Crime and Economic Incentives

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Keywords

Abstract

In economic models of crime, changing economic incentives alter the participation of individuals in criminal activities. We critically appraise the work in this area. After a brief overview of the workhorse economics of crime model for organizing our discussion on crime and economic incentives, we first document the significant rise of the economics of crime as a research field and then go on to review the evidence on the relationship between crime and economic incentives. We divide this discussion into incentives operating through legal wages in the formal labor market and the economic returns to illegal activities. Evidence that economic incentives matter for crime emerges from both.

1. INTRODUCTION

Economic motives for crime participation have long been recognized. One can find them referred to in many historical writings, including as far back as those of Ancient Greek philosophers (e.g., Aristotle and Plato) and many since. As an analytical area in economics, the field was really kick-started in the 1960s by Becker's application of rational utility models to crime choices made by individuals. Since then, the field has grown rapidly, and the scope for economic incentives to affect crime has been placed center stage.

In Becker's (1968) model, and that of Ehrlich (1973), individuals decide whether to engage in crime by carrying out a cost-benefit calculation under uncertainty. To do so, they evaluate whether the expected benefits from crime (the economic benefits that accrue from the criminal act netting out the probability of being caught) outweigh the expected costs (normally given in terms of an opportunity cost). In this model, economic incentives affect crime participation in a number of direct and indirect ways.

The first is through alternatives to crime. This has commonly been framed in terms of a job in the labor market, which gives individuals a certainty equivalent payoff from wages. Thus, if the wage on offer in the formal labor market improves, and all else stays constant, crime participation is predicted to fall. A large literature, which we critically review below, has studied connections between crime and labor market outcomes with the aim of working out the extent to which this dimension of economic incentives matters for crime.

The second way in which incentives can matter is through the returns to crime. If criminal earnings are higher (or perceived to be higher), then, again all else equal, crime participation is predicted to be higher. Thus, if the value of loot from crime rises, or if criminal productivity rises, thus enhancing the crime return, then the returns from crime go up, which raises crime on the margin.

Both these routes involve a direct impact of economic incentives on crime. The other means by which the standard economic model of crime can generate incentive effects that potentially alter criminal behavior is indirectly through the deterrence and incapacitation effects of the criminal justice system. If crime sanctions are lowered, then the incentives to commit crime go up (and vice versa).

We structure this review article around the first two ways in which economic incentives can affect crime. The emphatic focus on punishment in much of the existing literature has in part diverted attention away from other interesting determinants of crime, such as changes in the takings from crime. Here we examine this understudied aspect of crime, while we also compare and contrast it to other market incentives, such as changes in labor market conditions. With regard to punishment, we refer the reader to several very good, comprehensive, and up-to-date reviews of the possible crime deterrence effects of the criminal justice system (see Chalfin & McCrary 2015, Nagin 2013, Paternoster 2010). Placing the focus on incentives and their scope to affect criminality means that we mainly consider the economic dimensions of crime and therefore have less to say about violent crimes, especially on violence between people and within families.[1]

To undertake our review of research on crime and economic incentives, we structure the remainder of the article as follows. In Section 2, we first discuss the economic approach to crime and how it can be used to motivate this discussion. We also present some suggestive bibliometric evidence to illustrate how the economics of crime has been a significantly growing research area in the past few decades. In Section 3, we focus on the work on crime and labor market outcomes. In

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[1]Our micro focus also means that we do not cover research on crime trends over time in different countries. Readers are referred to Buonanno et al. (2011) for empirical analysis of cross-country crime trends for the United States and Europe.

Section 4, we consider the smaller, but growing, body of work on criminal earnings. Section 5 then briefly concludes.

2. THE ECONOMICS OF CRIME AS A RESEARCH FIELD

In this section, we consider two aspects of the economics of crime. We first formally introduce the economic model of crime and consider its advantages and disadvantages for evaluating research findings on crime and economic incentives. Second, we consider how the model and its implications provided a stimulus for work in the area, by showing some simple bibliometric evidence on the rise of the economics of crime as a research field.

2.1. Economic Models of Crime

Figure 1 shows the bare essentials of the Becker/Ehrlich model. Individuals face a choice between crime and work. Crime and legal work yield monetary payoffs of W_C and W_L, respectively, but if an individual partakes in crime, there is a (nonzero) probability of being caught, π. If caught, there is a sanction imposed from the criminal justice system of S. Denoting the utility derived from W_C and W_L as $U(\cdot)$, an individual undertakes an expected utility calculation and engages in crime (C) if the expected benefits from crime (the left-hand side of the inequality in **Figure 1**) outweigh the expected costs (the right-hand side of the inequality).

Thus, crime participation decisions of individuals (the crime supply) are shaped by a combination of incentives (W_C, W_L) and deterrence (π, S). Simple comparative statics produce the predictions that, ceteris paribus, increases in criminal earnings raise crime ($\partial C/\partial W_C > 0$) and increases in legal wages, the probability of being caught, and the size of the sanction if caught lower crime ($\partial C/\partial W_L < 0$; $\partial C/\partial \pi < 0$; $\partial C/\partial S < 0$).

There are, of course, strengths and limitations of thinking of individual crime decisions in this utilitarian way. The model is, in and of itself, very simplistic, and one should take care in extrapolating it to real-world decisions. However, without loss of generality, it can be extended toward realism in several ways. First, rather than having a discrete choice between work or crime, it is easy to reframe the approach as a time-allocation problem in which work and crime can be activities to which individuals allocate time (see Lochner 2004, 2011). Doing so still yields the same kinds of predictions. Second, the model has homogeneous criminals (i.e., crime specialization is not
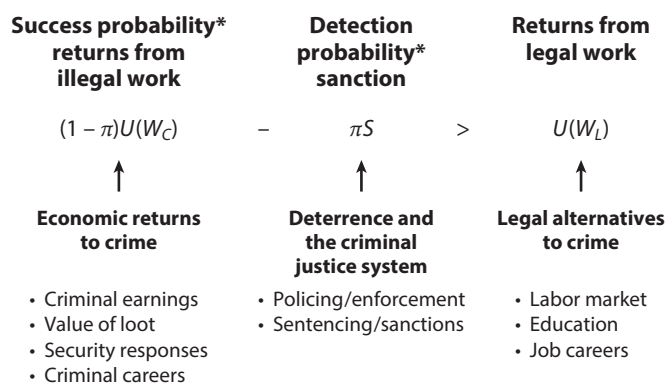
Success probability* returns from illegal work		Detection probability* sanction		Returns from legal work
$(1 - \pi)U(W_C)$	$-$	πS	$>$	$U(W_L)$
↑		↑		↑
Economic returns to crime		**Deterrence and the criminal justice system**		**Legal alternatives to crime**
• Criminal earnings • Value of loot • Security responses • Criminal careers		• Policing/enforcement • Sentencing/sanctions		• Labor market • Education • Job careers

Figure 1

Becker/Ehrlich crime utility model.

considered) and homogeneous loot (which yields a return). The model can also be extended to allow for different types of criminal specialization (e.g., car thieves, pickpockets, burglars, robbers) and for goods with different criminal returns. This does complicate matters a little, in that criminals may switch types of crime and loot, but a similar logic again follows (see Draca et al. 2014).

A third relevant issue concerns the notion that the model is silent on the type of crime committed. However, it does seem intuitive that property crime is likely to be better understood with the way in which economic incentives can drive crime in this model. It is true that a small literature does apply the Becker/Ehrlich model to violent crime. In Grogger (2000), for example, the mechanism through which this can work is through violence being complementary to drug crimes. However, we suspect that in general the model is less useful in this context in that, in most settings, relative labor market opportunities seem less likely to be a significant determinant of violent crime.

More generally, the model is less amenable to more complex extensions in other directions. One limitation is that it is static. This very clearly misses an important aspect of criminal behavior, especially when one notes the empirical observation that many criminals are prolific offenders (Machin et al. 2014) and when one recognizes the buildup of criminal human capital by career criminals (often instead of the buildup of stocks of human capital). The latter occurs in the dynamic models of Lochner (2004) and Mocan et al. (2005) and in the criminology literature [e.g., the career criminals work of Sampson & Laub (1993, 2005)] in which the dynamics of crime for individuals over the life cycle are stressed (the notion of crime onset, specialization, and desistance are key events in this dynamic approach).[2]

In what follows, we consider the economic motives for crime by critically appraising empirical research that looks at both crime and formal labor market opportunities and at the economic returns to crime. Before that, we begin by presenting some bibliometric evidence that reveals how the research field of the economics of crime has rapidly grown over time.

2.2. The Rise of the Economics of Crime Research Field

Figure 2 presents some simple, suggestive evidence of the evolution of the economics of crime as a research field by illustrating the number of articles on the economics of crime published in a sample of major economics journals. The trend sharply rises over time.[3] Indeed, the number of articles more than doubles after 1990, exceeding even the peak of the early 1970s. Given this upward trend, it is not surprising that the economics of crime has significantly risen in prominence as a field of its own within the academic economics discipline.[4]

3. CRIME AND THE LABOR MARKET

In the labor market context, as per Freeman's (1999) review, the economic model of crime suggests that, on the margin, participation in criminal activity is the result of the potential earnings from

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[2]The individual crime choice model is also less useful for considering crimes committed by groups of individuals (e.g., crime in gangs or organized crime) for which network approaches that permit interactions between individuals in a group are relevant.

[3]A regression of the log of the number of articles per year on a linear trend produces an estimated coefficient (and associated standard error) of 0.045 (0.003), showing a 4.5% per year increase on average in the six decades between the 1950s and 2000s.

[4]Cook et al. (2013a) discuss the factors that lie behind this increased research interest. They highlight several pertinent features, including the usefulness of the normative analytical economic framework for addressing policy design questions such as those in the crime area, significant improvements in data availability and quality, and the implementation of modern statistical methods that enable the study of causal relations in crime and crime control.
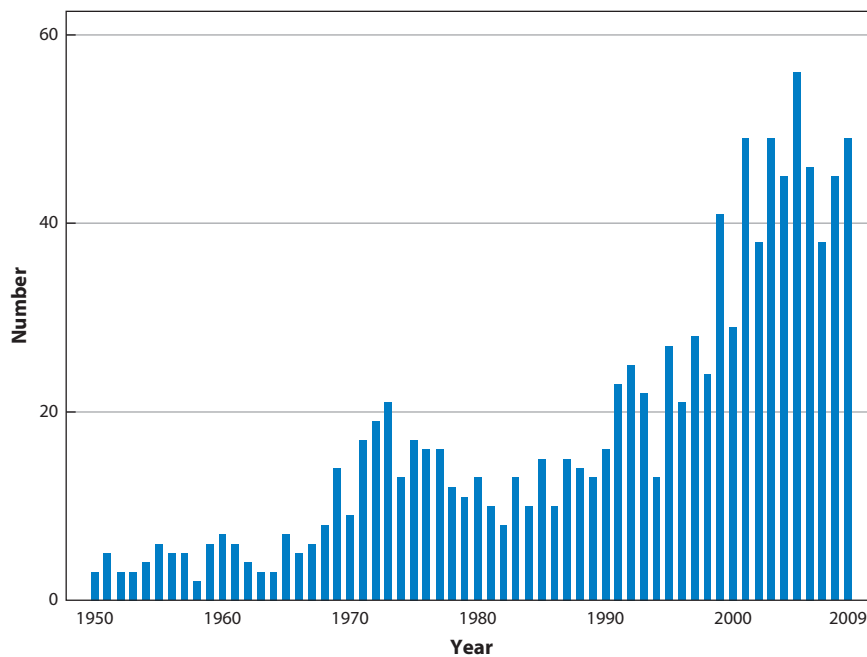
Figure 2

Annual number of papers in leading economics journals on the economics of crime. Journals included are *American Economic Review*, *Bell/RAND Journal of Economics*, *Econometrica*, *Economic Journal*, *Economica*, *Journal of Law and Economics*, *Journal of Political Economy*, *Quarterly Journal of Economics*, *Review of Economic Studies*, and *Review of Economics and Statistics*. The selected papers were chosen by the criteria that they contained the following keywords in the abstract or the title: crime, criminal, deterrence, and delinquency. All items that were not research articles (e.g., back matter, errata, conference notes) were excluded.

successful crime exceeding the value of legitimate work, in which the earnings from crime are discounted according to the risk of apprehension and subsequent sanctions.

3.1. Crime and Unemployment

There has been an extensive debate over the link between crime and unemployment. The early literature tried to provide evidence in favor of or against the Becker model and primarily focused on the issue of whether crime rates, and in particular property crime rates, relate to unemployment rates in a variety of different settings. In his *Handbook of Labor Economics* chapter on the economics of crime, Freeman (1999) concludes that the evidence of a general link between crime and unemployment was "fragile, at best," a conclusion that at first glance seems at odds with the economic model of crime.

Since Freeman's (1999) chapter, which summarized the literature based on studies up to the mid-1990s, work in this area has become more refined. This is true in terms of the quality of data used and in terms of the study of particular groups for whom one might think that the economic model of crime, in which individuals on the margins of crime decide whether to partake in illegal activities, might be more appropriate.

Indeed, this evidence suggests that a setting in which one can identify effects from unemployment on crime is for young adults. Thus, Gould et al. (2002) examine the impact of

contemporaneous unemployment and wages on the criminal behavior of less educated young males. Exploiting a panel of US counties, they find significant effects for both wages and unemployment on property and violent crimes, which we discuss in more detail below. Fougère et al. (2009) find strong effects from youth unemployment (but not overall unemployment) on crime in France, whereas Grönqvist (2013) uses Swedish register data to show a strong and precisely estimated link between youth unemployment and crime, for both property and violent crimes. Thus, there does appear to be an empirical relationship between youth crime and youth unemployment.

Recent methodological improvements have also moved the work closer to finding unemployment effects on property crime (although somewhat less so for violent crime). Such evidence has come from the use of panel data (rather than cross sections, for which estimates can be severely confounded by omitted variables) and instrumental variables methods seeking to ensure that causation can run from unemployment to crime (rather than in the opposite direction). For example, Raphael & Winter-Ebmer (2001) and Lin (2008) find significant effects of unemployment on property crime, although, as Chalfin & McCrary (2015) note, there are time periods (e.g., the recent economic downturn since 2008) during which the covariation of crime and unemployment runs counter to the predictions of the basic economics of crime model.[5]

3.2. Crime and Earnings

In addition to the literature on unemployment, studies that relate crime rates to specific measures of earnings have found more decisive evidence of a link between crime and the labor market. This could be expected for the simple reason that low-wage workers outnumber the unemployed, making low-wage incidence a better barometer of labor market conditions. The fixed costs of entering criminal activity might also make long-run labor market characteristics such wages or human capital more informative for criminal participation (as noted in Chalfin & Raphael 2011). Indeed, at the individual level, Grogger's (1998) study using the National Longitudinal Survey of Youth (NLSY) cohort data confirms that many people who self-report some criminal activity are also active in the employed labor market, making them sensitive to wage changes along an extensive margin between legal and illegal work.

Gould et al. (2002) provide evidence based on a US panel of counties, using the wages for non-college-educated males as their earnings measure. An interesting feature of their analysis is that they include wage and unemployment measures contemporaneously, which allows for some benchmarking of effects. For example, over the 1979–1993 period, the recorded 23.3% fall in unskilled wages predicted 43% of the total increase in property crime, whereas the 3.05 percentage point increase in the unemployed predicted 24% of the change. Wages also dominated the results for violent crime (predicting 53% of the increase versus 8% for unemployment). Gould et al. address potential problems related to the endogeneity of crime and economic conditions[6] using an instrumental variables strategy that interacts fixed state-level characteristics with aggregate economic shocks (following the logic of Bartik 1991). They find that the instrumented estimates are larger than those estimated by least squares for the wage measure but are lower for unemployment.

Studies for other countries reinforce the evidence for a strong link between wages and crime. For example, Machin & Meghir (2004) analyze a 20-year region-level panel for the police force

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[5]Crime evolution during and beyond the Great Recession forms an important and challenging future research agenda.

[6]In particular, migration decisions could respond to crime rates (Cullen & Levitt 1999), and employers might pay compensating differentials for the risk of crime (Roback 1982).

areas of England and Wales. They use a wage measure based on the 25th percentile of the distribution for the retail trade sector as this sector is a major employer of low-skill workers. Empirically, they find that the marginal effect of a 10% increase in the wage measure corresponds to a 0.7 percentage point fall in the crime rate (with the baseline crime rate at 8% or 80 crimes per 1,000 people). This is robust to controls for the conviction rate (additionally instrumented by sentence lengths) and lagged dependent variables to account for persistence in crime rates. Similarly, Entorf & Spengler's (2000) analysis of data on German regions over time uncovers significant associations between crime and income, again in line with the notion that changing economic incentives matter for crime.[7]

3.3. Labor Market Scarring

The above work on the link between labor market conditions and crime arguably addresses flow relationships, that is, how changes in economic opportunity costs at the margin (i.e., wages and unemployment) affect a criminal participation decision in the current period. However, the large swings in crime rates over recent decades could impart stock effects through a scarring mechanism. By this, we mean that the incentive for legal market labor might be systematically reduced via contact with the legal system through arrest, conviction, and incarceration. In turn, this would increase the net incentive for crime recidivism at the individual level. Given increases in the rate of incarceration, this reduced incentive could then add to the potential pool of criminal labor, as former inmates find themselves with permanently lower returns to legal work.

Analyses of this scarring problem run into the problem of unobservables: Correlations between individual labor market performance and events such as arrest might be related to underlying characteristics. This is illustrated well by Raphael (2011), who uses data on observable characteristics from the National Corrections Reporting Program to simulate the notional position of inmates in the overall earnings distribution. Inmates are heavily concentrated in the tails, with 46% in the bottom quartile and 70% below the median. This means it is plausible that potential scarring effects could be limited by the simple fact that those who undergo arrest, conviction, or incarceration are already at the bottom of the distribution and have less distance to fall.

An early treatment of this question is offered by Grogger (1995), who was notably ahead of his time in utilizing administrative data (in this case for California) on criminal histories and labor market earnings. His empirical strategy relies on including fixed effects in a longitudinal earnings model and then tracking out the wage effects of arrest over a number of quarters. The effects are moderate—equal to approximately 4% of earnings in the quarter contemporaneous with arrest and falling to an average of approximately 2–3% over the next five quarters before fading out to a zero statistical effect. However, it should be kept in mind that Grogger's (1995) data derive from the 1980s, and it is possible that, as documented by Raphael (2011), increased attention to criminal background checks on the demand side of the labor market could have since shifted the earnings penalty that arises from contact with the legal system through arrest, conviction, or incarceration.

Kling (2006) uses a similar longitudinal design to Grogger's (1995) but addresses the effects of incarceration and concentrates more heavily on identification issues. He focuses on the population of incarcerated offenders and the effects of sentence length on postrelease labor market outcomes. In the case of incarceration, sentence length is likely to again be correlated with underlying earnings

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[7]A closely related set of research that considers connections between crime and the inequality of income is reviewed by Rufrancos et al. (2013), who claim that research uncovers a systematic relationship between property crimes and income inequality, although there is no relationship for violent crime.

characteristics. In response, Kling (2006) uses the random assignment of judges in the California and Florida legal systems he studies to generate exogenous variation in sentences. This research design finds no substantial negative effects of incarceration length in the longer run, with apparent short-run positive effects explained by observable characteristics. It should be noted that Kling (2006) does not compare the labor market performance of the incarcerated against a comparable sample of never-incarcerated workers. However, his results are compelling for delivering the result that the wage scars of experiences such as arrest and incarceration seem likely to be working at the extensive margin. That is, it is the fact of arrest and incarceration that matters rather than variations in the intensive margin such as sentence length.

3.4. Crime and Education

The determinants of earnings power have long featured in empirical labor economics studies, with the Mincer (1958, 1974) earnings function (and its extensions) being a key tool for labor economists to study earnings differences across different types of workers. The Mincer earnings functions makes log(earnings) a function of various demographic characteristics (e.g., age/experience or gender) and factors that yield wage returns (e.g., education), together with other determinants of earnings power. In the framework introduced above, one can make the legal wage W_L a function of wage determinants so as to generate predictions of the relationship between crime and these determinants (working through the labor market). So we might specify that $W_L = f$(age, gender, education, X), where X is a set of other possible wage determinants.[8]

With this extension, several features of crime incidence can be studied. These include the nature of crime-age profiles, the relatively understudied subject (by economists) of crime and gender, the now quite deeply studied (by economists) area of crime and education, and the relation between crime and other earnings determinants.[9] Of these, probably the area best understood and most written about by economists is that of crime and education, so we choose to focus on this aspect to study the means by which earnings determinants can act as drivers of crime through incentive effects.

Work on crime and education has taken care to ensure that the direction of causation running from more education to less crime can be established. This has been facilitated in various ways, but most commonly by studying the crime-reducing effect of education that can result from increases in compulsory school-leaving ages. Lochner & Moretti (2004) exploit increases in the school-leaving age across US states at different times to generate plausibly exogenous variations in education, whereas Machin et al. (2011) study the raising of the compulsory school-leaving age in England (from 15 to 16 in 1973) in a regression-discontinuity setting. Both report significant crime reductions from the education induced by the legislation changes and thus offer additional evidence of incentive effects, this time as indirect effects working through more education.[10]

These studies focus on the longer-term effects in which education-induced inactive effects can reduce crime for people who leave the schooling system with higher education levels.[11] Other

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[8]Many wage determinants have been studied in the labor economics field. Some of the more commonly studied include (over and above age, gender, and education) union status, industry of work, occupation, and immigrant status.

[9]A good example of another wage determinant that has received quite a lot of recent attention is immigrant status, with a number of empirical papers focusing on crime and immigration (reviewed in Bell & Machin 2013).

[10]Other recent work showing negative crime-education relationships includes that by Brugard & Falch (2014), who use Norwegian imprisonment data, and by Hjalmarsson et al. (2015), who study Swedish administrative data.

[11]Readers are also referred to Deming (2011), who presents evidence that individuals who attend what he refers to as better schools (those in which children enroll in their first choice through lotteries in US public schools) engage in less crime after they have left school.

work looks at possible incapacitation effects from more education (i.e., studying the notion that keeping individuals in the classroom can prevent them from partaking in criminal behavior). This self-incapacitation effect is documented by Tauchen et al. (1994), who find that time spent at school (and work) during a year is negatively correlated with the probability of arrest that year. Hjalmarsson (2008) looks at the opposite relationship, reporting results that both more time being caught committing crime and more time in prison increase the likelihood of dropping out of high school.

To deal with endogeneity in this setting, Jacob & Lefgren (2003) instrument days that students stay out of school with exogenous teacher training days, and Luallen (2006) uses unexpected school closings driven by teacher strikes as an instrument for student absence from school. Both find important incapacitation effects of education on criminal participation in that crime is higher on these unexpected days off. Lastly, Anderson (2014) also reports US evidence, based on minimum high school dropout ages that vary across states, in line with the notion that keeping youth in school decreases arrest rates. These findings of incapacitation effects from schooling, together with the work on longer-term crime reductions from education, thus highlight that a channel through which incentive effects on crime can operate is increased education.[12]

3.5. Criminality and Experimental Interventions

Given that it is well known that cognitive and social-cognitive skill accumulation benefits educational outcomes, other related work has studied the scope for criminality to be affected by factors that can alter such skill development. The best studies in this area are those adopting an experimental research design with a treatment group determined by randomized allocation, whose outcomes are then compared to a valid control group.

There are two examples of such US programs that have received much research effort and attention. First, the High/Scope Perry Preschool Study offered an intensive preschool program to a relatively small number of disadvantaged children (58 in the treatment group and 65 in the control group) in Michigan in the 1960s who have been followed up through adulthood. Second, the larger-scale Moving to Opportunity experiment randomized families into groups receiving housing vouchers that would enable the treatment group to move to low-poverty areas of residence. The scope for these experimental interventions to affect crime outcomes has been studied in both settings.[13] Given their focus on treatments allocated to (relatively) early aged individuals (especially in the Perry program), both studies can shed some light on how initial conditions have the scope to affect subsequent criminal behavior.

In cost-benefit assessments of the longer-run impact of the Perry preschool program (Belfield et al. 2006, Heckman et al. 2013), a significant part of the economic and social benefits that accrued to the treatment group resulted from crime reduction among males. In fact, these studies strongly make the case that crime reduction through the improvement of child development—especially on the social-cognitive dimensions—drives the net returns resulting from the program. Thus, education improvements through both cognitive and noncognitive skill accumulation seem

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[12]Another possible incapacitation channel in some countries is from compulsory military service. There is much less research on connections between compulsory military service and crime, but the existing studies actually point to higher criminal propensities from those conscripted to partake in military service (see the analysis of individuals randomized to military service in Argentina in Galiani et al. 2011).

[13]We acknowledge that we are being highly selective here and that there are many other policy interventions for which possible crime-reducing effects have been studied, in many places around the world. A systematic and comprehensive review of these, and their specific details, however, goes well beyond the scope of this review.

to be important factors in reducing criminality, at least in the context of this specific randomized control trial.

The focus of the larger-scale Moving to Opportunity program was different, with specific interest in the crime field on whether moving neighborhoods had scope for crime reduction. Again, one mechanism highlighted by Kling et al. (2005) and Sciandra et al. (2013) is whether any crime-reducing effect from moving arises from changes to academic and nonacademic skill building. Kling et al. and Sciandra et al. study crime and delinquency outcomes for young people, analyzing whether treatment (more specifically, intention to treat) had an effect in the years after randomized residential moves were facilitated.

The studies report that being allocated a housing voucher significantly improved neighborhood conditions and that these better conditions were initially associated with significantly reduced violent crime, although such effects became attenuated over time. The same was not true of property crimes, which rose, but again showed attenuation as the individuals grew older (and presumably moved on to the downward-sloping portion of the crime-age curve). The violent crime reductions were more connected to the new neighborhoods to which people relocated, rather than to past neighborhood conditions, leading the authors to conclude that "situational" neighborhood effects mattered more, highlighting a route for crime reductions to follow from the educational and social benefits generated by living in a neighborhood characterized by less disadvantage.

3.6. Criminal Careers and Career Criminals

The area of criminal careers, that is, the life cycle and pattern of specialization of illegal work among criminals, has mostly resisted attempts at formal study from economists. This is obviously a result of a data constraint—criminal activity is by definition covert. Contributions to the criminology literature, such as Sampson & Laub (1993, 2005), have studied the life course, individual-level pattern of criminal careers, identifying phases such as onset, specialization, and desistance to describe the life cycle of crime participation. This criminological approach has many thematic similarities with an economic perspective, in particular via the strong developmental approach it takes to understanding the criminal life course. However, this criminological approach has a stronger focus on parsing out the effect of key events and the identification of career turning points, which has been much less prominent in economics.

The economic approach to criminal careers naturally begins with a dynamic model. Mocan et al. (2005) offer one approach that encompasses the accumulation of criminal and legal sector capital over time.[14] Individuals are lifetime utility maximizers for which the source of utility from consumption and income comes from both the legal and criminal sectors. Individuals have endowments of legal and criminal human capital, which depreciate over time. Both types of human capital rise with experience in the sector and are increased by investment in the respective sectors. The individual's income is a function of human capital and rates of return in both sectors. In each period, the individual solves a dynamic stochastic optimization problem. He or she decides first on the amount of time to allocate to legal and criminal work and second on the optimal level of consumption.

Crime is risky in the sense that a criminal faces a certain probability of being caught and sent to prison. The probability of prison depends on the skill of the criminal as measured by criminal human capital and the amount of time spent in the criminal sector as measured by experience in the sector. Whereas legal human capital may decline in prison in addition to depreciation effects (e.g., because of reputation effects), criminal human capital may increase if criminals in prison

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[14]Other dynamic models of criminal participation include those by Flinn (1986), Lochner (2004), and Lee & McCrary (2009).

learn from each other. Among dynamic models of crime, this model is useful because it can accommodate a broad range of determinants for criminal careers, from labor demand shocks to neighborhood effects.

Recent work by Bell et al. (2014) investigates the strength of these types of dynamic effects with reference to recessions. Specifically, they test whether recessionary conditions at the point of school exit influence participation in crime by comparing outcomes across cohorts. US data on incarceration show that the local experience of a recession (defined as the unemployment rate being 5 percentage points higher than normal) results in a 5.5% increase in the probability of being incarcerated over the subsequent two decades, with most of the effect accruing to high school dropouts. UK arrest data show that a recession is also associated with a 5.7% increase in the probability of ever being arrested, again with stronger effects for individuals with fewer years of schooling. Hence, this study establishes that criminal careers can indeed be made according to initial labor market conditions. Furthermore, this focus on recessions as a turning point for the onset of criminal careers offers a bridge to the criminological literature, as per Sampson & Laub (2005).

The continuation and reinforcement of criminal careers via peer effects during incarceration make up the focus of Bayer et al. (2009). The issue of peer effects drives the classic questions of whether prisons play a role in schooling inmates for future crime. Bayer et al. address this question using a sample of Florida juvenile correctional facilities over a two-year period. Their identification strategy is based on the variation induced by turnover at facilities. Offenders arrive at facilities at arbitrary dates and are therefore exposed to different sets of peers for durations also determined by these peers' original (arbitrary) entry dates. This makes assignment to facilities random with respect to the individuals already in the facilities. They defend this empirically by showing that within-facility variation in peer characteristics is orthogonal to observable characteristics and ruling out a role for co-assignment (i.e., the allocation of known partners in crime to the same facility).

The peer effects Bayer et al. (2009) find operate on a matching basis; for example, exposure to more peers with a history of burglary reinforces the probability of future burglary only if the individual also has a prior history in burglary. In terms of magnitudes, these reinforcement effects are moderate. For burglary, a one–standard deviation increase in peer exposure increases the probability of recidivism from 13.6% to 16.6%. For felony drug crimes, the probability increases from 28.5% to 31.6%. However, the finding that these effects prevail only for matched sets of offenders is the most intriguing message, and this is compatible with a number of plausible mechanisms, such as the formation of criminal networks, enhanced skill acquisition, and the simple reinforcement of individual behavior patterns.

Both Bell et al. (2014) and Bayer et al. (2009) suggest a mechanism based on a type of crime-related occupation-specific capital. That is, different investments and events change the balance between human capital for the legal sector and human capital for the illegal sector over time. The literatures discussed above have emphasized factors that determine the return to legal market opportunities, for example, wage levels and educational opportunities. In contrast, a key but still relatively unexplored factor influencing the balance between participation in the legal and illegal sectors is the return to crime, which we discuss in detail in the next section of this review.

4. THE ECONOMIC RETURNS TO CRIME

We now turn to what is known about the earnings from crime, the (literal) question of how much crime pays. Arguably, this seems to be the most understudied element of crime determinants that arise from the basic economic model of crime, as it is an area in which there is less of an evidence

base to draw general conclusions. That said, research in the area is active, despite the conceptual and measurement difficulties that tend to be associated with obtaining good data on the returns to crime for individuals.

The current literature can be divided into three areas that all reflect some aspect of the realized return to illegal activities among criminals. First, there is the older, rather small literature on the attempted measurement of earnings of criminals, notably the studies by Viscusi (1986) and Levitt & Venkatesh (2000). Second, there is an emerging group of studies that examine how the changing value of goods operates as an incentive for property-related crimes. Finally, there is literature on how security technology and investments—for example, vehicle immobilizers (as in Vollaard & Van Ours 2015)—affect property theft rates. The installation of such security technologies increases the fixed cost of stealing particular goods, thereby lowering the expected return to criminals. We cover these three areas in turn.

4.1. Criminal Earnings

The existing empirical knowledge on criminal earnings tends to come from two sources, either labor market surveys that ask directly about illegal earnings [e.g., see Grogger (1998), who exploits the NLSY's questions on illegal income] or field-based work on the economics of criminal enterprises, particularly drug gangs (Levitt & Venkatesh 2000, Reuter et al. 1990). The emerging message from both these sources is that crime does not pay much for most participants, with only a few criminals benefiting from a highly skewed structure of illegal rewards.

In terms of the general level of criminal earnings, the empirical evidence is dominated by studies from the 1980s. A wave of work (e.g., Freeman & Holzer 1986, Viscusi 1986) utilized the NBER-Mathematica Survey of Inner-City Black Youth, which was conducted in 1979–1980 for a sample of 2,358 minority youths in Boston, Chicago, and Philadelphia. Viscusi (1986) deals comprehensively with the crime-related information in this survey, putting forward a model based on there being an explicit compensating differential for bearing the risk that comes with the decision to participate in crime. In this sample, Viscusi finds that criminal income is relatively high, at approximately $1,504 annually (compared to $2,800 in legal earnings for the overall sample). The most lucrative area of reported criminal work is found to be drug dealing, which earns about one-third more than property crimes and has a high participation rate of 32.4% among the crime-active subsample of respondents.

Grogger's (1998) study using the NLSY arguably presents the most complete picture of the choice to supply labor to either crime or the formal labor market. Importantly, the survey evidence from the NLSY shows that criminal activity is concurrent with formal employment in the labor market, rather than an extensive margin choice of being either in or out of the two options. His estimate of mean annual criminal income is $1,188, which is comparable to both Viscusi's (1986) and Freeman's (1991) numbers for the NBER-Mathematica Survey of Inner-City Black Youth.

A unique feature of the survey used by Viscusi (1986) is that it elicits direct information on perceived arrest, conviction, and incarceration risks among criminal participants. Only 6% of respondents perceived the risk of arrest to be high. Because perceived risk varies across criminal activities in the data, Viscusi is able to empirically show that there is an upward-sloping risk-reward trade-off for crime participation. He further calculates that the risk premium is comparable to the job risk compensation among blue-collar workers. Other studies of criminal earnings in this era (Freeman 1991, Macoun & Reuter 1992, Reuter et al. 1990) support the notion that average illegal earnings are close to or higher than the average legal earnings faced by criminals. However, using data on losses among victims, Wilson & Abrahamse (1992) estimate that criminals earned less per hour relative to other workers. They note, however, that a subset of prolific offenders did

experience criminal incomes in excess of legal incomes. This finding of a skewed distribution of incomes among criminals is also evident in Hagedorn (1994) and is further examined by Levitt & Venkatesh (2000).

Levitt & Venkatesh (2000) link the issue of illegal earnings to the economics of criminal enterprises, in this case a Chicago drug gang whose financial operations were documented over a four-year period. This focus provides some important context for understanding criminal earnings, namely the hierarchical structure of criminal work. Drug selling is input intensive—the wage bill to revenue share is approximately one-third. Wages for street-level dealers are low, comparable to the minimum wage, and carry serious risks (the death rate for the sample was 7% annually). The incentive for gang participation therefore lies in the prospect of moving up the hierarchy within the gang, in line with a tournament model. Rewards at the top are very high— with wages between 10 and 25 times higher than "foot soldier" wages.

4.2. Internal Returns to Criminal Opportunity

Another very small literature deals with what could be called changes in the internal rates of the return to criminal opportunity. By this, we mean the cash flow or return generated by a criminal project, holding the probability of detection or other costs fixed. This concept is most relevant for the case of property theft. In the following, we focus on some empirical studies of property theft rates and prices, along with experimental evidence on how people respond to changes in returns.

Reilly & Witt (2008) examine the relationship between domestic burglaries and the real price of audiovisual goods (a major component of the loot obtained in burglaries). They consider an annual time series of UK burglary and price data over the period 1976–2005, when the retail price of audiovisual goods fell by an average of 10% per year. Their main specification is an error-correction model that includes controls for unemployment and inequality (a Gini-based measure) together with their main price variable. The long-run estimates from this model indicate an elasticity of 0.286, such that a 10% fall in prices is associated with a long-run fall in the volume of domestic burglary of 2.9%.

Draca et al. (2014) look at the relationship between goods prices and crime across a wide range of goods. They use records from the London Metropolitan Police's crime reporting system, which features a property type code that classifies goods stolen as part of theft, burglary, and robbery incidents. These property types are then matched by label description to Office of National Statistics data on retail prices. **Figure 3** presents a scatter plot in which changes in crime types are shown to be positively correlated with changes in their retail prices.

The results of panel regressions for Draca et al.'s (2014) main panel of 44 matched goods—with goods ranging from clothing, drink and foodstuffs, electronic equipment, and household goods to jewelry—indicate an average elasticity with respect to prices of 0.3–0.4. Furthermore, there is a short lag between price changes and crime, with the majority of adjustment occurring within three months of a given price change. This limits the scope for any time-varying unobservables to explain the price effect.

However, Draca et al. (2014) further address endogeneity concerns by focusing on a subset of goods—three metals (copper, lead, and aluminum), as well as jewelry and fuel—for which domestic prices can be plausibly linked to international prices. In the case of metals, they instrument local scrap metal dealer prices with global commodity prices, and fuel is instrumented with oil prices and jewelry with the price of gold. This approach has the advantage of isolating price changes that are a function of international demand (e.g., commodity demand from China) rather than variations due to local demand, which could in turn change the local stock of goods available for theft. The results for this subset of goods show higher elasticities that mostly exceed unity,
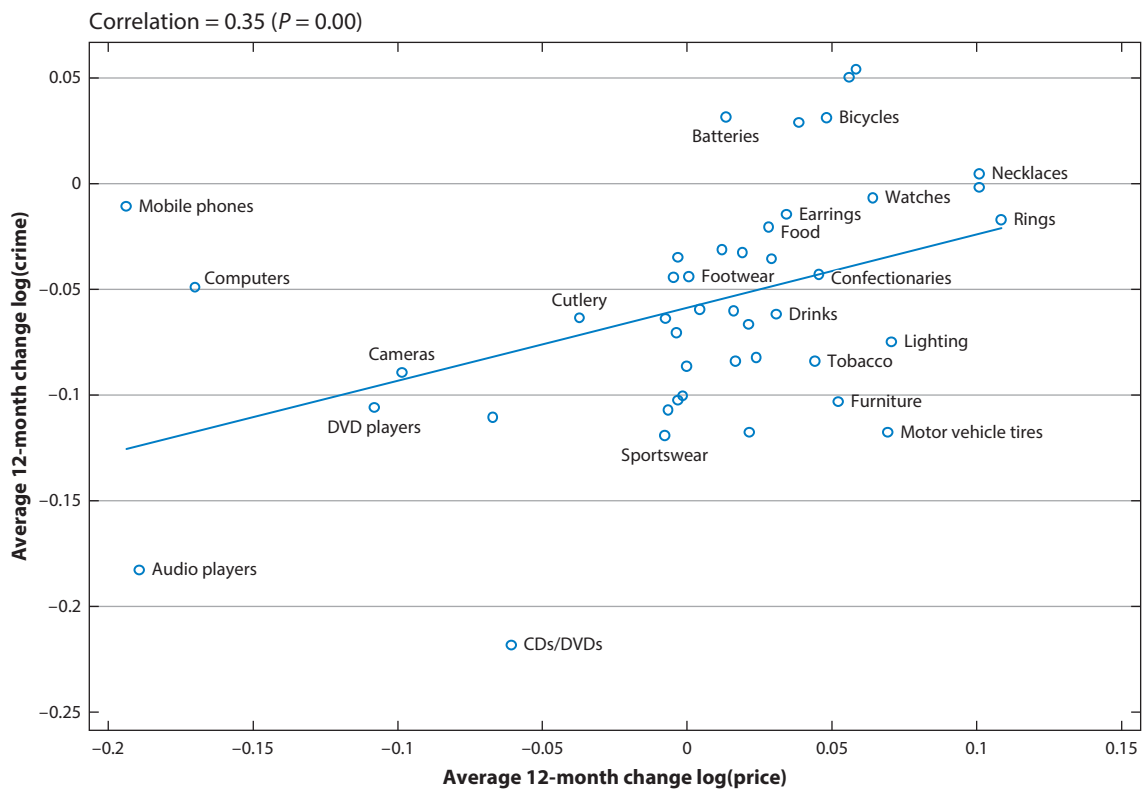
Figure 3

Average 12-month changes in log(crime) and log(prices), 2002–2012, for a matched sample of 44 goods. The figure uses monthly crime data on items stolen in thefts, burglaries, and robberies in London matched to the prices of those items (from Consumer Price Index data). The 12-month changes are calculated by month and averaged over the 120 periods during which these changes can be calculated (i.e., with the first 12-month change calculated in January 2003). Some labels (mostly on relatively small crime categories) have been omitted for space reasons. Figure adapted from Draca et al. (2014).

indicating that criminals are highly elastic with respect to prices and the implied value of criminal opportunities.

Lastly, some recent experimental evidence by Harbaugh et al. (2011) features tests of how possible crime participation responds to the value of loot. In their experiment, they present groups of high school and college students with the choice of whether to steal from a randomly matched partner across different rounds. Decisions are made with respect to 13 potential bundles, which vary according the value of the money stolen, the probability of getting away with the theft, and the level of the fine if caught. The outcomes of the experiment indicate that the probability of theft increases by 3% with each one-dollar increase in the amount of money available to steal. Taking into account baseline theft rates (0.36) and the mean value of loot for the sample ($3.82), they obtain an elasticity of theft with respect to value of 0.32. Importantly, because this is an experimental setting, they are able to condition out factors such as the certainty and severity of punishment from this calculation.

This experimental approach is also taken up in the behavioral economics and criminology literatures. Jolls et al. (1998) put forward "bounded willpower" as the key behavioral issue for the economic of crime. By this, it is meant that systematic mistakes can be made by prospective

criminals when evaluating either the risk of apprehension or the expected personal costs of punishment. The latter issue of punishment relates to hyperbolic discounting manifested as strong impatience for taking up near-term rewards and discounting of the costs of long-term punishments. The experimental evidence on this (e.g., Spelman 1995) does not deliver gradients of perceived punishment that match up cleanly with the hyperbolic model.

However, the criminology literature has studied the empirical incidence of key behavioral characteristics such as discounting (which can be interpreted as devaluing the future) and impulse control (interpreted as failure to consider the future). Nagin & Pogarsky (2004) study the National Longitudinal Study of Adolescent Health to measure the covariation of discounting and self-control measures with outcome measures comprising both petty crime (e.g., shoplifting, group fighting, causing a disturbance) and key social behaviors (e.g., exercise, drinking, and college orientation). They found that only impulse control was strongly correlated with violent offending, whereas both measures of present orientation were associated with property offending (albeit with a stronger role for discounting in this case). Another strand in criminology has specifically studied perceptions regarding threats of sanctions (e.g., Pogarsky 2007, Pogarsky et al. 2004); for more details, we refer the interested reader to Nagin's (2013) recent survey of this line of work.

4.3. Investments in Security

Given the emerging evidence that criminals respond to the price or value characteristics of potential criminal opportunities, it is natural to think that nonprice characteristics may also have a role. Specifically, a key set of characteristics is likely to be found in the fixed costs that higher levels of investment in personal security impose on specific criminal opportunities. As Cook (1986) notes, such self-protection efforts will have an effect on both the total volume and distribution of crime. That is, as one set of victims invests in self-protection, this may displace criminal activities toward other victims who have not yet made such investments (thus generating negative externalities). In practice, these distributional impacts will depend on the balance between the private and social benefits created by particular security technologies.

Ayres & Levitt's (1998) study of the Lojack car security system illustrates this point well. The Lojack system operates via a radio transmitter hidden inside cars that greatly facilitates recovery in the case of theft. Because Lojack is not directly observable by criminals, the deterrent effect of the technology operates through criminals' perceptions of the mean adoption rate of the technology. Hence, there is a positive externality—even cars that do not have Lojack installed benefit from lower rates of motor vehicle theft. Empirically, Ayres & Levitt (1998) study the effect of Lojack across 57 US cities between 1981 and 1994. The measured effects associated with Lojack are high with, for example, each percentage point increase in the Lojack market share in cities translating into a 7% fall in car theft. The authors note that such large effects would be consistent with Lojack disrupting prolific, professional chop shop operations that specialize in vehicle theft.

Ayres & Levitt (1998) also do not find any evidence of displacement effects, either in geographical terms or with respect to other crimes. Finally, they calculate that the marginal social benefits of Lojack are approximately 15 times higher than the marginal social costs. As a consequence, only 10% of the benefits are captured by the car owner installing Lojack, suggesting that there is severe underprovision of the technology in response to private incentives.

Other studies of automobile antitheft technologies have shown similar, large effects associated with security devices. Gonzalez-Navarro (2013) studies the effects of Lojack in Mexico, where the rollout of the technology for selected Ford models was well publicized. This meant that, out of the 48% reduction in thefts for treated models, 18% of the effect was displaced toward unprotected cars in states where Lojack was not present. Vollaard & Van Ours (2015) study the introduction of

engine immobilizers as part of Dutch government regulation over the 1995–2008 period. The introduction of immobilizers for new car allows the authors to examine before and after effects for specific models. They find that the gross immobilizer effect of -60% becomes a net effect of -40% once the displacement effects onto older models are accounted for.

Vollaard & Van Ours (2011) also focus on the effect of home security technology in their study of new building regulations in the Netherlands. These regulations mandated the introduction of burglary-proof windows and doors. This policy applied to all homes built from 1999 onward, allowing them to set up a difference-in-differences design comparing alternative cohorts of homes according to the year of construction. Average burglary rates for the postregulation cohort are 1.61% compared to 2.15% for preregulation homes. The regression analysis indicates a conditional effect of -0.56%, which corresponds to a 26% reduction in the burglary victimization rate. They find no evidence of displacement effects with respect to older homes and positive but insignificant effects for bicycle thefts and thefts from cars (garages were not covered by the new building code). In terms of a benefit calculation, the estimated installation cost is approximately 430 euros per home, and the benefits amount to 460 euros over the average 75-year life span of Dutch homes.

In addition to technology enhancing individual security, there have also been widespread increases in private security expenditures, for example, the employment of guards and the installation of camera systems. Cook & McDonald (2011) consider the effects of Business Improvement District (BID) initiatives in Los Angeles—nonprofit collaborations in which businesses contribute to a pool of private security expenditures to cover a common area. Their data cover the 1994–2005 period across 1,072 Los Angeles police reporting districts, with the number of districts affected by BIDs increasing from 37 in 1996 to 179 by 2005. They find that BID introduction is associated with an 11% relative decline in crime and a sizable (32%) reduction in arrests. They find no evidence of crime displacement toward police districts that neighbor BID areas. In turn, the social benefits (calculated primarily in terms of the estimated victimization costs and the savings in public expenditure from reduced arrest rates) are large—approximately 20 times the amount of private expenditures.

We should note here that investments in security represent a channel that is distinct from the effects of general investments in policing on crime. Following the discussion by Chalfin & McCrary (2015), the police and crime literature covers two main strands related to police and manpower, on one hand, and police and deployment, on the other. The former literature (stretching from early contributions, such as Cameron 1988, to influential instrumental variables studies, such as Levitt 1997) and the recent comprehensive review by Chalfin & McCrary (2015) consider the effect of general measures of police manpower on crime outcomes typically measured at the city or state level. The latter literature on deployment is then marked by a tactical focus that covers hot-spots research in criminology (e.g., Braga 2005, Sherman & Weisburd 1995) and quasi-experimental work on large-scale police operations (as in DiTella & Schargrodsky 2004 or Draca et al. 2011).

The balance of the studies in both strands suggests that the measured effects of policing on crime are more compatible with a deterrence mechanism, as opposed to incapacitation.[15] Hence the effects of police manpower can be framed as a variable input lowering the expected return to crime by raising the probability of apprehension. In contrast, investments in security are a durable input that reduces expected returns by imposing higher fixed costs on available

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[15]Specifically, contributions such as Levitt (1998) and Owens (2013) study the incapacitation channel by examining arrest rates, concluding that the effects suggest a larger role for deterrence.

criminal opportunities. The question for policy (and currently an open research question) then is determining the right mix of investments in manpower and security enhancement to reduce crime.

5. CONCLUSIONS

This review focuses on the issue of how crime is related to economic incentives. It focuses in detail on two specific dimensions: (*a*) the relationship between crime and labor market opportunities and (*b*) the economic returns to crime from illegal opportunities. Both have been central planks in the significant rise of the economics of crime research field over the past few decades. We conclude that the findings from this rapidly expanding research area uncover a variety of different forms of evidence showing that economic incentives matter for crime outcomes.

DISCLOSURE STATEMENT

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