

Crime and Economic Incentives

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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 organising our discussion on crime and economic incentives, we first document the significant rise of the economics of crime as a field of research in economics and then go on to review the evidence on the relationship between crime and economic incentives. We divide this discussion between incentives operating through legal wages in the formal labour market and into the economic returns to illegal activities. Evidence that economic incentives matter for crime emerges from both.

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1. Introduction

Economic motives for crime participation have long been recognised. One can find them referred to in many historical writings, including some from a long time ago such as the intellectual writings of the philosophers of Ancient Greece (like Aristotle and Plato) and in many places 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 this time the economics of crime field has grown rapidly and the scope for economic incentives to affect crime has been placed centre stage.

In the Becker (1968) model (and that of Ehrlich, 1973), individuals decide whether or not 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 of some sort). In this model economic incentives affect crime participation in a number of direct and indirect ways.

The first is through alternatives to crime. Commonly this has been framed in terms of a job in the labour market, which gives individuals a certainty equivalent payoff from wages. Thus if the wage on offer in the formal labour market improves, and all else stays constant, crime participation is predicted to fall. A large literature, which we critically review in this paper, has studied connections between crime and labour 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, on the margin, raises crime.

Both of these routes concern 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 behaviour is indirectly through the deterrence and incapacitation effects of the criminal justice system. If crime sanctions are lowered then the incentives to do 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 of a lot of the existing literature on punishments has, in part, diverted attention away from other interesting determinants of crime, such as the 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 labour market conditions. On the punishments work itself, we refer the reader to a number of very good, comprehensive and up-to-date reviews of the possible crime deterrence effects of the criminal justice system (see Chalfin and McCrary, 2014, Nagin, 2013, and 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, for the most part, have less to say on 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 paper as follows. In Section 2 of the paper we first discuss the economic approach to crime and how it can be used to motivate this discussion. We also show some suggestive bibliometric evidence to illustrate how the economics of crime

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

has been a significantly growing area in economics in the past few decades. In Section 3, we focus in on the work on crime and labour market outcomes. In 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.

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 respectively yield monetary payoffs of W_C and W_L , but if an individual partakes in crime there is a (non-zero) 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 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 towards 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 where work and crime can be activities that individuals allocate time to (see Lochner, 2004, 2010). Doing so still yields the same kinds of predictions. Second, the model has homogeneous criminals (i.e. crime specialization is not considered) and homogeneous loot (which yields a return). The model can also be extended to allow for different types of criminal specialization (car thieves, pickpockets, burglars, robbers, for example) and for goods with different criminal returns. This does complicate matters a little, in that criminals may switch crime types and types of 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. This said, 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 labour 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 behaviour, especially when one notes the empirical observation that many criminals are prolific offenders (Machin et al., 2014) and when one recognises the

building up of criminal human capital by career criminals (often instead of building up stocks of human capital). The latter occurs in the dynamic models of Lochner (2004) and Mocan et al. (2005), and in the criminology literature (like the career criminals work of Sampson and Laub, 1993, 2005, plus many others) where 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 labour market opportunities and that looks at the economic returns to crime. Prior to that, we however show some bibliometric evidence that reveals how the economics of crime research field overall has rapidly grown as a part of economic research over time.

The Rise of the Economics of Crime Research Field

We present some simple, suggestive evidence of the evolution of the economics of crime as a research field in Figure 2, which plots the number of articles on the economic of crime published in a sample of major economics journals over time (determined by a word search in leading journals as defined in the notes to the Figure). The trend is sharply up 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 over time.⁴

² The individual crime choice model is also less useful for considering crimes committed by groups of individuals – for example, crime in gangs, or organised crime – where 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 percent per annum increase on average in the six decades between the 1950s and 2000s.

⁴ Cook et al (2013) offer a discussion of the factors that lie behind this increased research interest. They highlight a number of pertinent features, including the usefulness of the normative analytical economic framework for addressing policy design questions like those in the crime area, significant improvements in

3. Crime and the Labour Market

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

Crime and Unemployment

Over the years there has been an extensive debate over the link between crime and unemployment. This was the first part of the literature that tried to bring evidence in favour or against the Becker model and has 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) concluded 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 Handbook Chapter, which summarised the literature based on studies up to the mid-1990s, however, work in this area has become more refined. This is true in terms of the quality of data that has been used and in terms of studying particular groups for whom one might think the economic model of crime, where individuals on the margins of crime decide whether or not to partake in illegal activities, might be more appropriate.

data availability and quality that have occurred over time and the implementation of modern statistical methods that enable the study of causal relations in crime and crime control to all be important features.

Indeed, this evidence tends to suggest that one setting where one can identify effects from unemployment to 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 crime, 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, while Grönqvist (2013) uses Swedish register data to show a strong and precisely estimated link between youth unemployment and crime, both for property and violent crimes. Thus, there does appear to be an empirical relation between youth crime and youth unemployment.

Recent methodological improvements have also moved the work closer to finding unemployment effects on property crime (though somewhat less so for violent crime). The use of panel data (rather than cross-sections where estimates can be severely confounded by omitted variables) and instrumental variable methods seeking to ensure that causation can run from unemployment to crime (rather than in the opposite direction) have produced such evidence. For example, Raphael and Winter-Ebmer (2001) and Lin (2008) find significant effects of unemployment on property crime although, as Chalfin and McCrary (2014) note, there are time periods (like the recent economic downturn since 2008) where the co-variation of crime and unemployment run counter to the predictions of the basic economics of crime model.⁵

Crime and Earnings

In addition to the literature on unemployment, the range of studies that relate crime rates to specific measures of earnings have found more decisive evidence of a link

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

between crime and the labour market. This could be expected for the simple reason that low wage workers outnumber the unemployed, making low wage incidence a better ‘barometer’ of labour market conditions. The fixed costs of entering criminal activity might also make long-run labour market characteristics such as wages or human capital more informative for criminal participation (as noted in Chalfin and 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 labour 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 per cent fall in unskilled wages predicted 43 per cent of the total increase in property crime while the 3.05 percentage point increase in unemployed predicted 24 per cent of the change. Wages also dominated the results for violent crime (predicting 53 per cent of the increase versus 8 per cent for unemployment). They address potential problems related to the endogeneity of crime and economic conditions⁶ 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.

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

Studies for other countries reinforce the evidence for a strong link between wages and crime. For example, Machin and Meghir (2004) analyse a 20-year region-level panel for the police force areas of England and Wales. They use a wage measure based on the 25th percentile of the distribution for the retail trade sector since this sector is a major employer of low skill workers. Empirically, they find that the marginal effect of a 10 per cent increase in the wage measure corresponds to 0.7 percentage point fall in the crime rate (where the baseline crime rate is 8 per cent or 80 crimes per 1000 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 and 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

Labour Market Scarring

The above work on the link between labour 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 labour 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 labour, as former inmates find themselves with permanently lower returns to legal work.

⁷ A closely related set of research that considers connections between crime and the inequality of income is recently reviewed in Ruffinos et al. (2013) who claim that research uncovers a systematic relation between property crimes and income inequality, though no relationship for violent crime.

Analyses of this scarring problem run into the problem of unobservables: correlations between individual labour market performance and events such as arrest might be related to underlying characteristics. This is illustrated well by Raphael (2010), who uses data on observable characteristics from the National Corrections Reporting Program (NCRP) to simulate the notional position of inmates in the overall earnings distribution. Inmates are heavily concentrated in the tails, with 46 per cent in the bottom quartile and 70 per cent 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 in Grogger (1995), a paper that was notably ahead of its time in utilising administrative data (in this case, for California) on criminal histories and labour 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 around 4 per cent of earnings in the quarter contemporaneous with arrest and falling to an average of around 2-3 per cent over the next 5 quarters before fading out to a zero statistical effect. However, it should be kept in mind that Grogger's (1995) data derives from the 1980s and it is possible that, as documented in Raphael (2010), increased attention to criminal background checks on the demand side of the labour market could have since shifted the earnings penalty that arises from contact with the legal system through arrest, conviction or incarceration.

The work by Kling (2006) used a similar longitudinal design to Grogger (1995), but addressing the effects of incarceration and concentrating more heavily on identification issues. The focus of this study is the population of incarcerated offenders

and the effects of sentence length on post-release labour market outcomes. In the case of incarceration, sentence length is likely to again be correlated with underlying earnings characteristics. In response, Kling (2006) uses the random assignment of judges in the Californian 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 labour 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.

Crime and Education

The determinants of earnings power have long featured in empirical labour economics studies, with the Mincer (1958, 1974) earnings function (and its extensions) being a key tool for labour economists to study earnings differences across different types of workers. The Mincer earnings functions makes $\log(\text{earnings})$ a function of various demographic characteristics like age/experience or gender and factors that yield wage returns like education, together with other determinants of earnings power. In the framework we have introduced 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 labour market). So we might specify that $W_L = f(\text{age, gender, education, } X)$ where X is a set of other possible wage determinants.⁸

With this extension, several features of crime incidence can be studied. This includes the nature of crime-age profiles, the relatively under-studied 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 best understood and most written about area by economists is that of crime and education, so we choose to focus upon this aspect to study 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 and Moretti (2004) exploit increases in the school leaving age across US states at different time to generate plausibly exogenous variations in education, whilst 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 education 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 where education induced inactive effects can reduce crime for people who leave the schooling system with higher education

⁸ Many have been studied in the labour economics field. Some of the more commonly studied wage determinants (over and above age, gender and education) are union status, industry of work, occupation, immigrant status and a range of others.

⁹ A good example of another wage determinant that has received quite a lot of attention more recently is immigrant status, with there being a number of empirical papers studying crime and immigration (see the review of this work by Bell and Machin, 2013).

¹⁰ Other recent work showing negative crime-education relations includes Brugard and Falch (2014) who use Norwegian imprisonment data and Hjalmarsson et al. (2014) who study Swedish administrative data.

levels.¹¹ Other 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 behaviour). This ‘self-incapacitation’ effect was documented by Tauchen et al. (1994) who found that time spent at school (and work) during a year is negatively correlated to the probability of arrest that year. Hjalmarsson (2008) looked at the opposite relationship, reporting results that more time being caught committing crime and more time in prison both increase the likelihood of being a high school dropout.

To deal with endogeneity in this setting, Jacob and Lefgren (2003) instrument days that students stay off 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 in these ‘unexpected’ days off. Lastly, Anderson (2009) 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 a channel of how incentive effects on crime can operate is through increased education.¹²

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 have scope to alter such skill development. The best studies in

¹¹ See also Deming (2011) who presents evidence that individuals who attend what he refers to as better schools (those where children enrol in their first choice through lotteries in US public schools) engage in less crime after they have left school.

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 that which exists actually points to higher criminal propensities from those conscripted to do military service (see the analysis of individuals randomized to do military service in Argentina by Galiani et al. 2011).

this area are those which adopt an experimental research design with a treatment and control group which is randomly allocated to a treatment aimed at boosting skills.

Two examples of such US programmes that have received a lot of research effort and attention are:

- i) The High/Scope Perry Preschool Program which offered an intensive pre-school 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 and who have been followed up through adulthood.
- ii) The larger scale Moving to Opportunity experiment where families were randomized into receiving housing vouchers that would enable the treatment group to move location to a low poverty area 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 Perry), they can be pitched as shedding some light on how initial conditions have scope to affect subsequent criminal behaviour.

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 amongst males. In fact, these studies strongly make the case that it is crime reduction through improvement of child development – especially on the social-cognitive dimensions – that drives the net returns that resulted from the programme. Thus education improvements through both cognitive and non-cognitive skill accumulation seem to be important factors in reducing criminality, at least in the context of this specific randomized control trial.

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

The focus of the larger scale Moving to Opportunity programme was different, with specific interest in the crime field on whether moving neighbourhood had scope for crime reduction. Again, however, one mechanism highlighted in the research of Kling et al. (2005) and Sciandra et al. (2013) was whether any crime reducing effect from moving arises from altering academic and non-academic skill building. To study this, Kling et al. and Sciandra et al. studied crime and delinquency outcomes for young people, analysing 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 neighbourhood conditions and that these were better conditions were associated with significantly reduced violent crime to start with, though 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 neighbourhoods where people relocated, rather than to past neighbourhood conditions, leading the authors to conclude that “situational” neighbourhood effects mattered more, highlighting a route for crime reductions to follow from the educational and social benefits generated by living in a neighbourhood characterised by less disadvantage.

Crime Careers and Career Criminals

The study 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 due to a data constraint – criminal activity is by definition covert. Contributions to the criminology literature, such as Sampson and 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 where the source of utility from consumption and income comes from both the legal and the criminal sector. 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 the both sectors. In each period, the individual solves a dynamic stochastic optimization problem. First, they decide how much time to allocate to legal and criminal work and second, they decide 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. While legal human capital may decline in prison in addition to depreciation effects, for example due to reputation effects, criminal human capital may increase if criminals in prison learn from each other. Among dynamic models

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

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 influences participation in crime by comparing outcomes across cohorts. US data on incarceration shows that local experience of a recession (defined as the unemployment rate being 5 percentage points higher than normal) results in a 5.5 per cent increase in the probability of being incarcerated over the subsequent two decades, with most of the effect accruing to high school drop-outs. UK arrests data show that a recession is also associated with a 5.7 per cent 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 labour 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 and Laub (2005).

The continuation and reinforcement of criminal careers via peer effects during incarceration is 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 corrections 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 (that is, the allocation of known partners in crime to the same facility).

The peer effects they 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 per cent. For felony drug crimes, the probability increases from 28.5 to 31.6 per cent. However, the finding that these effects only prevail 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 behaviour patterns.

Both of these studies (Bell et al., 2014 and Bayer et al., 2009) suggest a mechanism based on 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 we have discussed so far have emphasised 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 turn to 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 question (literally) of how much does crime pay? Arguably, and in our view, at the time of writing this seems to be the most under-studied element of crime determinants that arise from the basic

economic model of crime, being the area on which there is less of an evidence base from which it is possible to draw general conclusions. That said, it is an area where research 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. Firstly, there is the older, rather small literature on the attempted measurement of earnings of criminals, notably the studies by Viscusi (1986) and latterly by Levitt and Venkatesh (2000). Secondly, 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 and Van Ours, 2014) – 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.

Criminal Earnings

The existing empirical knowledge on criminal earnings tends to come from two sources, either labour market surveys that ask directly about illegal earnings (for example, 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 and 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 (for example, Freeman and Holzer, 1986, or Viscusi, 1986) utilized the NBER Survey of Inner City Black Youth, which was

conducted in 1979-80 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 (1986) 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% amongst the 'crime active' sub-sample of respondents.

Grogger's (1998) study using the NLSY arguably presents the most complete picture of the choice to supply labour to either crime or the formal labour market. Importantly, the survey evidence from the NLSY shows that criminal activity is concurrent with formal employment in the labour market, rather than being an extensive margin choice of being either 'in or out' of the two options. His estimates of mean annual criminal income is \$1,188, which is comparable to both Viscusi's (1986) and Freeman's (1991) numbers for the NBER 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. Since perceived risk varies across criminal activities in the data, Viscusi (1986) 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, Reuter et al., 1990, Macoun and Reuter, 1992) 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 and Abrahamse (1992) estimated that criminals earned less per hour relative to other workers. They noted though 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 a thread followed up in Levitt and Venkatesh (2000).

This study by Levitt and Venkatesh (2000) links 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.

‘Internal Returns’ to Criminal Opportunity

A second very small literature deals with what could be called changes in the ‘internal rates of 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 and Witt (2008) examine the relationship between domestic burglaries and the real price of audio-visual 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 from 1976-2005, when the retail price of audio-visual goods fell by an average 10 per cent per annum. Their main specification is an error-correction model (ECM) that includes controls for unemployment and inequality (a Gini-based measure) together with their main price variable. The long-run estimates from this ECM indicate an elasticity of 0.286, such that a 10 per cent fall in prices is associated with a long-run fall in the volume of domestic burglary of 2.9 per cent.

The paper by Draca et al. (2014) looks at the relationship between goods prices and crime across a wide range of goods. They use records from the London Metropolitan Police's (LMP) 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 ONS data on retail prices. Figure 3 shows a scatterplot taken from Draca et al. (2014) where changes in crime types are shown to be positively correlated with changes in their retail prices.

The results of panel regressions for their main panel of 44 matched goods – covering goods ranging from clothing, drink and foodstuffs, electronic equipment, household goods, and jewellery – 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, they further address endogeneity concerns by focusing on a subset of goods – three metals (copper, lead and aluminium), as well as jewellery and fuel – where 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, while fuel is instrumented with oil prices and jewellery with the price of gold. This approach has the advantage of isolating price changes that are a function of international demand (for

example, 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 sub-set of goods show higher elasticities that mostly exceed unity, 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, the 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 thirteen potential bundles which vary according the value on 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 per cent 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, since 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 literatures from behavioural economics and criminology. Jolls et al. (1998) outline '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

(for example, 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 and Pogarsky (2004) study the National Longitudinal Survey of Adolescent Health (LSAH) to measure the covariation of discounting and self-control measures with outcome measures comprised of to both petty crime (for example, shoplifting, group fights, causing a disturbance) and key social behaviors (for example, exercise, drinking and college orientation). They found that only impulse control was a strong correlate of violent offending while 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 (for example, Pogarsky et al., 2004, and Pogarsky, 2007) and, for more detail, we refer the interested reader to Nagin’s (2013) recent survey of this line of work.

Investments in Security

Given this emerging evidence that criminals respond to the price or value characteristics of potential criminal opportunities, it is also natural to think that non-price 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 towards other victims who have not yet made such investments, (so generating negative externalities). In

practice, these distributional impacts will depend on the balance between the private and social benefits created by particular security technologies.

The study of the Lojack car security system by Ayres and Levitt (1998) illustrates this point well. The Lojack system operates via a radio-transmitter hidden inside cars that greatly facilitates recovery in the case of theft. Since 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 and 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 Lojack market share in cities translating into a seven percent 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 and Levitt (1998) also do not find any evidence of displacement effects, either geographically 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 there is severe under provision of the technology in response to private incentives.

Other studies of automobile anti-theft technologies have shown similar, large effects associated with security devices. Gonzalez-Navarro (2013) studies the effects of Lojack in Mexico, where the roll-out of the technology for selected Ford models was well-publicized. This meant that, out of the 48 per cent reduction in thefts for 'treated' models, 18 per cent of the effect was displaced towards unprotected cars in states where Lojack

was not present. Vollaard and Van Ours (2014) study the introduction of engine immobilisers as part of Dutch government regulation over the 1995-2008 period. The introduction of immobilisers for new car allows them to examine before and after effects for specific models. They find that the gross immobiliser effect of -60 per cent becomes a net effect of -40 per cent once the displacement effects onto older models are accounted for.

Vollaard and 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 for all homes built from 1999 onwards, allowing them to set-up a difference-in-difference design comparing alternative cohorts of homes according to the year of construction. Average burglary rates for the post-regulation cohort are 1.61 per cent compared to 2.15 per cent for pre-regulation homes. The regression analysis indicates a conditional effect of -0.56 percent, which corresponds to a 26 per cent 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 while the benefits amount to 460 euro over a the average 75-year lifespan 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. The study by Cook and McDonald (2011) considers the effects of Business Improvement District (BID) initiatives in Los Angeles (LA) – non-profit collaborations whereby business contribute towards a pool of private security expenditures to cover a common area. Their data covers the 1994-2005 period

across 1, 072 LA police reporting districts, where the number of districts affected by BIDs increased 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 towards police districts that neighbor BID areas. In turn, the social benefits (calculated primarily in terms of the estimated victimization costs and the saving in public expenditure from reduced arrest rates) are large – around 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 in the recent survey by Chalfin and McCrary (2014), the police and crime literature covers two main strands related to ‘police and manpower’ on one hand along with ‘police and deployment’ on the other. The former literature (stretching from early contributions such as Cameron, 1988, through to influential instrumental variable studies such as Levitt, 1997) and the recent comprehensive review study by Chalfin and McCrary (2014) 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 hotspots research in criminology (for example, Sherman and Weisburd, 1995, or Braga, 2005) and quasi-experimental work on large-scale police operations (as in DiTella and Schargrodsky, 2004, or Draca et al., 2011).

The balance of the studies in both strands appears to suggest 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

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.

contrast, investments in security are a durable input that reduces expected returns by imposing higher fixed costs on available criminal opportunities. The question for policy (and at the time of writing an open research question) then is determining the right mix of investments in manpower and security enhancement to reduce crime.

5. Conclusions

This review paper focusses in on the issue of how crime is related to economic incentives. It focusses in detail on two specific dimensions of this, the relation between crime and labour market opportunities, and on the economic returns to crime from illegal opportunities. Both of these have been central planks in the significant rise of the economics of crime as a research field over the past few decades. We conclude from our review 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.

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Figure 1: Becker/Ehrlich Crime Utility Model

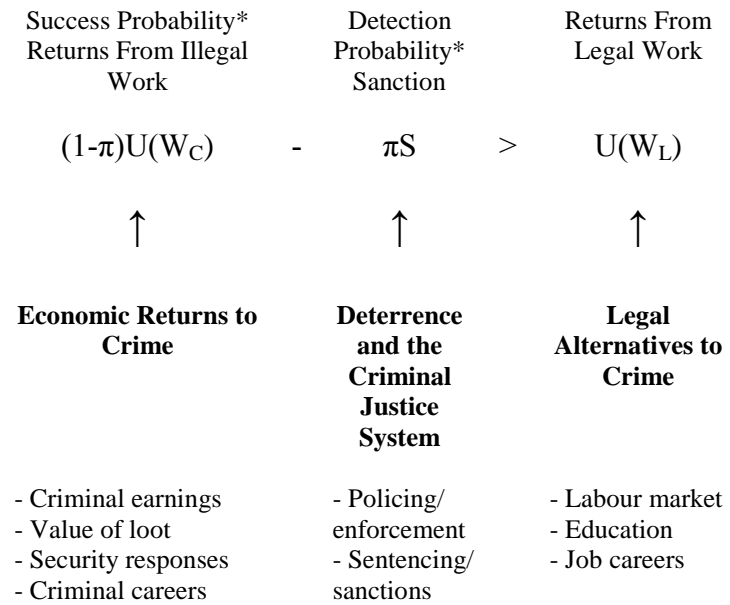
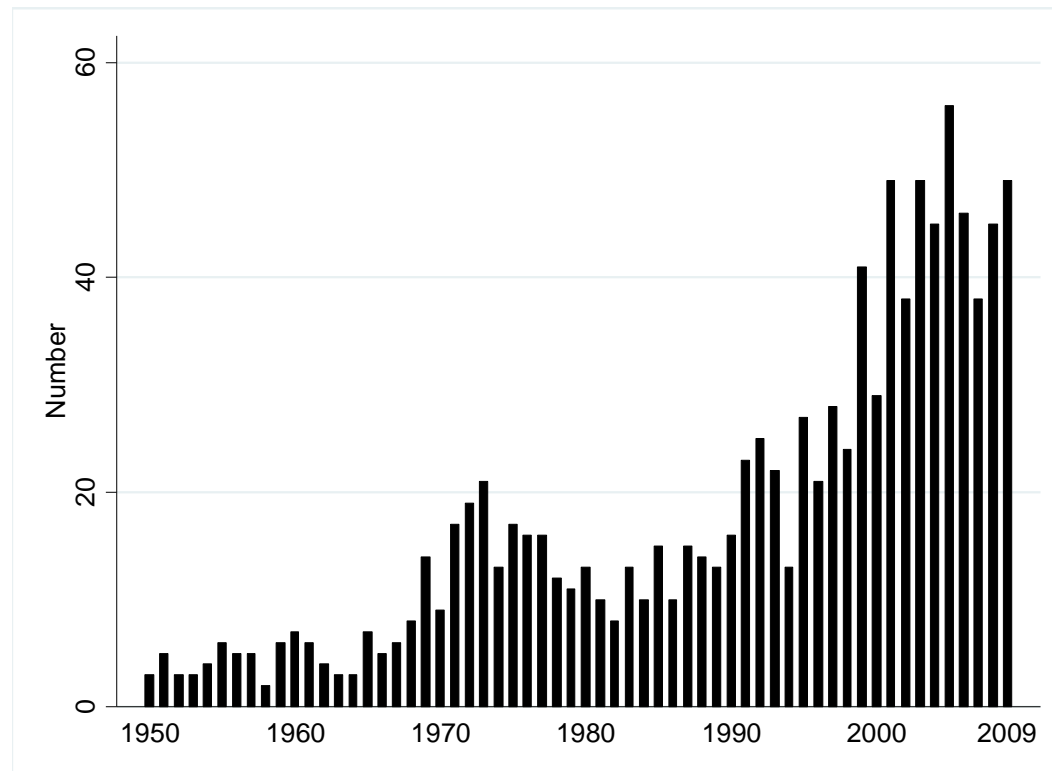
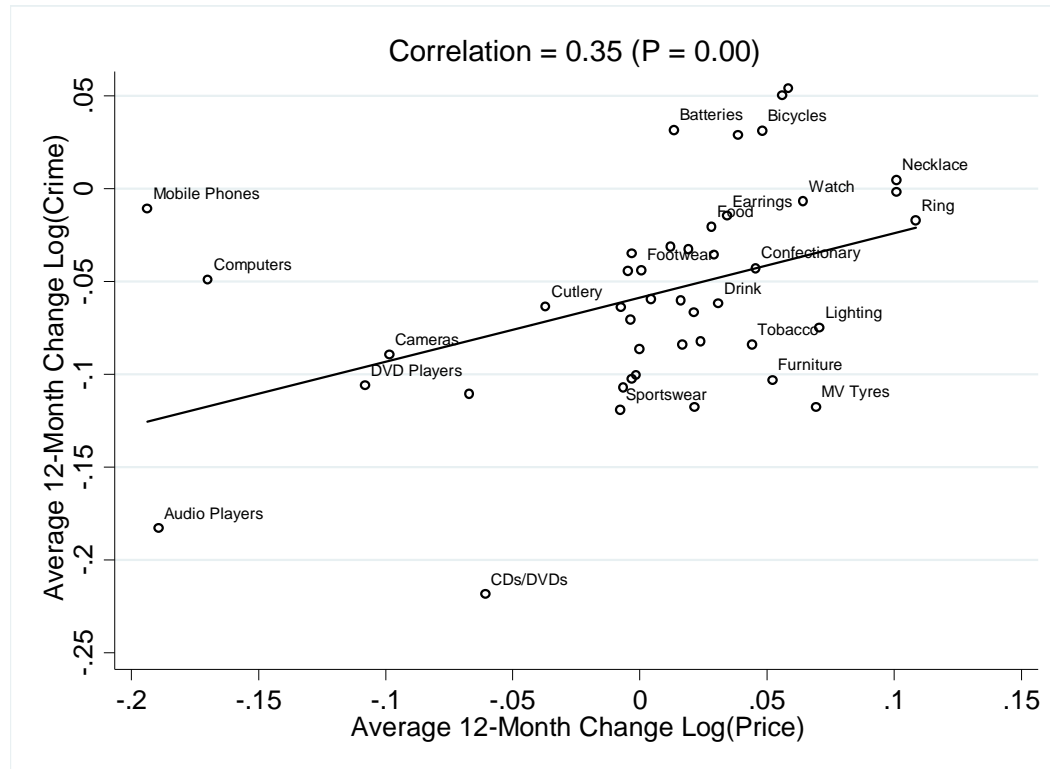


Figure 2:
Annual Numbers of Economics of Crime Papers in Leading Economics Journals



Notes: Economics of crime papers published in *Econometrica*, *Economica*, *Journal of Law and Economics*, *Journal of Political Economy*, *The American Economic Review*, *The Bell/RAND Journal of Economics*, *The Economic Journal*, *The Quarterly Journal of Economics*, *The Review of Economic Studies* and *The Review of Economics and Statistics*. The selected papers were chosen by the criteria that they contained the following keywords in the abstract and/or the title : ‘crime’, ‘criminal’, ‘deterrence’, ‘delinquency’. All items which were not research articles (like back matter, errata, conference notes etc.) were excluded.

Figure 3:
Average 12-Month Changes in Log(Crime) and Log(Prices), 2002-2012



Notes: Taken from Draca et al. (2014) The Figure uses monthly crime data on items stolen in thefts, burglaries and robberies in London between 2002 and 2012 matched to the prices of those items (from consumer price index data). It shows the average 12-month change in (log) crimes and price indices per good for a matched sample of 44 goods. The Figure shows 12-month changes calculated by month and averaged over the 120 periods where 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.