012.
- Jean Y. Choe, Linda A. Teplin, and Karen M. Abram. Perpetration of violence, violent victimization, and severe mental illness: Balancing public health concerns. *Psychiatric Services*, 59(2):153–164, 2008.
- Todd R. Clear. *Imprisoning communities: How mass incarceration makes disadvantaged neighborhoods worse*. Oxford University Press, 2007.
- Ronald H. Coase. The problem of social cost. *Journal of Law and Economics*, 3(1):1–44, 1960.
- Philip Cook and Jens Ludwig. Aiming for evidence-based gun policy. *Journal of Policy Analysis and Management*, 25(3):691–735, 2006.
- Philip J Cook. Costs of crime. In Sanford H. Kadish, editor, *Encyclopedia of Crime and Justice*. New York: Free Press, 1983.
- Philip J. Cook. The demand and supply of criminal opportunities. *Crime and Justice*, 7: 1–27, 1986.
- Philip J Cook and Jens Ludwig. Economical crime control. National Bureau of Economic Research Working Paper, 2010.
- Philip J. Cook and John MacDonald. The role of private action in controlling crime. In Philip J. Cook, Jens Ludwig, and Justin McCrary, editors, *Controlling Crime: Strategies and Tradeoffs*. University of Chicago Press, 2011.
- Hope Corman, Dhaval Dave, and Nancy Reichman. Effects of welfare reform on women’s crime. *National Bureau of Economic Research working paper 18887*, 2013.
- Decio Coviello and Nicola Persico. An economic analysis of black-white disparities in NYPD’s stop and frisk program. NBER Working Papers 18803, National Bureau of Economic Research, Inc, 2013.
- Alison E Cuellar and Sara Markowitz. Medicaid policy changes in mental health care and their effect on mental health outcomes. *Health Economics, Policy, and Law*, 2(1), 2007.
- Julie Cullen, Brian Jacob, and Steven Levitt. The effect of school choice on participants: Evidence from randomized lotteries. *Econometrica*, 74:1191–1230, 2006.

- Marah Curtis, Sarah Garlington, and Lisa S. Schottenfield. Alcohol, drug, and criminal history restrictions in public housing. *Cityscape: A Journal of Policy Development and Research*, 15(3):37–52, 2013.
- David M. Cutler, Edward L. Glaeser, and Jacob L. Vigdor. The rise and decline of the American ghetto. *Journal of Political Economy*, 107(3):455–506, 1999.
- Melissa Dell. Trafficking networks and the Mexican drug war. Working Paper, Harvard University, 2012.
- D. Deming. Early childhood intervention and life-cycle skill development. *American Economic Journal: Applied Economics*, 1(3):111–134, 2009.
- David J Deming. Better schools, less crime? *The Quarterly Journal of Economics*, 126(4): 2063–2115, 2011.
- Dhammika Dharmapala and Stephen L. Ross. Racial bias in motor vehicle searches: additional theory and evidence. *Contributions in Economic Analysis and Policy*, 3(1), 2004.
- Rafael Di Tella and Ernesto Schargrodsky. Do police reduce crime? estimates using the allocation of police forces after a terrorist attack. *American Economic Review*, 94(1): 115–133, 2004.
- Rafael Di Tella and Ernesto Schargrodsky. Criminal recidivism after prison and electronic monitoring. National Bureau of Economic Research Working Paper, 2009.
- John Donohue. Assessing the relative benefits of incarceration: The overall change over the previous decades and the benefits on the margin. *Do Prisons Make Us Safer? The Benefits and Costs of the Prison Boom*, 2009.
- John Donohue and Steven Levitt. The impact of legalized abortion on crime. *Quarterly Journal of Economics*, 116(2):379–420, 2001.
- John Donohue and Steven D Levitt. Further evidence that legalized abortion lowered crime: A reply to joyce. *Journal of Human Resources*, 39(1), 2004.
- John J Donohue and Steven D Levitt. Measurement error, legalized abortion, and the decline in crime: A response to foote and goetz. *The Quarterly Journal of Economics*, 123(1): 425–440, 2008.

- Mirko Draca, Stephen Machin, and Robert Witt. Panic on the streets of london: Police, crime, and the july 2005 terror attacks. *American Economic Review*, 101(5):2157–2181, 2011.
- Francesco Drago and Roberto Galbiati. Indirect effects of a policy altering criminal behaviour: Evidence from the italian prison experiment. *American Economic Journal: Applied Economics*, 4(2):199–218, 2012.
- Francesco Drago, Roberto Galbiati, and Pietro Vertova. The deterrent effects of prison: Evidence from a natural experiment. *Journal of Political Economy*, 117(2), 2009.
- Steven N. Durlauf and Daniel S. Nagin. The deterrent effect of imprisonment. In Philip J. Cook, Jens Ludwig, and Justin McCrary, editors, *Controlling Crime: Strategies and Trade-offs*, pages 43–94. University of Chicago Press, Chicago and London, 2011.
- Richard Easterlin. Relative economic status and the American fertility swing. In Eleanor Sheldon, editor, *Family Economic Behavior: Problems and Prospects*. Philadelphia: Lippincott, 1973.
- J. E. Eck and E.R. Maguire. Have changes in policing reduced violent crime? an assessment of the evidence. In Blumstein and Wallman, editors, *The Crime Drop in America*. New York: Cambridge University Press, 2000.
- Isaac Ehrlich. Participation in illegitimate activities: A theoretical and empirical investigation. *Journal of Political Economy*, 81(3):521–565, 1973.
- Glenn Ellison and Edward L. Glaeser. Geographic concentration in u.s. manufacturing industries: A dartboard approach. *Journal of Political Economy* 105(5): 889–927, 105(5): 889–927, 1997.
- European Sourcebook of Crime and Criminal Justice Statistics. Universite de Lausanne, Institut de criminology and de droit penal, 2010.
- William N. Evans and Emily G. Owens. Cops and crime. *Journal of Public Economics*, 91(1):181–201, 2007.
- Jeffrey Fagan. Expert Report submitted to United States District Court Southern District of New York in *Floyd v. City of New York*, 2010.
- Pablo Fajnzylber, Daniel Lederman, and Norman Loayza. What causes violent crime? *European Economic Review*, 46(7):1323–1357, 2002.

- Reynolds Farley and William H. Frey. Changes in the segregation of whites from blacks during the 1980s: Small steps toward a more integrated society. *American Sociological Review*, 59(1):23–45, 1994.
- Mark S Fleisher and Scott H Decker. An overview of the challenge of prison gangs. *Corrections Management Quarterly*, 5, 2001.
- Richard G. Frank and Thomas G. McGuire. Mental health treatment and criminal justice outcomes. In Philip Cook, Jens Ludwig, and Justin McCrary, editors, *Controlling Crime: Strategies and Payoffs*. University of Chicago Press, Chicago and London, 2011.
- Richard B. Freeman. Why do so many young american men commit crimes and what might we do about it? *Journal of Economic Perspectives*, 10:25–42, 1996.
- Richard B. Freeman. Does the booming economy help explain the fall in crime? In *Perspectives in Crime and Justice: 1999-2000 Lecture Series, NCJ 184245*, pages 23–43. Washington, D.C.: National Institute of Justice, 2001.
- Roland G. Fryer, Paul S. Heaton, Steven D. Levitt, and Kevin M. Murphy. Measuring crack cocaine and its impact, 51(3): 1651-1681. *Economic Inquiry*, 51(3):1651–1681, 2013.
- Furman Center for Real Estate and Urban Policy. The benefits of business improvement districts: Evidence from New York City. Policy Brief, New York University, 2007.
- Sebastian Galliani, Martin A. Rossi, and Ernesto Schargrotsky. Conscription and crime: Evidence from the argentine draft lottery. *American Economic Journal: Applied Economics*, 3(2):119–136, 2011.
- E. Garces, Duncan Thomas, and Janet Currie. Longer-term effects of head start. *American Economic Review*, 92:999–1012, 2002.
- Pieter A. Gautier, Arjen Siegmans, and Aico Van Vuuren. Terrorism and attitudes towards minorities: The effect of the theo van gogh murder on house prices in amsterdam. *Journal of Urban Economics*, 65(2):113–126, 2009.
- Andrew Gelman, Jeffrey Fagan, and Alex Kiss. An Analysis of the New York City Police Department’s “Stop-and-Frisk” Policy in the Context of Claims of Racial Bias. *Journal of the American Statistical Association*, 102(479):813–823, 2007.
- Edward L. Glaeser. The impacts of terrorism on urban form [comment]. *Brookings-Wharton papers on urban affairs*, pages 291–294, 2007.

- Edward L. Glaeser and Bruce Sacerdote. Why is there more crime in cities? *Journal of Political Economy*, 107(S6):S225–S258, 1999.
- Edward L. Glaeser and Jesse M. Shapiro. Cities and warfare: The impact of terrorism on urban form. *Journal of Urban Economics*, 51(2):205–224, 2002.
- Edward L. Glaeser, Bruce Sacerdote, and Jose A. Scheinkman. Crime and social interactions. *The Quarterly Journal of Economics*, 111(2):pp. 507–548, 1996.
- Lauren E. Glaze. Correctional populations in the United States 2009. *US Bureau of Justice Statistics*, NCJ 231681, 2010.
- Eric D. Gould, Bruce A. Weinberg, and David B. Mustard. Crime rates and local labor market opportunities in the United States: 1979–1997. *Review of Economics and Statistics*, 84(1):45–61, 2002.
- Jeffrey Grogger. Market wages and youth crime. *Journal of Labor Economics*, 16:756–791, 1998.
- Pauline Grosjean. A history of violence: The culture of honor and homicide in the U.S. South. *Journal of the European Economic Association*, forthcoming, 2014.
- William T. Harbaugh, Naci H. Mocan, and Michael S. Visser. Theft and deterrence. NBER working paper 17059, 2001.
- Bernard E Harcourt. *Against prediction: profiling, policing, and punishing in an actuarial age*. University of Chicago Press, 2006.
- Elizabeth A. Harris and Nicole Perlroth. For Target, the breach numbers grow. *New York Times*, January 11, 2014.
- E. Helland and Alexander Tabarrok. Does three strikes deter? a nonparametric estimation. *Journal of Human Resources*, 42(2):309–330, 2007.
- Sara Heller, Harold A. Pollack, Roseanna Ander, and Jens Ludwig. Preventing youth violence and dropout: A randomized field experiment. *National Bureau of Economic Research working paper 19014*, 2013.
- Robert W. Helsley and William C. Strange. Gated communities and the economic geography of crime. *Journal of Urban Economics* 46(1): 80-105., 46(1):80–105, 1999.
- Robert W. Helsley and William C. Strange. Mixed markets and crime. *Journal of Public Economics*, 89(7):1251–1275, 2005.

- Patrick L. Hill, Brent W. Roberts, Jeffrey T. Grogger, Jonathan Guryan, and Karen Sixkiller. Decreasing delinquency, criminal behavior, and recidivism by intervening on psychological factors other than cognitive ability: A review of the intervention literature. In Philip Cook, Jens Ludwig, and Justin McCrary, editors, *Controlling Crime: Strategies and Payoffs*, National Bureau of Economic Research Conference Report. University of Chicago Press, Chicago and London, 2011.
- Albert O. Hirschman. *Exit, Voice, and Loyalty: Responses to Decline in Firms, Organizations, and States*. Harvard University Press, 1970.
- Harry J Holzer. Collateral costs: Effects of incarceration on employment and earnings among young workers. In Steven Raphael and Michael A. Stoll, editors, *Do Prisons Make Us Safer? The Benefits and Costs of the Prison Boom*, pages 239–268. New York: Russell Sage, 2009.
- H. Hotelling. Stability in competition. *Economic Journal*, 39:41–57, 1929.
- Ayşe Imrohoroglu, Antonio Merlo, and Peter Rupert. What accounts for the decline in crime? *International Economic Review*, 45(3):707–729, 2004.
- International Centre for Prison Studies. World Prison Population List (ninth edition), 2011.
- Brian A Jacob and Lars Lefgren. Are idle hands the devil’s workshop? incapacitation, concentration and juvenile crime. Technical report, National Bureau of Economic Research, 2003.
- Jane Jacobs. *The death and life of great American cities*. Random House LLC, 1961.
- Rucker Johnson. Ever-increasing levels of parental incarceration and the consequences for children. *Do prisons make us safer? The benefits and costs of the prison boom*, pages 177–206, 2009.
- Rucker C. Johnson and Steven Raphael. How much crime reduction does the marginal prisoner buy? *Journal of Law and Economics*, 55(2):275–310, 2012.
- Ryan S. Johnson, Shawn Kantor, and Price V. Fishback. Striking at the roots of crime: The impact of social welfare spending on crime during the great depression. NBER working paper 12825, 2007.
- K.L. Jones and D.W. Smith. Recognition of the fetal alcohol syndrome in early infancy. *Lancet*, 2:999–1001, 1973.

- Theodore J. Joyce. Abortion and crime: A review. *National Bureau of Economic Research working paper 15098*, 2009.
- Lawrence Katz, Steven D. Levitt, and Ellen Shustorovich. Prison conditions, capital punishment, and deterrence. *American Law and Economics Review*, 5(2):318–343, 2003.
- Joanne Kaufman. The building has 1,000 eyes: Residences large and small, doorman or no, are stepping up their reliance on surveillance cameras. *New York Times*, October 6, 2013.
- Todd D. Kendall and Robert Tamura. Unmarried fertility, crime and social stigma. *Journal of Law and Economics*, 53(1):185–221, 2010.
- David Kennedy, Anthony Braga, Anne Piehl, and E. Waring. *Reducing Gun Violence: The Boston Gun Project's Operation Ceasefire*. National Institute of Justice, Washington, D.C., 2001.
- Ronald C. Kessler, Leonard Adler, Russell Barkley, Joseph Biederman, Keith Conners, Olga Demler, Stephen V. Faraone, Laurence L. Greenhill, Mary J. Howes, Kristina Secnik, Thomas Spencer, Bedirhan Ustan, Ellen E. Walters, and Alan Zaslavsky. The prevalence and correlates of adult adhd in the united states: Results from the national comorbidity survey replication. *American Journal of Psychiatry*, 163:716–723, 2006.
- Mark Kleiman. *When Brute Force Fails: How to Have Less Crime and Less Punishment*. Princeton University Press, 2009.
- Jonathan Klick and Alexander Tabarrok. Using terror alert levels to estimate the effect of police on crime. *Journal of Law and Economics*, 48(1):267–279, 2005.
- Jeffrey R. Kling. Incarceration length, employment, and earnings. *The American Economic Review*, 96(3):863–876, 2006. National Bureau of Economic Research working paper 12003.
- John Knowles, Nicola Persico, and Petra Todd. Racial bias in motor vehicle searches: Theory and evidence. *Journal of Political Economy*, 109(1):203–229, 2001.
- David Kocieniewski. A little girl shot, and a crowd that didn't see. *New York Times*, July 9, 2007.
- Besiki Kutateladze, Vanessa Lynn, and Edward Liang. Do race and ethnicity matter in prosecution? A review of empirical studies. Vera Institute of Justice, New York., 2012.
- Ilyana Kuziemko and Steven D Levitt. An empirical analysis of imprisoning drug offenders. *Journal of Public Economics*, 88(9), 2004.

- David Lee and Justin McCrary. The deterrent effect of prison. *Princeton University Department of Economics working paper*, 2009.
- Seungmug Lee. *The impact of burglar alarm systems on residential burglaries*. PhD thesis, Rutgers School of Criminal Justice, 2008.
- Amy E Lerman. The people prisons make: effects of incarceration on criminal psychology. *Do Prisons Make Us Safer?: The Benefits and Costs of the Prison Boom*, pages 151–176, 2009.
- Phillip B. Levine, Douglas Staiger, J. Kane, and D.J. Zimmerman. Roe v. Wade and American fertility. *American Journal of Public Health*, 89(2):199–203, 1999.
- Steven D Levitt. The effect of prison population size on crime rates: Evidence from prison overcrowding litigation. *The Quarterly Journal of Economics*, 111(2), 1996.
- Steven D. Levitt. Using electoral cycles in police hiring to estimate the effect of police on crime. *The American Economic Review*, pages 270–290, 1997.
- Steven D. Levitt. Why do increased arrest rates appear to reduce crime? deterrence, incapacitation, or measurement error. *Economic Inquiry*, 36(3):353–372, 1998a.
- Steven D. Levitt. Juvenile crime and punishment. *Journal of Political Economy*, 106(6): 1156–1185, 1998b.
- Steven D. Levitt. The limited role of changing age structure in explaining aggregate crime rates. *Criminology*, 37(3):581–597, 1999.
- Steven D. Levitt. Using election cycles in police hiring to estimate the effect of police on crime: Reply. *American Economic Review*, 87(3):270–290, 2002.
- Steven D. Levitt. Understanding why crime fell in the 1990s: Four factors that explain and six that do not. *Journal of Economic Perspectives*, 18(1):163–190, 2004.
- Raymond V. Liedka, Anne Morrison Piehl, and Bert Useem. The crime control effect of incarceration: Does scale matter? *Criminology and Public Policy*, 5(2):245–276, 2006.
- Ming Jen Lin. More police, less crime: Evidence from US state data. *International Review of Law and Economics*, 29(2):73–80, 2009.
- Lance Lochner. Individual perceptions of the criminal justice system. *American Economic Review*, 97(1):444–460, 2007.

- Lance Lochner. Education and crime. In Philip Cook, Jens Ludwig, and Justin McCrary, editors, *Controlling Crime: Strategies and Payoffs*, National Bureau of Economic Research Conference Report. University of Chicago Press, Chicago and London, 2011.
- Lance Lochner and Enrico Moretti. The effect of education on crime: Evidence from prison inmates, arrests, and self-reports. *American Economic Review*, 94, 2004.
- Charles E. Loeffler. Does imprisonment alter the life course? evidence on crime and employment from a natural experiment. *Criminology*, 51(1):137–166, 2013.
- Glenn C. Loury. *The Anatomy of Racial Inequality*. Harvard University Press, 2002.
- Glenn C. Loury. *Race, Incarceration, and American Values*. MIT Press, 2008.
- Glenn C. Loury. A nation of jailers. *Cato Unbound*, 2009.
- R.B. Lu, W.W. Lin, J.F. Lee, H.C. Ko, and J.C. Shih. Neither antisocial personality disorder nor antisocial alcoholism is associated with mao-a gene in han chinese males. *Alcoholism Clinical and Experimental Research*, 27(6):889–893, 2003.
- Jeremy Luallen. School’s out... forever: A study of juvenile crime, at-risk youths and teacher strikes. *Journal of Urban Economics*, 59(1):75–103, 2006.
- Stephen Machin, Oliver Marie, and Suncica Vujic. The crime reducing effect of education. *Economic Journal*, 121:463–484, 2011.
- D.E. Marcotte and Sara Markowitz. A cure for crime? psychopharmaceuticals and crime trends. *Journal of Policy Analysis and Management*, 30(1):29–56, 2011.
- Douglas S. Massey and Nancy A. Denton. Trends in the residential segregation of blacks, hispanics, and asians: 1970-1980. *American Sociological Review*, 52(6):802–825, 1987.
- Chandler B. McClellan and Erdal Tekin. Stand your ground laws, homicides, and injuries. Working Paper 18187, National Bureau of Economic Research, June 2012.
- Justin McCrary. Using electoral cycles in police hiring to estimate the effect of police on crime: Comment. *American Economic Review*, pages 1236–1243, 2002.
- Robert D. McFadden and Susan Saulny. A crime revisited: The decision; 13 years later, official reversal in jogger attack. *New York Times*, December 6 2002.
- Edwin S. Mills. Terrorism and us real estate. *Journal of Urban Economics*, 51(2):198–204, 2002.

- Todd D. Minton. Jail inmates at midyear 2011: Statistical tables. *Bureau of Justice Statistics*, NCJ237961, 2012. Accessed at <http://www.bjs.gov/content/pub/pdf/jim11st.pdf>.
- J.A. Miron. Violence and the u.s. prohibitions of drugs and alcohol. *American Law and Economics Review*, 1(1):78–114, 1999.
- T.E. Moffitt and S. Ross. Enhancing children’s self-control to reduce crime and promote the health and welfare of the population. In Philip Cook, Jens Ludwig, and Justin McCrary, editors, *Controlling Crime: Strategies and Payoffs*, National Bureau of Economic Research Conference Report. University of Chicago Press, Chicago and London, 2011.
- Gunnar Myrdal. *American Dilemma: The Negro Problem and Modern Democracy*. Harper and Brothers, 1944.
- Daniel Nagin. Criminal deterrence: Research at the outset of the 21st century. *Crime and Justice*, 23:1–42, 1998.
- Daniel S. Nagin, Francis T. Cullen, and Cheryl Lero Jonson. Imprisonment and reoffending. *Crime and justice*, 38(1):115–200, 2009.
- R. Neugebauer, H.W. Hoek, and E. Susser. Prenatal exposure to wartime famine and development of antisocial personality disorder in early adulthood. *Journal of the American Medical Association*, 4:479–481, 1999.
- Frank Newport. Us drinking rate edges up slightly to 25-year high. Gallup Poll, accessed at [www.gallup.com/poll/141656/drinking-rate-edges-slightly-year-high.aspx](http://www.gallup.com/poll/141656/drinking-rate-edges-slightly-year-high.aspx), 2010.
- Robert O’Brien. Relative cohort size and age-specific crime rates: An age-period-relative-cohort-size model. *Criminology*, 27:57–77, 1989.
- Brendan O’Flaherty. Why repeated criminal opportunities matter: A dynamic stochastic model of criminal decision-making. *Journal of Law, Economics, and Organization*, 14(2): 232–255, 1998.
- Brendan O’Flaherty and Rajiv Sethi. Crime and segregation. *Journal of Economic Behavior & Organization*, 64(3-4):391–405, 2007.
- Brendan O’Flaherty and Rajiv Sethi. Racial stereotypes and robbery. *Journal of Economic Behavior & Organization*, 68(3-4):511–524, 2008.
- Brendan O’Flaherty and Rajiv Sethi. Why have robberies become less frequent but more violent? *Journal of Law, Economics, and Organization*, 25(2):518–534, 2009a.

- Brendan O’Flaherty and Rajiv Sethi. Public outrage and criminal justice: Lessons from the Jessica Lal case. In Bhaskar Dutta, Tridip Ray, and E. Somanathan, editors, *New and Enduring Themes in Development Economics*. World Scientific, 2009b.
- Brendan O’Flaherty and Rajiv Sethi. The racial geography of street vice. *Journal of Urban Economics*, 67(3):270–286, 2010a.
- Brendan O’Flaherty and Rajiv Sethi. Witness intimidation. *The Journal of Legal Studies*, 39(2):399–432, 2010b.
- Brendan O’Flaherty and Rajiv Sethi. Peaceable kingdoms and war zones: Preemption, ballistics and murder in Newark. In Rafael Di Tella, Sebastian Edwards, and Ernesto Schargrodsky, editors, *The Economics of Crime: Lessons for and from Latin America*. University of Chicago Press, 2010c.
- Brendan O’Flaherty and Rajiv Sethi. Homicide in black and white. *Journal of Urban Economics*, 68(3):215–230, 2010d.
- Melvin L. Oliver and Thomas M. Shapiro. *Black Wealth White Wealth: A New Perspective on Racial Inequality*. Routledge, 1995.
- Devah Pager, Bruce Western, and Naomi Sugie. Sequencing disadvantage: Barriers to employment facing young black and white men with criminal records. *Annals of the American Academy of Political and Social Science*, 623:195–213, 2009.
- A. Papachristou, T. Meares, and J. Fagan. Attention, felons: Evaluating project safe neighborhood in chicago. *Journal of Empirical Legal Studies*, 4(2):223–272, 2007.
- Orlando Patterson. *Slavery and Social Death: A Comparative Study*. Harvard University Press, 1982.
- Samuel Perreault. Police reported crime statistics in canada 2012. Juristat, Statistics Canada, 2013.
- Maureen A. Pirog and Craig L. Johnson. Electronic funds and benefits transfers, e-government, and the winter commission. *Public Administration Review*, 68(6):S103–S114, 2008.
- J. Ponseti, O. Granert, T. van Eimeren, O. Jansen, S. Wolff, K. Beier, G. Deuschl, H. Bosinski, and H. Siebner. Human face processing is tuned to sexual age preferences. *Biology letters*, 10(5), 2014.

- Panu Poutvaara and Mikael Priks. The effect of police intelligence on group violence: Evidence from reassignments in Sweden. *Journal of Public Economics*, 93(3-4):403–411, 2009.
- Travis C. Pratt and Francis T. Cullen. Assessing macro-level predictors and theories of crime: A meta-analysis. In Michael Tonry, editor, *Crime and Justice: A Review of Research*, volume 32. University of Chicago Press, Chicago, 2005.
- Adrian Raine. *The Anatomy of Violence: The Biological Roots of Crime*. Pantheon, New York, 2013.
- Steven Raphael and Jens Ludwig. Prison sentence enhancement: The case of project exile. In J. Ludwig and P. Cook, editors, *Evaluating Gun Policy: Effects on Crime and Violence*, pages 251–286. Washington, D.C.: Brookings Institution Press., 2003.
- Steven Raphael and Michael Stoll. *Why Are So Many Americans in Prison?* Russell Sage, New York, May 2013.
- Steven Raphael and Michael A. Stoll. Introduction. In Steven Raphael and Michael A. Stoll, editors, *Do Prisons Make Us Safer? The Benefits and Costs of the Prison Boom*, pages 1–26. Russell Sage, New York, 2009a.
- Steven Raphael and Michael A. Stoll. Why are so many Americans in prison? In Steven Raphael and Michael A. Stoll, editors, *Do Prisons Make Us Safer? The Benefits and Costs of the Prison Boom*, pages 27–72. Russell Sage, New York, 2009b.
- Steven Raphael and Rudolf Winter-Ebmer. Identifying the effect of unemployment on crime. *Journal of Law and Economics*, 44(1):259–283, 2001.
- Albert J. Reiss, Jr. and Jeffrey A. Roth, editors. *Understanding and Preventing Violence*. National Academy Press, Washington, D.C., 1993.
- Jessica Wolpaw Reyes. Environmental policy as social policy? the impact of childhood lead exposure on crime. *BE Journal of Economic Analysis and Policy: Contributions to Economic Analysis and Policy*, 7(1), 2007.
- Jessica Wolpaw Reyes. Lead exposure and behavior: Effects on antisocial and risky behavior among children and adolescents. Working Paper, Amherst College, 2012.
- A.J. Reynolds, J.A. Temple, D.L. Robertson, and E.A. Mann. Long-term effects of an early childhood intervention on educational achievement and juvenile arrest: A 15-year follow-up of low-income children in public schools. *Journal of the American Medical Association*, 285:2239–2246, 2001.

- Doyle Rice. Usa saw fewest lightning deaths on record in 2013. *USA Today*, January 11, 2014.
- Stephanie A. Riolo, Tuan Anh Nguyen, John F. Greden, and Cheryl A. King. Prevalence of depression by race/ethnicity: Findings from the national health and nutrition examination survey iii. *American Journal of Public Health*, 95(6):998–1000, 2005.
- Sue Z. Sabol, Stella Hu, and Dean Hamer. A functional polymorphism in the monoamine oxidase a gene promoter. *Human Genetics*, 103:273–279, 1998.
- S.C. Salop. Monopolistic competition with outside goods. *Bell Journal of Economics*, 10: 145–156, 1979.
- Robert J. Sampson and Jacqueline Cohen. Deterrent effects of police on crime: A replication and theoretical extension. *Law and Society Review*, 22(163-189), 1988.
- Robert J. Sampson and Janet Lauritsen. Racial and ethnic disparities in crime and criminal justice in the united states. *Crime and Justice*, 21:311–374, 1997.
- Robert J. Sampson, Stephen W. Raudenbush, and Felton Earls. Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science*, 918, 1997.
- Sarath Sanga. Reconsidering racial bias in motor vehicle searches: theory and evidence. *Journal of political economy*, 117(6):1155–1159, 2009.
- Marc Santora and Michael Schwirtz. An epidemic of carjackings afflicts Newark. *New York Times*, December 28, 2013.
- A. Saperstein and A. Panner. The race of a criminal record: how incarceration colors racial perception. *Social Problems*, 57(1):92–113, 2010.
- Thomas C. Schelling. Dynamic models of segregation. *The Journal of Mathematical Sociology*, 1(2):143–186, 1971.
- Joel Schrag and Suzanne Scotchmer. The self-reinforcing nature of crime. *International Review of Law and Economics*, 17(3):325–335, 1997.
- Rajiv Sethi and Rohini Somanathan. Inequality and segregation. *Journal of Political Economy*, 112(6):1296–1321, 2004.
- Rajiv Sethi and Rohini Somanathan. Racial inequality and segregation measures: Some evidence from the 2000 census. *The Review of Black Political Economy*, 36(2):79–91, 2009. ISSN 0034-6446.

- Lawrence W. Sherman, Patrick R. Gartin, , and Michael E. Buerger. Hot spots of predatory crime: Routine activities and the criminology of place. *Criminology*, 27(1):27–56, 1989.
- David Skarbek. Prison gangs, norms, and organizations. *Journal of Economic Behavior & Organization*, 82(1):96–109, 2012.
- Wesley Skogan and Kathleen Frydl, editors. *Fairness and Effectiveness in Policing: The Evidence (Committee to Review Research on Police Policy and Practices)*. Washington, DC: The National Academies Press, 2004.
- William Spelman. Jobs or jails? the crime drop in texas. *Journal of Policy Analysis and Management*, 24(1):133–165, 2005.
- Statistical Abstract. United States Bureau of the Census, Various Years.
- Daniel Steffensmeier, Cathy Striefel, and Miles Harer. Relative cohort size and youth crimes in the united states, 1953-1984. *American Sociological Review*, 52:702–710, 1987.
- Michael A. Stegman, Jennifer S. Lobenhofer, and John Quintero. The state of electronic benefits transfer (ebt). Working Paper, Center for Community Capital, University of North Carolina at Chapel Hill, 2003.
- The Sentencing Project. Trends in US corrections, 2011.
- Robert Tillman. The size of the ‘criminal population’: The prevalence and incidence of adult arrest. *Criminology*, 25(3):561–579, 1987.
- United States General Accounting Office. Racial profiling: Limited data available on most motorist stops, 2000.
- U.S. Bureau of Labor Statistics. Occupational employment statistics, 2013b.
- U.S. Department of Health and Human Services. National household survey of drug abuse, highlights, 1991.
- U.S. District Court, Southern District of New York. United States of America v. Andrew Michael Jones aka “Inigo,” Gary Davis, aka “Libertas,” Peter Philip Nash, aka “same-samebutdifferent,” aka “Batman73,” aka “Symmetry,” aka “Anonymousasshit,” S1 13 Cr. 950, 2013.
- U.S. Social Security Administration. History of the social security administration 1993-2000. Accessed at [www.ssa.gov/history/ssa/ssa2000chapter5.html](http://www.ssa.gov/history/ssa/ssa2000chapter5.html), 2000.

- Jeffrey M. Valla, Stephen J. Ceci, and Wendy Williams. The accuracy of inferences about criminality based on facial appearance. *Journal of Social, Evolutionary, and Cultural Psychology*, 5(1):66–91, 2011.
- Jan C van Ours and Ben Vollaard. The engine immobilizer: A non-starter for car thieves. Technical report, CESifo Working Paper: Public Choice, 2013.
- Thierry Verdier and Yves Zenou. Racial beliefs, location, and the causes of crime. *International Economic Review*, 45(3):731–760, 2004.
- Ben Vollaard. Preventing crime through selective incapacitation. *Economic Journal*, 123(567):262–284, 2013.
- Ben Vollaard and Jan van Ours. Does regulation of built-in security reduce crime? evidence from a natural experiment. *The Economic Journal*, 121:485–504, 2011.
- Booker T. Washington. My view of segregation laws. *The New Republic*, December 4 1915.
- Branden C Welsh and David P. Farrington. Effects of closed-circuit television on crime. *Annals of the American Academy of Political and Social Science*, 587(1):110–135, 2009.
- C.S. Widom and L.M. Brzustowicz. Maa and the ìycle of violenceî: Childhood abuse and neglect, maa genotype, and risk for violent and antisocial behavior. *Biological Psychiatry*, 60(7):684–689, 2006.
- David E. Wildasin. Local public finance in the aftermath of september 11. *Journal of Urban Economics*, 51(2):225–237, 2002.
- Christopher Wildeman. Paternal incarceration and children’s physically aggressive behaviors: Evidence from the fragile families and child wellbeing study. *Social Forces*, 89(1):285–309, 2010.
- James Q. Wilson and George Kelling. Broken windows, the police, and neighborhood safety. *Atlantic Monthly*, March, 1982.
- Richard Wright, Erdal Tekin, Volkan Topalli, Chandler McClellan, and Timothy Dickinson. Less cash, less crime: Evidence from the electronic benefit transfer program. NBER working paper 19996, 2014.
- Richard T. Wright and Scott H. Decker. *Armed Robbers In Action: Stickups and Street Culture*. Northeastern, 1997.

John Yinger. Measuring racial discrimination with fair housing audits: Caught in the act. *The American Economic Review*, 76(5):881–893, 1986.

Franklin Zimring, G. Hawkins, and S. Kamin. *Punishment and Democracy: Three Strikes and You're Out in California*. New York: Oxford University Press., 2001.

Franklin E. Zimring. *The Great American Crime Decline*. New York: Oxford University Press, 2007.

Franklin E. Zimring. *The City That Became Safe: New York's Lessons for Urban Crime and Its Control*. Oxford University Press, 2011.