Violent Crime and Perceived Deterrence: An Empirical Approach using the Offending, Crime and Justice Survey

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ABSTRACT

This paper provides an econometric assessment of the deterrence model, with a specific focus on violent crime in England and Wales. It finds that beliefs about the probability of arrest are substantially lower than official arrests rates, but when adjusting for non-reporting by victims, the perceived risk of arrest and actual arrest rate are very similar. Further, no empirical evidence is found to the effect that perception of the probability of arrest differ between criminals and non-criminals. Perceptions about general perceived risk of arrest are not found to be related to an individual's own criminal and arrest history. Instead, an individual's beliefs about the perceived probability of arrest are largely affected by neighbourhood conditions and victimisation. The link between perceptions and criminal behaviour is also examined, but the empirical evidence is not in line with the basic predictions of the economic theory of crime.

1. INTRODUCTION

THE ECONOMIC MODEL OF CRIME assumes that potential offenders compare the costs and benefits of criminal activity and make rational decisions when deciding to engage in crime (Becker 1968). Hence, for more than 40 years, economists have conventionally assumed that individuals are well-informed about official sanctions (i.e. the probability of detection, the likelihood of punishment and the severity of the punishment) and respond to incentives generated by the criminal justice system (CJS). Much of the previous work on crime that focused on actual measures of deterrence and property-related crimes (e.g. Saridakis and Spengler 2012; Pudney *et al* 2000; Hale 1998) provides convincing support for the argument that increases in the likelihood of being caught and punished decrease the expected utility of offending and make individuals less likely to commit these types of offences.

Criminologists, however, have criticised economic models and the assumption they make that potential offenders know the objective certainty of being caught and punished. Instead they argue that individuals may have little knowledge of the legal penalties that the CJS assigns to various crimes (see Kleck and Barnes 2013; Kleck 2003) and thus propose a different way to test the deterrence effect by examining individuals' perceptions of the CJS and their criminal behaviour (see work, for example, by Anwar and Loughran 2011; Matsueda *et al* 2006; Kleck *et al* 2005; Pogarsky *et al* 2004). Nevertheless, the response of perception to new information and experience, and the change in individual behaviour induced by stated beliefs, is being analysed by economists (see, for example, Saridakis 2013; Lochner 2007; Sah 1991), providing further support to the deterrence hypothesis for analysing perceptual measures of deterrence for, in the main, property crime.

In contrast, violent crime has received a limited amount of statistical attention in the economic literature, although it is one of the prominent concerns of individuals. Moreover, recent figures shows that it costs approximately £124 billion a year to the UK economy (IEP 2013; Brand and Price 2000). Importantly, the existing economic work on violent crime (see Saridakis 2004, 2011; Saridakis and Spengler 2012) focuses on actual measures of deterrence and suggests negligible impacts of deterrence variables on violent crime. Other research in this area indicates that there can be contradictory deterrence effects (Cameron 1988) depending on the type of violent crime (for example domestic violence)[2] being committed. Further, there is much evidence to indicate that deterrents considered highly effective, such as capital punishment, does not necessarily have a deterrent effect on homicides (Passell and Taylor 1977; Bowers and Pierce 1975).

This research disregards perceptual measures of deterrence and its potential impact on the decision to engage in violent crime activity. The purpose of the present paper is to shed more light on this issue by providing an econometric assessment of the deterrence model, with specific focus on violent crime in England and Wales using the 2003 Offending, Crime and Justice Survey (OC&JS).[3] The focus of this contribution is based on how perceptions of deterrence are modified in response to individuals' past violent criminal activity and arrest outcomes, and whether these perceptions influence their behaviour.

To summarise the results of this study, it was found that individuals' perceived risk of arrest is not affected by their own crime and arrest history. However, being a victim of violent crime and living in a neighbourhood exhibiting decay have significant and positive effects on the reported probability of arrest. Perceptions of the CJS were found to have a weak effect on deterring violent crime, thus supporting previous work that use actual measures of deterrence. The results have important policy implications and naturally raise questions regarding policies targeting the reduction of violent crime through the deterrence mechanism.

- 24 -

The remainder of this paper is organised as follows: Section 2 reviews the literature. Section 3 summarises the data on criminal participation in the 2003 OC&JS. Section 4 presents the empirical methodology. Section 5 discusses the results. Section 6 concludes the paper.

2. Perceived deterrence and criminal activity

Research in the field on modeling the relationships between the perception of deterrence and its effect on criminal behaviour have been studied over the last thirty years (see Maxson *et al* 2011). Becker's (1968) economic model of crime has been the foundation hypothesis used by researchers in the field. The economic model of crime suggests that individuals are likely to be deterred as the expected probability or the severity of the penalties of crime increases (for further discussion see Matthews and Agnew 2008). In other words, deterrence theory is a theory of crime and criminal behaviour that makes the assumption that people act rationally when analysing the penalties for their action and make a decision to face the resulting consequences (see Paternoster 2010).

According to Pauwels *et al* (2011), research in the area of deterrence is normally classified under two categories, one being macro-level research using official crime statistics to test the relationship between objective levels of punishment and crime; the other individual level research, using survey methods to analyse the links between the perceptions of formal and informal sanctions and self-reported criminal behaviour. The method that researchers have used to examine individual beliefs empirically and perceptions in this area of research has been Bayesian updating, which is based on Bayes's rule of conditional probability. Bayesian updating, as specified by Edwards et al (1963), is based on a subjective belief that individuals begin with prior information, and as the individual acquires more information through actions about offending and its outcomes, a rational individual would tend to rely more on this new information and less on his or her own belief.

Thomas and Loughran (2013) utilised the Bayesian risk-updating model established by Anwar and Loughran (2011) to examine if the weight that individuals put on new offending information is different across persons on the basis of individual characteristics. The Bayesian risk-updating model allows the perception of risk to be based on two measurable components, an individual's prior risk perception and the current ratio of arrests to crime committed. Thomas and Loughran (2013) tested three hypotheses to examine if individual characteristics moderate the weight individuals place on their own signal and the unobservable portion of the signal in meaningful ways. A main finding of the study is that high-propensity offenders are more responsive to formal sanctions and as a result are potentially more deferrable, than low-propensity individuals.

Pogarsky *et al* (2005) investigate and test a theoretical model in which perceptions about the certainty of punishment changes according to the offending experiences of the individual, while others are established due to the

consequences from those experiences. The model was proposed as a more comprehensive model of perceptual change than those that existed previously in the deterrence literature. One key assumption of the model is that individuals form perceptions based on the probability of punishment for crimes, which then affects the probability of their committing crimes. The main findings in this study are that, firstly, arrests had no effect on the perceptions of sanctions for offences such as stealing or attacking; secondly, decreases in perceived certainty were related to peer offending for stealing but not for attacking; thirdly, previous involvement in offending enhanced the effects of criminal experiences on perceived risks; and finally, moral inhibition decreased the level to which criminal activity affected sanction risk perceptions.

A more recent study by Lochner (2007) on individual perceptions of the criminal justice system, found a positive association between the likelihood of an individual being arrested and the local arrest rates. It was also determined that young males who engage in crime and are not detected revise their perceived probability of being arrested downwards and those who engage and are caught revise their probability of being arrested upwards. Lochner's (2007) model complements the earlier work of Sah (1991), whose model offered a theoretical analysis on the positive relationship between an individual's beliefs about the probability of being arrested and the number of people they perceive as committing a crime and their arrest rates. Similarly Rincke and Traxler (2009), in their study of deterrence through 'word-of-mouth', found that the link between the actual and perceived risk of detection was based on the preventive influence of law enforcement. They also found that there was a direct effect, which was based on the use of personal experience to revise risk perceptions, and an indirect effect motivated by word-of-mouth or an updating, based on the experiences of associates.

Further, Matthews and Agnew (2008) contribute to the existing literature on deterrence by investigating whether involvement with delinquent peers conditions the effects of perceived certainty on actual offending.[4] The main result of the data indicates that in most cases, the perceived certainty of punishment discourages further criminal behaviour only among those with some or no delinquent peers. This perceived belief does not have a preventative effect on offending among those with a large proportion of delinquent peers. It is unclear why delinquent peers did not condition the effect of perceived certainty on damage to property. A methodological problem of this research was identified as one of being the use of cross-sectional data, a reliance on samples of university students, and the use of questionable measures of delinquent peer association and/or the failure to control relevant variables.

Wikstrom *et al* (2011) applied the theoretical framework of situational action theory to argue that individuals abide by the law, not through fear but because they do not see crime as an alternative action. Their findings support the results that perception of deterrence is linked to an individual's propensi-

ty to commit a crime, and it influences his or her involvement in criminal activity. Of significance is that their results suggest that perceptions of deterrence are fundamentally immaterial to those who lack a propensity to commit acts of crime. Wikstrom *et al* (2011) stated that the main point of situational action theory is the idea that human action is fundamentally an outcome of how people perceive their action alternatives and how they make their choices. The theory proposes that an individual's moral rules and habits are the key individual characteristics that influence his or her perception of action alternatives and an individual's ability to exercise self-control. In situational action theory, deterrence comes into play as part of the factors that influence individuals' action choices when they consider committing an act of crime. The findings show that the subjects in the main tend to assess the risk of getting caught highest if committing theft from a car and lowest if committing an act of vandalism.

Pauwels et al (2011) investigated the relationship between perceived sanction risk and offending, using a sample of 843 Dutch adolescents, and compared their results with previous studies. One of the main findings of this study is that the more an individual is affected by perceived sanctions, the less he or she is inclined to support particular types of offending. In the overall analysis there was no support for the notion that the relationship between perceived deterrence and general offending is contingent on self-control and low morality.

Maxson *et al* (2011) investigate the effect of the risk of legal sanctions on the intention to commit three types of offences (stealing a purse or wallet, selling marijuana and stealing a car) with the aim of assessing whether the influence of deterrence varies in gang youth as compared to non-gang youth. Maxson *et al* (2011) criticise deterrence researchers who have relied heavily on testing high school and undergraduate students, because the sample may misinterpret the deterrence effect since it includes individuals who are unlikely to engage in illegal behaviour. The main finding of the research is that there is no evidence to suggest that gang members are more susceptible to punishment than non-gang members. There is also limited evidence to support the claim that certainty can be a deterrent.

Saridakis (2013) uses cross sectional data from the 1998 Youth Lifestyle Survey to investigate empirically the relationship between perceived deterrence and criminal involvement, focusing mainly on shop crime and its interaction with the perceived likelihood of detection and the perceived consequences stemming from detection in terms of job loss. The deterrence model employed utilises an instrumental variable strategy, and his main result is that perceived deterrents significantly influence criminal activity. His model includes factors that influence beliefs, including family background, demographic location, past criminal activities, previous arrest outcomes and attitudes towards police and shoplifting. Saridakis (2013) finds a positive link between perceived deterrence and shop crime, but acknowledges difficulties in

determining a set of identifying restrictions that are significant determinants of perceptions and not of crime.

3. DATA AND SAMPLE PROPERTIES

This paper uses the 2003 OC&JS, which is based on a nationally representative (core and youth boost) sample of 10,079 people, aged 10-66 (Hamlyn *et al* 2003) in England and Wales.[5] Young people were over-sampled because they attract particular policy and criminological research interests (Budd *et al* 2005). The OC&JS collects information on whether individuals have committed a serious assault in their lifetime, within the last year, and within the last four weeks. The relevant questions are given in Appendix 1 (Q1-Q3).[6] The OC&JS asked respondents to provide an 'exact' count of offences in the last year, allowing for a finer differentiation between types of offender (Budd et al 2005). Those who had committed a serious assault in the last year were then asked whether the police contacted them about it, whether this resulted in a court case, and whether they were convicted.

The statistics of self-reported crime and arrests among individuals in the 2003 OC&JS are shown in Table 1. About 18 per cent of the individuals report having committed an assault in their lifetime. Approximately 3 per cent of the sample reported an assault offence in the last year, with a mean rate of 3.24 serious assaults per offender. Around 21.58 per cent of assaults measured by the survey resulted in the offender being spoken to by the police. While this rate is substantially lower than the official clearance rate (52.6 per cent), it corresponds accurately to the official national-wide clearance rate after adjusting for non-reporting by victims. Table 2 suggests that 22.5 per cent and 23.9 per cent of assaults resulted in detection in 2002/2003 and 2003/2004, respectively.

Table 1: Self-Reported Criminal Activity and Criminal Justice Contact (2003 OC&JS)

Number of respondents	9,868
Percent who committed assault but not in the last year	14.34
Percent who committed assault in the last year	3.19
Avg. number of assaults in the last year	3.24
Percent arrested for assault in the last year (of those who offended in the last year)	21.58
Percent taken to court for assault in the last year (of those who were arrested)	5.58
Percent convicted for assault in the last year (of those who were taken to court)	30.39
Persons arrested for assault in the last year/persons who committed assault in the last year	0.12

Note:
All measures computed using sample weights.

Table 2: National Detection Rates for Assault

Year	2002/2003	2003/2004
Clearance rate [1]	52.6	50.1
Reporting rate [2]	42.8	47.8
Adjusted Clearance rate [3]	22.5	23.9

Notes:

[1] Clearance rates are taken from the Criminal Statistics. Detailed information on the way the police are able to show a crime as detected is conytained in section H of the counting rules.

[2] Per cent of crimes reported to police by the vitim are given by Dodd *et al* (2004)

[3] Clearance rate (row 1) adjusted for reporting rates (row 2).

With respect to perceptions of penalties, there are two main questions in the 2003 OC&JS that deals with this issue. Respondents over the age of 15 years were asked about their perception of the average detection rate for assault and punishment after arrest for the first and third times.[7] The questions are presented in Appendix 2 (Q4-Q5). An interesting feature of the OC&JS is that perceived probabilities of detection were reported, rather than categorical measures (e.g. very likely, quite likely). Furthermore, the respondents of the OC&JS were asked about the general rather than personal probability of arrest. As previous research has suggested (e.g. Jensen *et al* 1978), the former measure might be less open to endogenous updating bias, but at the same time might be measured with errors.[8]

Table 3 shows that, in general, individuals tend to report a slightly higher perceived probability of arrest than the true arrest rates discussed earlier.[9] More explicitly, the average perceived probability of arrest for assault (24.9 per cent) is found to be close to the sample arrest rate (21.58 per cent) and to the official probability of arrest (23.9 per cent). It can be argued that assault is a crime committed frequently and that individuals can learn quickly about the true probability of arrest (see Lochner 2007). The results with respect to race are summarised as follows: (1) between the ages of 16-20 years (Panel B) the differences in average perceptions were not found to be statistically significant; (2) Blacks between the ages of 21-30 years (Panel C) have a significantly higher mean perceived probability of arrest than Whites; and (3) for those aged above 30 years (Panel D), Asians have a significantly lower mean perceived probability of arrest than Whites. However, these differences are not large in absolute terms. Previous research, including Tonry (1995) and Lochner (2007) also suggests that official arrest rates and perceived arrests do not vary across ethnic groups.

	All	Whites	Blacks	Asians	Mixed & other ethnic origin	All (Median [1])
Table 3: Average Perceived Probabilities (%) of Arrest for Assault Causing Injury						
A) All Individuals	24.92	24.90	27.89	21.77	28.11	15.00
(standard error)	(0.33)	(0.34)	(2.38)	(1.89)	(2.39)	(1.46)
[sample size]	[8,012]	[7,406]	[131]	[259]	[216]	[8,012]
B) Individuals aged 16-20	24.74	24.79	21.00	24.89	25.99	20.00
(standard error)	(0.66)	(0.70)	(3.56)	(2.87)	(3.48)	(0.50)
[sample size]	[1,381]	[1,234]	[29]	[73]	[45]	[1,381]
C) Individuals aged 21-30	22.72	22.08	31.18	25.13	27.77	15.00
(standard error)	(0.69)	(0.69)	(5.04)	(3.76)	(4.78)	(2.11)
[sample size]	[1,763]	[1,589]	[28]	[76]	[70]	[1,763]
D) Individuals aged 31-66	25.54	25.64	28.13	19.19	28.76	15.00
(standard error)	(0.41)	(0.42)	(3.08)	(2.62)	(3.24)	(1.834)
[sample size]	[4,868]	[4,583]	[74]	[110]	[101]	[4,868]

Notes:

Sample weights were used in calculating all statistics. The hypothesis that the average perception is the same for Whites and different ethnic categories was tested. The hypothesis was rejected in sub-sample C when comparing Whites to Blacks (p-value = 0.07) and sub-sample D when comparing Whites to Asians (p-value = 0.01). Differences in beliefs among age groups were found for Whites (p-value = 0.01).

[1]Sample weights were used in calculating the median. Standard errors were obtained usinh bootstrap techniques.

A preliminary step in investigating the association between the individual's offending history and perceptions is presented in Table 4. Panel (B) in Table 4 shows that individuals aged 16-20 years, who have never committed assault, have a higher perceived risk of arrest than those who have engaged in this type of crime occasionally or frequently. Furthermore, those who have committed assault but refused to report the number of offences, tend to believe their chance of arrest is slightly lower than those not engaging in assault. The difference in the mean perception between non-criminals and criminals was not statistically significant. Similar findings arise for Panel (C) and Panel (D).

The fact that perceptions of arrest probability seem not to differ significantly between individuals with different criminal backgrounds may be a result of the measure of perceived risk. The question that was asked in the OC&JS is related to aggregate risk so the above results are necessarily silent about whether offending history affects the probability of personal risk (see Waldo and Chiricos 1972; Jensen et al 1978; Grasmick and Green 1980). Furthermore, a notable point can be acquired from the above finding: if, as this preliminary analysis finds, there is no statistically significant difference in beliefs between non-criminals and criminals, then the issue of potential endogeneity between

Table 4: Mean Perceived Probabilities (%) of Arrest for Assault Causing Injury

	Did not commit this type of crime	Committed this type of crime one to three times	Committed this type of crime more than three times	Committed this type of crime, but unknown number of times	Does not know if committed this type of crime
A) All Individuals	25.05	23.89	25.54	25.87	24.32
(standard error)	(0.36)	(0.92)	(2.14)	(2.34)	(3.33)
[sample size]	[6,432]	[1,091]	[249]	[155]	[87]
B) Individuals aged 16-20	25.34	23.12	22.33	24.78	25.99
(standard error)	(0.81)	(1.42)	(2.70)	(2.76)	(5.40)
[sample size]	[964]	[255]	[81]	[63]	[18]
C) Individuals aged 21-30	23.18	21.19	19.06	19.12	31.91
(standard error)	(0.76)	(1.89)	(2.60)	(3.67)	(8.61)
[sample size]	[1,310]	[325]	[67]	[38]	[22]
D) Individuals aged 31-66	25.46	25.35	29.48	29.42	20.95
(standard error)	(0.44)	(1.24)	(3.48)	(4.05)	(3.49)
[sample size]	[4,158]	[509]	[101]	[54]	[47]

Notes:

All statistics computed using sample weights. There is no statistical difference in the mean perception between those who have never committed an assault and the other categories for all individuals and the three sub-samples. Comparing the three age groups, significant differences in beliefs were reported for those who never committed assault (p-value=0.03) and for those who committed assault more than 3 times (p-value=0.06).

crime and beliefs may not be crucial. Although this is examined in more detail later on, it is worth pointing out that existing criminological literature (e.g. Paternoster et al 1983) suggests that measures of aggregate perceived risk are unlikely to be affected by own criminal activity.

4. THE EMPIRICAL MODEL

This section discusses the econometric models used to study the effect of the perception of deterrence measures on violent crime. In order for criminal behaviour to be understood, three elements are central to the economic model: (1) individuals' past criminal behaviour and arrest outcome (e.g., Saridakis 2013; Lochner 2007); (2) criminal behaviour and arrest outcomes of others (e.g. Sah 1991), and (3) the economic theory of crime suggests that economic variables such as unemployment and low income are positively associated with crime (see Freeman 1999). In addition, beliefs about the probability of arrest and punishment are likely to depend on whether an individual has been a victim of crime, and if it is assumed that victims know the arrest outcome of their perpetrator(s). Further, previous work (Saridakis 2004, 2011; Cherry and List 2002; and Entorf and Spengler 2002) has found that both deterrence and economic variables have a stronger relationship with property crime than any other type of crime.

Theoretical work by Wilson and Kelling (1982) suggest that criminals update their perceived probability of arrest downwards when they operate on streets where potential victims are intimidated by prevailing conditions. We examine this hypothesis by controlling for various neighbourhood decay characteristics. We accept that there are other factors that may affect an individual's perception in committing crimes, such as age and gender, cultural characteristics (e.g. religion) and regional location. These factors have been studied in criminological research (for a review, see Entorf and Spengler 2002). Further details about the variables used in the empirical analysis are provided in Appendix 3.

4.1 Perceived Probability of Arrest

To examine the importance of the covariates adopted in this study in explaining individuals' perceptions about the risk of arrest for assault, a double-limit Tobit model is used, since the dependent variable lies between 0 and 100. Briefly, the double-limit Tobit model can be represented as follows:

$$y^* = \beta' x_i + u_i \tag{1}$$

where y^* is a latent variable (unobserved for values smaller than 0 and greater than 100) representing the perceived probability of arrest; x_i is the vector of independent variables, which includes the factors affecting perceptions; β is a vector of unknown parameters; u_i is a disturbance term assumed to be inde-

pendently normally distributed with a zero mean and constant variance σ; $i = 1,2...n$ (n is the number of observations). If y_i is denoted as the observed dependent variable, then:

$$y_i = \begin{cases} 0 & if & y_i^* \leq 0 \\ y_i^* & if & 0 \leq y_i^* \leq 100 \\ 100 & if & y_i^* \geq 100 \end{cases} \quad (2)$$

Estimation of model (1) is straightforward using maximum likelihood methods and provides us with direct measures of the effect of various explanatory variables on the perceived risk of arrest. Details of the likelihood function are given in Maddala (1983). A delete-a-group jackknife method was used to estimate parameter robust standard errors (see Kott 1998).

4.2 Perceived punishment after arrest
We use the multinomial logit method to estimate the factors associated with the perceptions of punishment at first and third arrest. In this analysis, an individual chooses one alternative from the group of choices (see question Q5 in Appendix 2), and, therefore, the ordering of choices is arbitrary. The dependent variable and the model are defined as follows:

$$Y_i \begin{cases} 1. \text{ Pay a fine if arrested} \\ 2. \text{ Community sentence / probation / jail if arrested} \\ 3. \text{ Release w/o charge if arrested (base category)} \end{cases} \quad (3)$$

and

$$\Pr(Y_i = j) = \frac{e^{\beta'_j x_i}}{\sum_{h=1}^{3} e^{\beta'_h x_i}} \quad j = 1...3 \quad (4)$$

where j denotes the specific one of the $j+1$ possible unordered choices with characteristics x_i and where β is normalised at 0 (see Wooldridge 2002). A stringent assumption of multinomial logit models is that outcomes categories for the model have the property of independence of irrelevant alternatives (IIA). We test for IIA using the Hausman specification test and find no evidence that the IIA assumption has been violated (see Hausman 1978; Hausman and McFadden 1984).[10] In order to determine the effect of an independent variable on the probability of a particular response, the partial derivative of the probability with

respect to the explanatory variables of interest is computed and evaluated at the means of the independent variables (see Greene 2000).[11]

4.3 Violent crime and perceptions
We then consider the relationship between perceptions of CJS penalties and involvement in assault. The probability of the discrete event of being an offender of assault is modelled as a probit. An individual's propensity to commit a crime is denoted by a latent variable r_i^*, which is related to the observed individual characteristics through the structural model:

$$r_i^* = \beta' x_i + \varepsilon_i \tag{5}$$

where x_i is a vector of individual characteristics, β is the corresponding vector of parameters to be estimated, and ε_i is a normally distributed error term with mean zero and variance one, that captures the unobserved determinants of offending. The latent variable r_i^* drives the observed outcome of being an offender of serious assault, r_i , through the measurement equation:

$$r_i = \begin{cases} & \text{if } r_i^* > 0 \\ & 0 \text{ otherwise} \end{cases} \tag{6}$$

Estimation of model (5)-(6) is by maximum likelihood with the marginal effects (see Greene 2000) being estimated for the continuous and discrete variables (the change in predicted probability associated with changes in the explanatory variables). As an alternative specification, an ordered probit model (where r_i expresses the banded frequencies for the number of times the respondent has ever committed assault) is also estimated (see Wooldridge 2002).

5. EMPIRICAL FINDINGS

5.1 Perceived Probability of Arrest

Estimates from the two-limit Tobit models for the entire sample are presented in Table 5, as well as for two sub-samples: those still in full-time education; and those who have left. Splitting the sample into the above two categories is likely to provide a more accurate measure for beliefs before and after the transition out of education. Ordinary least square (OLS) regression is also used as a reference. Altogether, there seems to be little difference between running a simple OLS and taking a two-limit Tobit model, since there are only a few observations lying between 0 and 100 (4.42 per cent and 0.38 per cent of the overall sample, respectively).[12]

The results in Table 5 show that personal characteristics have an important role in determining beliefs. For those who have left full-time educa-

tion, the perceived risk of arrest increases with age and then starts to decrease when an individual reaches the age of 53 years (standard error=6.612).[13] The coefficient of age is statistically insignificant for those still involved in the educational system and so is excluded from the regression. This is not necessarily surprising given the small variation in age in that sub-sample.[14] We find no effect of gender on reported beliefs about the probability of arrest. Single individuals are estimated to have a higher average perceived probability of arrest than others with similar socio-economic and demographic characteristics. With respect to race, the analysis of the entire sample and post-school sub-sample reveals no effect of race and ethnic background on the reported probability of arrest. Among those still in education, however, minorities (with the only exception of Blacks) hold a significantly lower perceived probability of arrest than Whites.

There is also a strong indication in Table 5 that religious affiliation has a positive and significant effect on beliefs among those who are still in education. In the same sub-sample, low gross household income and the absence of one natural parent from the household are both found to be associated with lower perceived probability of arrest. Social-class covariates explain very little of the variation in perceptions of the risk of arrest for assault. In particular, among those who have left full-time education, being an employee in a managerial position was found to have a negative effect on perception but it is only marginally significant at the 10 per cent level. The hypothesis that the coefficients of employee with managerial and supervision profession are jointly zero was also tested. The significance level of the test is 19.95 per cent and, therefore, the hypothesis cannot be rejected. The coefficients for educational qualification are always positive (with the sole exception of those on trade apprenticeships) and significantly different from zero for the post-school sub-sample.

In each model, individuals' perceptions of the arrest probability were found to be largely independent of their past criminal activity and past arrest and punishment outcomes. Also, parents' history of trouble with the police was found to have no effect on reported beliefs about the probability of arrest. These results are quite different from those reported by Lochner (2007) in a US panel data study. Two possible reasons may explain this disparity: Lochner's use of panel data rather than a cross-sectional survey; and his use of a perception variable intended to reflect personal risk rather than general risk.

Two further hypotheses are tested: (1) whether individuals who are victimised alter their perceptions of arrest in response; and (2) whether neighbourhood lawlessness and disarray influence an individual's beliefs. The coefficients on victimisation are generally negative and significant. Although the OC&JS does not record whether an arrest was made, it can be assumed that the majority of serious assaults are undetected, given the official arrest rates reported in Table 2. Therefore, one may expect that individuals would adjust the probability of arrest downward after victimisation. We also examine the broken windows' theory of Wilson and Kelling (1982), by testing the signifi-

Table 5: OLS and Double-Limit Tobit Estimates of Perceived Probability of Arrest for Assault Causing Injury

	whole sample				still in education[1]				left full-time education			
	OLS		Double-Limit Tobit		OLS		Double-Limit Tobit		OLS		Double-Limit Tobit	
	Coeff	Robust std err	Coeff	Jackknife std err	Coeff	Robust std err	Coeff	Jackknife std err	Coeff	Robust std err	Coeff	Jackknife std err
Age (at survey date)	0.353**	0.164	0.304*	0.172	-	-	-	-	0.502*	0.172	0.461**	0.180
Age square	-0.003	0.002	-0.003	0.002	-	-	-	-	-0.005**	0.002	-0.004*	0.002
Male	0.549	0.617	0.722	0.646	0.804	1.444	0.765	1.377	0.433	0.678	0.647	0.710
Single	2.094**	0.822	2.010*	0.863	4.524	2.974	4.434	3.197	2.060**	0.849	1.986**	0.892
Children in household	-0.021	0.729	-0.147	0.764	-4.359	3.245	-5.422	3.613	0.009	0.743	-0.101	0.779
Religious practice (Belongs to church/mosque/etc)	0.665	0.598	0.596	0.624	4.772***	1.459	4.872**	1.422	-0.021	0.652	-0.125	0.682
Race (white)												
Black	0.735	2.195	0.891	2.358	-3.784	4.294	-3.066	4.560	2.183	2.559	2.079	2.778
Asian	-0.263	1.864	-0.334	2.016	-5.464*	3.305	-5.614*	3.159	0.582	2.282	0.450	2.496
Mixed	-0.377	2.206	-0.502	2.350	-5.087*	2.830	-6.272**	2.723	1.040	2.101	1.302	2.200
Other ethnic origin	-1.587	2.652	-1.876	2.900	-1.629	2.575	-2.110	2.602	-1.440	1.182	-1.708	1.260
Not always resident in the UK		1.076		1.145								
Current Occupation/employment status (working f-time)												
At school	3.951*	2.186	3.714	2.281	2.406	2.023	2.217	1.708	-	-	-	-
Studying f-time (6th form college/college/university)	-1.454	1.640	-1.717	1.706	-	-	-	-	-	-	-	-
Employee with managerial profession	-2.417	1.483	-2.481	1.542	-	-	-	-	-2.476*	1.485	-2.538	1.546
Employee with supervision profession	-2.731*	1.612	-3.004*	1.684	-	-	-	-	-2.587	1.615	-2.853*	1.690
Employee with no managerial/supervision profession	-1.642	1.322	-1.662	1.376	-	-	-	-	-1.438	1.328	-1.447	1.384
Unemployed	-1.818	1.479	-2.020	1.551	-	-	-	-	-1.559	1.490	-1.748	1.566
Permanent unable to work	-0.704	2.116	-1.264	2.254	-	-	-	-	-0.277	2.126	-0.841	2.269
Retired	-2.788	1.969	-3.588*	2.117	-	-	-	-	-2.485	1.984	-3.300	2.136
Doing something else	-1.344	1.830	-1.622	1.931	-	-	-	-	-0.986	1.837	-1.230	1.941
Gross income (>£10,000)												
Less than £10,000	-0.964	0.696	-0.846	0.728	-3.903**	1.766	-3.887**	1.688	-0.463	0.752	-0.324	0.787
Refused to respond	-0.800	0.758	-0.876	0.799	-1.511	1.654	-1.526	1.574	-0.748	0.855	-0.851	0.906
Educational qualification (no qualification)												
Higher	4.487**	0.932	4.869**	0.987	-	-	-	-	4.930**	0.970	5.320**	1.029
A levels or equivalent	2.724**	0.989	3.067**	1.042	1.444	2.076	1.598	2.041	3.028**	1.079	3.363**	1.136
Trade apprenticeships	-1.626	1.656	-1.691	1.768	-18.102**	6.052	-22.993	15.553	-1.378	1.679	-1.413	1.789
GCSE A*-G level or equivalent	2.244**	0.803	2.538**	0.853	1.622	1.914	1.714	1.741	2.257**	0.855	2.552**	0.909
Other qualification	0.106	1.920	-0.426	2.130	8.546	5.733	8.900**	3.957	-1.043	2.029	-1.710	2.266

Table 5: cont...

	whole sample				still in education[1]				left full-time education			
	OLS		Double-Limit Tobit		OLS		Double-Limit Tobit		OLS		Double-Limit Tobit	
	Coeff.	Robust std err	Coeff.	Jackknife std err	Coeff.	Robust std err	Coeff.	Jackknife std err	Coeff.	Robust std err	Coeff.	Jackknife std err
Family background (brought up w. both natural parents)												
One natural parent	-0.567	0.848	-0.521	0.884	-3.337*	1.868	-3.489**	1.726	-0.020	0.951	0.077	0.989
One natural parent and a step parent	-0.164	1.021	-0.233	1.077	1.040	2.807	1.391	2.608	-0.255	1.105	-0.403	1.176
Othe arrangment	2.273	1.474	2.512	1.543	-1.003	4.705	-1.078	4.860	2.583*	1.546	2.848*	1.623
Alcohol consumption (never consumed alcohol)												
No alcohol drink in the last 12 months	-0.992	1.943	-1.220	2.120	1.589	5.136	1.306	5.403	-1.225	2.132	-1.391	2.336
Heavy drinker	0.015	1.452	0.188	1.564	-3.878	3.123	-3.963	3.193	0.340	1.637	0.572	1.769
Occasional drinker	-0.461	1.445	-0.183	1.556	-1.924	3.018	-1.895	3.016	-0.426	1.636	-0.077	1.769
Hard drug use (cocaine/crack/heroin use)	-1.715	1.086	-1.769	1.131	2.265	3.017	2.383	3.176	-1.751	1.168	-1.815	1.218
Good health status	0.791	0.739	0.732	0.778	-1.583	2.228	-1.622	2.192	0.966	0.783	0.910	0.826
No relatives within walking distance	0.067	0.595	-0.011	0.623	-0.891	1.560	-0.829	1.457	0.276	0.644	0.174	0.675
No friends within walking distance	-0.539	0.774	-0.681	0.817	0.673	2.496	0.296	2.555	-0.723	0.817	-0.845	0.864
Neighborhood teenagers a problem	-1.041*	0.60	-1.090*	0.623	-0.118	1.499	-0.095	1.429	-1.090*	0.650	-1.148*	0.680
Neighborhood drug using/seling a problem	-0.271	0.704	-0.451	0.741	0.580	1.750	0.473	1.688	-0.302	0.771	-0.487	0.813
Neighborhood alcohol consumption a problem	-1.272**	0.64	-1.257*	0.670	0.098	1.544	-0.119	1.477	-1.459**	0.706	-1.418*	0.740
"Parents have been in trouble with police"	0.962	1.110	1.032	1.163	-0.765	2.287	-0.720	2.236	1.344	1.262	1.400	1.324
Ever been fined by a court for any offence	-1.179	1.025	-1.093	1.070	-3.246	6.546	-3.657	7.585	-1.168	1.047	-1.085	1.093
Ever sentenced to supervision by a court for any offence	1.215	2.176	1.227	2.324	0.835	9.160	1.382	11.887	1.201	2.251	1.187	2.411
Ever been sentenced to custody by a court	3.618	3.088	3.718	3.294	-5.381	9.291	-6.024	11.891	3.680	3.140	3.772	3.355
Victim of assault	-1.612*	0.88	-1.561*	0.917	-0.057	2.039	-0.107	1.965	-1.991**	0.976	-1.901*	1.019
Commited assault	-0.642	0.774	-0.665	0.807	-1.129	1.721	-0.981	1.640	-0.529	0.865	-0.583	0.904
Regions (East Anglia and London)												
North England (North/North west/York and Humberside)	0.335	0.888	0.476	0.934	-1.490	2.166	-1.606	2.043	0.777	0.970	0.964	1.024
Midlands (East Midlands/West Midlands)	0.059	0.939	0.269	0.984	-2.499	2.374	-2.544	2.195	0.526	1.021	0.768	1.071
South England (South East/ South West)	0.230	0.876	0.376	0.919	-0.697	2.265	-0.599	2.156	0.487	0.951	0.634	1.001
Wales	2.609*	1.35	3.097**	1.408	-1.760	3.075	-1.429	2.863	3.555**	1.485	4.087**	1.551
Intercept	15.468***	3.82	15.725**	4.021	23.426**	5.427	23.381**	5.358	11.662**	4.063	11.660**	4.282
Log-likelihood	-		-33,750.736		-		-4,107.991		-		-29,600.710	
R-square	0.015		0.002		0.049		0.006		0.019		0.002	
Observations	7,578		7,578		940		940		6,638		6,638	

Notes: *Significant at 10% level. **Significant at 5% level.
[1]Given the small variation in age, the coefficient of age was statistically insignificant and so was excluded from the regression.

cance of variables reflecting neighbourhood decay.

The estimates in Table 5 suggest that individuals living in neighbourhoods with disobedient teenagers and who consider the neighbourhood to have alcohol problems, report lower probabilities of arrest than those living in cleaner and safer neighbourhoods. However, the coefficient of the variable identifying neighbourhoods with drug-related problems was small and insignificant. The hypothesis that the coefficients of all three neighbourhood characteristics are all zero is rejected at the 5 per cent level. Consequently, policies for the improvement of local community/neighbourhood conditions are supported by this research. Fixing 'broken windows' may actually restore order and reduce crime by increasing perceptions of the effectiveness of the CJS. Finally, there is some evidence of regional variation: individuals in Wales report a higher perceived probability of arrest and those living in London, and individuals in East Anglia report a lower perception than those in the rest of the country.

We report R^2 for both the linear regression and double-limit Tobit models.[15] The R^2 statistics are very small, suggesting that most of the variation in beliefs is due to unobservable factors, rather than measures of individual-level and neighbourhood-level characteristics.

5.2 Estimates of the Perceived Punishment after Arrest

Table 6 lists the marginal effects estimates of each independent variable for all three categories of perceived punishment after first and third arrest. By construction, they necessarily sum to zero across all the alternative punishment methods. The predicted probabilities of each alternative, and the predicted frequencies, are provided at the end of Table 6. The results show that age has a non-linear, U-shaped, effect on the probability of reporting release without charge if arrested. The inverse of this relationship is found in the marginal effects of age within the categories of severe penalties. Being male has a significant and negative marginal effect of reporting release without charge if arrested, but has a positive and significant marginal effect of reporting severe consequences of arrest.

The results also suggest that being Black increases the probability of reporting community/probation/jail sentence if arrested for the first time. Individuals from low social classes (e.g. unemployed, employee with no managerial duties) are less likely to report community/probation/jail sentence if arrested for the first time and released without charge if arrested for the third time. A weak effect between beliefs of punishment and education attainment was found. Individuals are more likely to report severe penalties if they are hard drug users and released without charge if they are occasional or regular drinkers.

Turning to the main variables of interest, two pertinent findings are apparent. First, the individual's criminal history and past interaction with the justice system has a significant and substantial effect on perceptions of punishment for being arrested for the first and third time. For example, past custodial

Table 6: Marginal Effects of Multinomial Logit For Perceived Punishment After Arrested for Assault Causing Injury First and Third Time

	First time Arrested for Assault Causing Injury						Third Time Arrested for Assault Causing Injury					
	Released w/o charge if arrested		Pay a fine if arrested		Community sentence/probation/jail term if arrested		Released w/o charge if arrested		Pay a fine if arrested		Community sentence/probation/jail term if arrested	
	ME	std.err.	ME	std.err.	ME	std.err.	ME	std.err.	ME	std.err.	ME	std.err.
Age (at survey date)	-0.015**	0.003	0.008**	0.002	0.008***	0.002	-0.006**	0.003	-0.004	0.003	0.010**	0.003
Age square	0.000**	0.000	-0.000**	0.000	-0.000*	0.000	0.000	0.000	0.000	0.000	-0.000*	0.000
Male	-0.055**	0.011	0.031**	0.009	0.024	0.007	-0.049**	0.010	-0.005	0.010	0.054**	0.013
Single	-0.014	0.014	0.009	0.011	0.004	0.010	-0.003	0.014	-0.018	0.014	0.021	0.017
Children in household	0.012	0.012	-0.010	0.009	-0.002	0.008	0.017	0.012	0.010	0.012	-0.027**	0.015
Religious practice (Belongs to church/mosque/etc)	0.003	0.010	0.005	0.008	-0.007	0.007	-0.008	0.010	0.006	0.010	0.001	0.012
Race (white)												
Black	-0.028	0.045	-0.054**	0.025	0.082**	0.040	-0.014	0.038	-0.049	0.034	0.063	0.047
Asian	0.006	0.032	0.005	0.026	-0.012	0.021	0.012	0.031	-0.015	0.028	0.003	0.037
Mixed and other ethnic origin	-0.089**	0.037	0.050	0.030	0.039	0.028	-0.044	0.027	-0.028	0.028	0.071	0.036
Not always resident in the UK	0.025	0.017	-0.017	0.013	-0.008	0.011	0.010	0.017	0.003	0.017	-0.013	0.021
Current Occupation/employment status (working f-time)												
At school	0.026	0.040	-0.002	0.033	-0.023	0.026	-0.069**	0.026	0.044	0.041	0.025	0.045
Studying f-time (6th form college/college/university)	0.016	0.027	0.001	0.023	-0.017	0.017	-0.027	0.023	0.038	0.030	-0.011	0.033
Employee with managerial profesion	0.018	0.020	-0.003	0.017	-0.015	0.012	0.000	0.022	0.012	0.024	-0.013	0.028
Employee with supervision profession	0.030	0.023	-0.009	0.019	-0.021	0.013	-0.024	0.023	0.035	0.028	-0.011	0.032
Employee with no managerial/supervision profession	0.009	0.019	0.011	0.016	-0.020*	0.011	-0.043**	0.019	0.019	0.021	0.024	0.025
Unemployed	-0.002	0.023	0.024	0.020	-0.022*	0.012	-0.050**	0.019	0.028	0.025	0.022	0.028
Permanently unable to work	-0.038	0.037	0.037	0.032	0.001	0.022	-0.061**	0.027	0.000	0.036	0.061	0.041
Retired	0.037	0.027	0.004	0.025	-0.041**	0.013	-0.060**	0.026	0.039	0.036	0.021	0.039
Doing something else	0.043*	0.024	-0.012	0.021	-0.031**	0.013	0.014	0.030	0.018	0.031	-0.031	0.036
Gross income (>£10,000)												
Less than £10,000	-0.001	0.012	0.004	0.010	-0.003	0.008	0.008	0.012	0.016	0.012	-0.024*	0.015
Refused to respond	0.017	0.013	0.000	0.011	-0.016*	0.009	0.009	0.013	0.017	0.013	-0.026	0.016
Educational qualification (no qualification)												
Higher	-0.023	0.016	0.002	0.012	0.020*	0.011	-0.009	0.015	-0.023	0.015	0.032*	0.019
A levels or equivalent	0.026	0.017	-0.024*	0.012	-0.002	0.012	0.017	0.017	-0.019	0.016	0.002	0.021
Trade apprenticeships	0.014	0.026	-0.023	0.019	0.010	0.020	0.003	0.031	-0.001	0.029	-0.003	0.037
GCSE A*-G level or equivalent	0.009	0.014	-0.026**	0.011	0.017	0.011	-0.006	0.014	-0.016	0.014	0.021	0.017
Other qualification	0.043	0.031	-0.045**	0.021	0.003	0.025	0.030	0.036	-0.045	0.030	0.015	0.042

Table 6: cont...

	First time Arrested for Assault causing Injury						Third Time Arrested for Assault Causing Injury					
	Released w/o charge if arrested		Pay a fine if arrested		Community sentence/probation/ jail term if arrested		Released w/o charge if arrested		Pay a fine if arrested		Community sentence/probation/ jail term if arrested	
	ME	std.err.	ME	std.err.	ME	std.err.	ME	std.err.	ME	std.err.	ME	std.err.
Family background (brought up w. both natural parents)												
One natural parent	0.007	0.015	0.005	0.012	-0.013	0.010	0.004	0.015	-0.003	0.018	-0.002	0.018
One natural parent and a step parent	-0.019	0.020	0.016	0.016	0.003	0.014	0.021	0.018	-0.017	0.018	-0.004	0.023
Other arrangement	-0.023	0.025	0.024	0.021	-0.001	0.016	-0.042*	0.022	-0.027	0.022	0.069**	0.028
Alcohol consumption (never consumed alcohol)												
No alcohol drink in the last 12 months	0.008	0.031	-0.004	0.025	-0.004	0.021	0.038	0.038	0.035	0.034	-0.072*	0.042
Heavy drinker	0.024	0.025	-0.007	0.020	0.017	0.017	0.055**	0.025	-0.015	0.024	-0.040	0.030
Occasional drinker	-0.002	0.025	0.011	0.021	-0.009	0.016	0.062**	0.028	-0.017	0.023	-0.045	0.031
Hard drug use (cocaine/crack/heroin use)	-0.029	0.020	0.015	0.016	0.014	0.015	-0.021	0.017	-0.018	0.018	0.039*	0.022
Good health status	0.008	0.013	0.000	0.010	-0.008	0.009	-0.019	0.013	0.023*	0.012	-0.004	0.016
No relatives within walking distance	0.000	0.010	-0.004	0.008	0.004	0.007	0.000	0.010	-0.021**	0.010	0.021*	0.012
No friends within walking distance	0.025**	0.013	-0.018*	0.010	-0.007	0.009	0.016	0.013	0.000	0.013	-0.015	0.016
Neighborhood teenagers a problem	0.007	0.010	0.000	0.008	-0.006	0.007	0.022**	0.010	-0.008	0.010	-0.014	0.012
Neighborhood drug using/selling a problem	0.025**	0.012	-0.012	0.010	-0.013	0.008	0.008	0.012	0.010	0.012	-0.018	0.015
Neighborhood alcohol consumption a problem	-0.006	0.012	-0.008	0.009	0.014*	0.008	0.004	0.011	0.001	0.011	-0.005	0.014
"Parents have been in trouble with police"	-0.014	0.021	0.019	0.017	-0.005	0.014	0.000	0.019	-0.014	0.019	0.014	0.024
Ever been fined by a court for any offence	-0.007	0.017	0.024*	0.015	-0.017	0.011	-0.008	0.018	-0.003	0.018	0.011	0.022
Ever sentenced to supervision by a court for any offence	-0.101**	0.046	0.047	0.034	0.053	0.035	-0.039	0.040	-0.046	0.037	0.085*	0.049
Ever been sentenced to custody by a court	-0.101**	0.057	0.037	0.040	0.065	0.045	-0.120**	0.039	-0.060	0.047	0.180**	0.057
Victim of assault	-0.003	0.017	0.012	0.013	-0.008	0.011	-0.002	0.016	-0.010	0.015	0.012	0.019
Committed assault	-0.012	0.013	0.021	0.011	-0.009	0.009	-0.023*	0.012	0.020	0.013	0.003	0.016
Regions (East Anglia and London)												
North England (North/North west/York and Humberside)	-0.032**	0.016	-0.001	0.012	0.034**	0.012	-0.024*	0.014	0.014	0.015	0.047**	0.018
Midlands (East Midlands/West Midlands)	-0.035**	0.017	-0.002	0.013	0.033**	0.013	-0.018	0.015	-0.023	0.015	0.041**	0.019
South England (South East/ South West)	0.001	0.015	-0.009	0.012	0.007	0.011	-0.013	0.014	-0.031**	0.014	0.044**	0.018
Wales	-0.056**	0.026	0.028	0.020	0.028	0.019	-0.064	0.018	-0.037*	0.019	0.101**	0.025
Probability	0.774		0.127		0.099		0.199		0.197		0.604	
Actual/Predicted N	5,835		956		744		1,455		1,483		4,586	

Notes: *Significant at 10% level. **Significant at 5% level.
Zero coefficients are due to rounding

sentence increases the probability of reporting community/probation/jail sentence for a third time arrest by almost a third (an increase of 18 percentage points on a baseline probability of 60 per cent). It is reasonable to assume that individuals who have been punished sometime in the past may know the punishment associated with an arrest, but they do not necessarily know the probability of the aggregate risk of arrest. Furthermore, individuals who have previously committed assault are less likely to report release without charge if arrested for a third time.

However, individuals may misinterpret the question. Rather than reporting a general average penalty, individuals may respond by reporting a specific personal penalty. Surprisingly, there is no evidence that parents' history of trouble with the police affects beliefs of punishment. Second, variables describing neighbourhood conditions have an overall significant and positive effect on the probability of reporting release without charge if arrested for a crime. This is in line with the predictions of the 'broken windows' theory of Wilson and Kelling (1982). A significant effect of regions was found for individuals not living in London and East Anglia, as being significantly more likely to report severe penalties after arrest.

5.3 The Influence of Perception on Criminal Behaviour
Table 7 reports the marginal effects (ME) of a probit model for criminal participation (the ordered probit coefficient estimates are provided in Appendix 4). The results show a negative and significant association between age and assault. Gender is also important in all models, where males appear more likely to be offenders of assault. Ethnicity appears also to be important, with Asians respondents (compared with Whites) statistically less likely to commit a crime.

In contrast to economic theory, unemployment is found to be statistically insignificant in all models. Low income (proxied by gross income less than £10,000) is found to be significant at the 10 per cent level for those still at school, but it carries the opposite sign from what is expected, based on the economic theory of crime.[16] Macro-studies have also reported a weak and/or ambiguous effect of unemployment and/or income on violent crime (e.g. Levitt 1996, 2001; Entorf and Spengler 2000, 2002). Also, for the post-school subsample, education is found to be positively associated with assault. This is a surprising result since one may expect that educated individuals would commit fewer violent crimes.[17] When separate models are estimated for males and females, the education variables remain statistically significant only for females. To explore this further, we re-estimate the model initially without the victimisation variable, and subsequently without variables such as alcohol consumption and good health status, which are found to be closely associated with education. The results, however, remain unaffected. As has been previously suggested by Witte (1997), the effect of education on crime is little explored and further research should be carried out to examine this relationship.

Table 7: Probit Estimates: Ever Commited Assault Causing Injury (Marginal Effects)

	Whole sample[1]		In f-t education[2]		Left f-t education[1]		Male[1]		Female[3]	
	ME	std.err.	ME	std.err.	ME	std.err.	ME	std.err.	ME	std.err.
Age (at survey date)	-0.004**	0.000	-		-0.004**	0.000	-0.005**	0.001	-0.003**	0.001
Male	0.107**	0.009	0.121**	0.030	0.106**	0.010				
Single	-0.015	0.012	-0.010	0.064	-0.013	0.012	-0.031	0.022	-0.009	0.013
Children in household	0.017	0.011	0.110	0.089	0.013	0.011	-0.013	0.020	0.024**	0.012
Religious practice (Belongs to church/mosque/etc)	-0.006	0.009	-0.011	0.030	-0.005	0.009	0.000	0.015	-0.007	0.010
Race (white)										
Black	-0.026	0.035	-0.010	0.096	-0.029	0.038	-0.060	0.061	-0.007	0.038
Asian	-0.074**	0.021	-0.009	0.071	-0.090**	0.020	-0.118**	0.036	-0.033	0.027
Mixed and other ethnic origin	0.018	0.029	-0.038	0.064	0.036	0.034	0.010	0.051	0.021	0.032
Not always resident in the UK	-0.007	0.016	-0.016	0.050	-0.007	0.017	-0.020	0.028	0.002	0.017
Current Occupation/employment status (working f-time)										
At school	0.009	0.032	0.032	0.040	-		-0.010	0.052	0.003	0.036
Studying f-time (6th form college/college/university)	-0.014	0.021	-		-		-0.016	0.036	-0.026	0.024
Employee with managerial profession	-0.005	0.019	-		-0.005	0.019	0.015	0.030	-0.034	0.021
Employee with supervision profession	-0.026	0.020	-		-0.025	0.019	0.000	0.036	-0.049**	0.019
Employee with no managerial/supervision profession	-0.022	0.017	-		-0.021	0.017	-0.022	0.027	-0.036	0.022
Unemployed	-0.001	0.021	-		0.002	0.020	-0.040	0.038	-0.020	0.023
Permanently unable to work	-0.019	0.027	-		-0.017	0.026	-0.021	0.042	-0.021	0.034
Retired	0.028	0.032	-		0.029	0.031	0.097*	0.055	-0.030	0.027
Doing something else	-0.067**	0.022	-		-0.064**	0.021	-0.074**	0.040	-0.067**	0.019
Gross income (>£10,000)										
Less than £10,000	0.003	0.011	-0.063*	0.035	0.009	0.011	-0.006	0.019	0.010	0.012
Refused to respond	-0.039**	0.011	-0.054*	0.031	-0.039**	0.012	-0.047**	0.020	-0.030*	0.011
Educational qualification (no qualification)										
Higher	0.034**	0.015	-		0.0359**	0.016	0.036	0.026	0.028*	0.017
A levels or equivalent	0.007	0.016	-0.015	0.041	0.010	0.017	0.012	0.028	-0.000	0.018
Trade apprenticeships	0.057**	0.031	0.018	0.249	0.058**	0.031	0.051	0.041	0.088	0.078
GCSE A*-G level or equivalent	0.030**	0.014	0.029	0.038	0.029**	0.015	0.019	0.024	0.033**	0.015
Other qualification	-0.022	0.032	-0.135	0.081	-0.006	0.035	-0.056	0.054	0.009	0.040

Table 7: cont...

	Whole sample[1]		In f-t education[2]		Left f-t education[1]		Male[1]		Female[3]	
	ME	std.err.	ME	std.err.	ME	std.err.	ME	std.err.	ME	std.err.
Family background (brought up w. both natural parents)										
One natural parent	0.037**	0.014	0.033	0.042	0.038**	0.016	0.028	0.024	0.040**	0.017
One natural parent and a step parent	0.054**	0.018	0.087	0.060	0.048**	0.019	0.068**	0.033	0.039**	0.019
Other arrangment	0.029	0.024	0.116	0.109	0.023	0.024	-0.023	0.042	0.052**	0.028
Alcohol consumption (never consumed alcohol)										
No alcohol drink in the last 12 months	0.041	0.039	-0.037	0.102	0.047	0.043	-0.011	0.059	0.101**	0.059
Heavy drinker	0.094**	0.024	0.158**	0.070	0.085**	0.026	0.088**	0.041	0.105**	0.030
Occasional drinker	0.056**	0.029	0.101	0.072	0.050	0.032	0.032	0.048	0.077**	0.035
Hard drug use (cocaine/crack/heroin use)	0.152**	0.020	0.102*	0.064	0.156**	0.021	0.181**	0.028	0.125**	0.029
Good health status	-0.039**	0.013	-0.064	0.047	-0.034**	0.013	-0.026	0.022	-0.044**	0.014
No relatives within walking distance	-0.001	0.009	0.013	0.030	-0.004	0.009	-0.007	0.016	0.003	0.010
No friends within walking distance	-0.015	0.012	0.002	0.051	-0.014	0.012	-0.010	0.021	-0.012	0.012
Neighborhood teenagers a problem	0.011	0.009	0.025	0.030	0.010	0.010	-0.011	0.016	0.027**	0.010
Neighborhood drug using/seling a problem	0.033**	0.012	0.071**	0.036	0.028**	0.012	0.041**	0.020	0.025**	0.013
Neighborhood alcohol consumption a problem	0.032**	0.010	0.094**	0.032	0.024**	0.011	0.039**	0.018	0.023**	0.011
"Parents have been in trouble with police"	0.065**	0.019	0.085*	0.055	0.063**	0.021	0.079**	0.033	0.049**	0.021
Victim of assault	0.183**	0.018	0.254**	0.045	0.168**	0.019	0.226**	0.025	0.139**	0.024
Perceived prob. of arrest	-0.000	0.000	-0.001	0.001	-0.000	0.000	-0.000	0.000	0.000	0.000
Imprisonment for both first and third time arrest	-0.015	0.014	0.005	0.067	-0.018	0.014	-0.005	0.025	-0.023	0.015
Regions (East Anglia and London)										
North England (North/North west/York and Humberside)	0.005	0.014	0.048	0.048	-0.001	0.014	0.006	0.024	0.006	0.015
Midlands (East Midlands/West Midlands)	0.002	0.015	-0.001	0.050	0.001	0.015	0.017	0.026	-0.007	0.015
South England (South East/ South West)	0.001	0.013	0.057	0.048	-0.005	0.014	-0.001	0.023	0.006	0.015
Wales	0.004	0.021	0.074	0.074	-0.006	0.021	0.007	0.036	-0.004	0.022
Log likelihood	-3099.788		-440.561		-2,645.562		-1,774.389		-1,302.380	
χ^2 *(degrees of freedom)*	1,049.8(46)		164.9(36)		888.1(44)		452.0(45)		436.2(45)	
Observations	7,578		940		6,638		3,536		4,042	

Notes:
*Significant at 10% level. **Significant at 5% level. Zero coefficients are due to rounding.
[1]When age[2] was included in the model, age was not any more statistically significant.
[2]Given the small variation in age, the coefficient of age was statistically insignificant and so was excluded from the regression.
[3]Age[2] was not statistically significant.

For the post-school sub-sample, having a disadvantaged family background, such as a lack of both natural parents in the household (when the individual was aged 10-16), is found to increase significantly the probability of being an offender. Additionally, heavy drinkers and drug users are more likely to commit an assault. This is in line with previous empirical studies (e.g. Ensor and Godfrey 1993; Saridakis 2004, 2011). A factor with a negative association with criminal participation is individuals having a good health status. The figures in Table 7 are also quite revealing about the association between offending behaviour and victimisation. There appears to be a positive and statistically significant association between victimisation and the risk of being an offender.[18] The results also show that a family history of trouble with the police is an important factor in criminality.[19] Similarly, living in a neighbourhood with alcohol and drug-related[20] problems are all positively associated with criminal involvement.

The economics of crime literature assumes that variables of deterrence are among the most important factors in the crime decision. However, the findings presented in the present paper provide weak evidence in favour of the deterrence hypothesis. The perceived general probability of arrest is found to carry the expected sign in most models, but it is always statistically insignificant. The coefficient of perceived punishment is also found to be negative and statistically insignificant in most specifications. The deterrence coefficients remain jointly statistically insignificant.[21] However, ordered probit estimates presented in the last column of Appendix 4 for the female sub-sample suggest a negative and statistically significant association between perceived punishment after arrest and assault. Thus, it may be the cost of punishment, rather than the risk of arrest, that influences female criminality.

6. CONCLUSIONS

This paper uses data from the 2003 Offending, Crime and Justice Survey to explore the perceptions of the Criminal Justice System held by individuals in England and Wales for assault, the most common indictable offence against a person. Beliefs about the probability of arrest are substantially lower than official arrests rates. When adjusting for non-reporting by victims, however, perceived risk of arrest and actual arrest rates are very similar. There is no empirical evidence to indicate that perceptions of the probability of arrest differ between criminals and non-criminals. However, there is some evidence to show that perception of punishment is determined by past criminal activity. Furthermore, weak evidence is found to the effect that the perceived probability of arrest and perceived punishment associated with first and third time arrest vary across races and age-groups.

Deterrence theory and information-based models of belief-updating suggest that beliefs are significantly affected by individuals' past criminal behaviour and arrest outcomes. In the present study, perceptions about the general perceived risk of arrest are not found to be related to an individual's own criminal and arrest history. Instead, an individual's beliefs about the per-

ceived probability of arrest are largely affected by neighbourhood conditions and victimisation. To examine the link between perceptions and criminal behaviour, probit and ordered probit models are estimated. The empirical evidence is not in line with the basic predictions of the economic theory of crime. Two important findings are summarised here: first, the analysis reveals only weak effects of economic conditions, such as unemployment and low income, on participation in violent crime. Second, no association is found between perceived risk and violent crime participation. One deficiency of this analysis, however, may be the fact that a general rather than person-specific measure of risk of arrest is used to analyse the crime-deterrence nexus. Sociologists and criminologists have suggested that although this type of general measure may be less open to endogeneity bias, personal risk of arrest may provide a stronger relationship between crime and deterrence. The analysis, however, finds some evidence that perception of punishment after arrest influences female criminal behaviour. Additionally, the results of this paper support sociological theories such as the 'broken window' theory of Wilson and Kelling (1982), thus providing support for policies targeting the improvement of local community/neighbourhood conditions. As an extension of this study, further research can be undertaken using panel data analysis along with various waves of the OC&JS survey. Such additional work would augment the results of this study and provide significant information for policy formulation.

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APPENDIX 1: Survey Questions on Assault Causing Injury

Q1. Have you ever used force or violence on anyone on purpose, for example, by scratching, hitting, kicking or throwing things, which you think injured them in some way?

1. Yes
2. No
3. Don't know
4. Don't want to answer

Q2. During your life, how many times have you done this?

1. Once
2. Twice or three time
3. Four times or more
4. Don't know
5. Don't want to answer

Q3. Have you done this in the last 12 months?

1. Yes
2. No
3. Don't know
4. Don't want to answer

APPENDIX 2: Survey Questions on Perceived Deterrents

Q4. Think about someone who punches another person in a pub knocking them out. Out of every 100 people who do this, how many do you think are caught by the police?

Numeric 0 to 100

Q5. Thinking about an adult who is caught by the police for punching someone else in a pub knocking them out. What do you think is the most likely thing that would happen to an adult who was caught doing this for the first (third) time?

1. Nothing
2. A verbal warning from the police
3. A formal written warning from the police or court
4. Ordered pay a fine
5. Community sentence/put on a probation
6. Sentence to prison
7. Other
8. Don't know
9. Refused

Appendix 3: Description of Covariates (n=7,578, weighted estimates with 95% confidence bands)

Covariate	Estimate	Range
Age (at survey date)	39.79±0.33	16-66
Male	49.17±1.33	0-1
Single	25.68±1.06	0-1
Children in household	44.25±1.35	0-1
Religious practice (Belongs to church/mosque/etc)	67.52±1.23	0-1
Race		
White (base)	91.38±0.84	-
Black	1.86±0.43	0-1
Asian	4.06±0.61	0-1
Mixed & other ethnic origin	2.7±0.46	-
Not always resident in the UK	12.10±0.95	0-1
Current Occupation/employment status		
At school	1.37±0.22	0-1
Studying full-time (6th form college/college/university)	6.31±0.55	0-1
Self-employed (base)	8.45±0.79	-
Employee with managerial profession	15.10±1.00	0-1
Employee with supervisory profession	7.65±0.73	0-1
Employee with no managerial/supervisory profession	36.73±1.29	0-1
Unemployed	2.24±0.37	0-1
Permanently unable to work	3.52±0.47	0-1
Retired	5.42±0.54	0-1
Doing something else	13.21±0.90	0-1
Gross income		
Less than £10,000	19.77±1.02	0-1
More than £10,000 (base)	64.53±1.25	-
Refused to respond	15.70±0.95	0-1
Educational qualification		
No qualification (base)	20.94±1.10	-
Higher	30.02±1.25	0-1
A levels or equivalent	14.85±0.92	0-1
Trade apprenticeships	3.60±0.52	0-1
GCSE A*-G level or equivalent	28.02±1.17	0-1
Other qualification	2.57±0.47	0-1

Covariate	Estimate	Range
Family background[1]		
Both natural parents (base)	79.07±1.05	-
One natural parent	10.52±0.80	0-1
One natural parent and a step parent	6.35±0.62	0-1
Othe arrangment	3.83±0.48	0-1
Alcohol consumption		
Never consumed alcohol (base)	5.72±0.69	-
No alcohol drink in the last 12 months	4.15±0.52	0-1
Heavy drinker	59.99±1.30	0-1
Occasional drinker	30.13±1.21	0-1
Hard drug use (cocaine/crack/heroin use)	7.44±0.71	0-1
Good health status	80.98±1.02	0-1
No relatives within walking distance	46.16±1.33	0-1
No friends within walking distance	16.45±0.98	0-1
Neighborhood teenagers a problem	46.63±1.33	0-1
Neighborhood drug using/selling a problem	21.63±1.08	0-1
Neighborhood alcohol consumption a problem	28.55±1.20	0-1
"Parents have been in trouble with police"	5.48±0.59	0-1
Ever been fined by a court for any offence	10.54±0.83	0-1
Ever been sentenced to supervision by a court for any offence	1.95±0.36	0-1
Ever been sentenced to custody by a court	1.19±0.28	0-1
Victim of assault	9.24±0.76	0-1
Commited assault	17.30±0.99	0-1
Regions		
East Anglia and London (base)	18.80±1.11	-
North England (North/North west/York and Humberside)	26.04±1.15	0-1
Midlands (East Midlands/West Midlands)	20.29±1.06	0-1
South England (South East/South West)	29.27±1.19	0-1
Wales	5.60±0.58	0-1

[1]For those aged 17 and over, refers to circumstances at the time the respondent was aged 10-16; for other, refers to current circumstances.

Appendix 4: Ordered Probit Estimates: No. of Times Ever Committed Assault Causing Injury

	Whole sample[1]		In f-t education[2]		Left f-t education[1]		Male[1]		Female[3]	
	ME	std.err.	ME	std.err.	ME	std.err.	ME	std.err.	ME	std.err.
Age (at survey date)	-0.017**	0.002	–		-0.017**	0.002	-0.018**	0.003	-0.016**	0.003
Male	0.447**	0.039	0.430**	0.101	0.454**	0.042	–		–	
Single	-0.064	0.052	0.014	0.211	-0.058	0.053	-0.121*	0.073	-0.026	0.076
Children in household	0.096**	0.045	0.322	0.242	0.084*	0.046	-0.006	0.064	0.162**	0.066
Religious practice (Belongs to church/mosque/etc)	-0.032	0.038	-0.059	0.100	-0.028	0.041	0.003	0.049	-0.067	0.059
Race (white)										
Black	-0.252	0.181	0.052	0.331	-0.354	0.221	-0.446*	0.267	-0.089	0.248
Asian	-0.341**	0.139	-0.097	0.264	-0.425**	0.169	-0.381**	0.181	-0.251	0.221
Mixed and other ethnic origin	0.073	0.113	-0.064	0.241	0.126	0.130	0.066	0.158	0.075	0.163
Not always resident in the UK	-0.003	0.068	-0.053	0.175	-0.001	0.074	-0.054	0.093	0.061	0.100
Current Occupation/employment status (working f-time)										
At school	0.005	0.129	-0.037	0.129	–		-0.079	0.172	0.006	0.210
Studying f-time (6th form college/college/university)	-0.069	0.094					-0.047	0.118	-0.192	0.171
Employee with managerial profession	-0.007	0.081			-0.001	0.082	0.062	0.095	-0.209	0.163
Employee with supervision profession	-0.178*	0.096			-0.174*	0.096	-0.110	0.116	-0.350**	0.178
Employee with no managerial/supervision profession	-0.107	0.074			-0.101	0.074	-0.098	0.087	-0.209	0.145
Unemployed	-0.019	0.088			-0.008	0.088	-0.066	0.133	-0.143	0.152
Permanently unable to work	-0.141	0.123			-0.130	0.123	-0.108	0.144	-0.232	0.244
Retired	0.007	0.123			0.018	0.124	0.173	0.156	-0.271	0.212
Doing something else	-0.346**	0.134			-0.340**	0.134	-0.319*	0.168	-0.470**	0.232
Gross income (>£10,000)										
Less than £10,000	0.008	0.045	-0.243*	0.136	0.037	0.048	-0.011	0.062	0.042	0.067
Refused to respond	-0.181**	0.052	-0.189*	0.111	-0.189**	0.060	-0.195**	0.070	-0.163**	0.080
Educational qualification (no qualification)										
Higher	0.161**	0.062	–		0.164**	0.065	0.123	0.083	0.189**	0.094
A levels or equivalent	0.027	0.067	-0.144	0.141	0.047	0.073	0.044	0.089	-0.024	0.106
Trade apprenticeships	0.212*	0.108	0.510	0.740	0.211*	0.110	0.158	0.121	0.379	0.296
GCSE A*-G level or equivalent	0.139*	0.057	0.060	0.127	0.139**	0.061	0.082	0.078	0.207**	0.084
Other qualification	-0.009	0.147	-0.635	0.556	0.073	0.155	-0.084	0.200	0.103	0.218

Appendix 4: cont....

	Whole sample[1]		In f-t education[2]		Left f-t education[1]		Male[1]		Female[3]	
	ME	std.err.	ME	std.err.	ME	std.err.	ME	std.err.	ME	std.err.
Family background (brought up w. both natural parents)										
One natural parent	0.139**	0.054	0.066	0.133	0.154**	0.059	0.082	0.073	0.217**	0.080
One natural parent and a step parent	0.181**	0.064	0.243	0.166	0.171**	0.070	0.135	0.093	0.224**	0.090
Other arrangement	0.170*	0.091	0.409	0.287	0.146	0.097	-0.050	0.143	0.322**	0.120
Alcohol consumption (never consumed alcohol)										
No alcohol drink in the last 12 months	0.181	0.147	-0.051	0.404	0.189	0.163	0.082	0.200	0.375*	0.224
Heavy drinker	0.423**	0.114	0.560**	0.247	0.387**	0.130	0.348**	0.152	0.571**	0.178
Occasional drinker	0.247**	0.115	0.400*	0.241	0.214	0.132	0.158	0.155	0.399**	0.177
Hard drug use (cocaine/crack/heroin use)	0.478**	0.057	0.235	0.176	0.508**	0.061	0.452**	0.071	0.541**	0.097
Good health status	-0.193**	0.048	-0.269*	0.140	-0.178**	0.052	-0.124*	0.067	-0.271**	0.070
No relatives within walking distance	0.007	0.038	0.117	0.103	-0.014	0.041	-0.024	0.050	0.043	0.058
No friends within walking distance	-0.061	0.051	-0.105	0.176	-0.052	0.053	-0.009	0.069	-0.104	0.079
Neighborhood teenagers a problem	0.035	0.039	0.114	0.104	0.021	0.042	-0.056	0.052	0.162**	0.059
Neighborhood drug using/seling a problem	0.146**	0.045	0.220*	0.113	0.134**	0.049	0.131**	0.061	0.164**	0.067
Neighborhood alcohol consumption a problem	0.126**	0.041	0.235**	0.104	0.109**	0.045	0.132**	0.056	0.114*	0.062
"Parents have been in trouble with police"	0.245**	0.065	0.270**	0.154	0.244**	0.073	0.244**	0.091	0.237**	0.095
Victim of assault	0.583**	0.050	0.741**	0.118	0.550**	0.055	0.585**	0.063	0.592**	0.081
Perceived prob. of arrest	-0.000	0.001	-0.003	0.002	0.000	0.001	-0.001	0.001	0.001	0.001
Imprisonment for both first and third time arrest	-0.068	0.064	-0.125	0.228	-0.069	0.067	0.016	0.080	-0.229**	0.113
Regions (East Anglia and London)										
North England (North/North west/York and Humberside)	0.014	0.058	0.221	0.155	-0.020	0.062	0.041	0.077	-0.007	0.088
Midlands (East Midlands/West Midlands)	-0.013	0.061	-0.018	0.174	-0.024	0.065	0.019	0.081	-0.046	0.094
South England (South East/ South West)	-0.009	0.056	0.247	0.153	-0.052	0.060	-0.011	0.075	0.018	0.085
Wales	-0.008	0.085	0.288	0.212	-0.067	0.094	-0.019	0.115	-0.023	0.130
Log likelihood	-4,212.875		-624.067		-3,572.839		-2,491.021		-3,974.000	
χ² (degrees of freedom)	1,002.1(46)		168.4(36)		842.2(44)		423.3(45)		428.5(45)	
Observations	7,383		906		6,477		3,409		3,974	

Notes:
*Significant at 10% level. **Significant at 5% level.
[1] When age[2] was included in the model, age was not any more statistically significant.
[2] Given the small variation in age, the coefficient of age was statistically insignificant and so was excluded from the regression.
[3] Age[2] was not statistically significant.

ENDNOTES

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2. See Farmer and Tiefenhaler (1996).

3. The OC&JS does not cover sexual offences. Sexual offences were excluded to ensure confidentiality in the survey (see Budd et al 2005). Robbery and assault without injury were covered in the survey but information on perceptions about the probability of arrest and various punishments for these types of offences were not provided. Therefore, the analysis focuses solely on assault with injury.

4. Also, Hjalmarsson (2009), who investigated the issue of the perception of individuals when they become an adult in the eyes of the court, found that the observed likelihood of an individual being caught and sent to jail increases by 5.2 per cent at the age of criminal majority. These findings, which are similar to those of Lochner (2007), conclude that if the expected punishment (a function of factors such as changes in the probability of jail, sentence length and prison conditions) is increased at the age of criminal majority, this will deter individuals from committing crime, and as a result there should be a reduction in crime.

5. The achieved core interviews were 6,892 with a response rate of 74 per cent.

6. In the analysis below, we have chosen to include information about the responses to the 'ever offended' and 'offended in the last 12 months' questions. The latter includes responses to the 'offended in the last four weeks' as respondents answering 'yes' to this question was too small to be analysed on its own.

7. Regarding the latter, the data show that individuals believe release without charge to be the most likely outcome and receiving community/probation/jail sentences the least likely outcome for first time arrest. However, when the question is repeated for perceived punishment after being arrested for a third time, most of the individuals tend to believe severe penalties are more likely to be imposed. There is a significant difference in perceptions of punishment between past offenders and non-offenders, and young individuals consider themselves to be less likely to face severe penalties than older individuals. Finally, there are some ethnic differentials.

8. A kernel density estimated (using a biweight kernel with a width of 4) distribution of the perceived probability of serious assault among individuals in the 2003 OC&JS shows that the distribution is skewed to the right with peaks at probabilities 0.05, 0.10, 0.20, 0.30, 0.40, 0.50, 0.60, 0.75, 0.80 and 0.90 (results are available upon request).

9. The pattern of the relationship between perceptions and age can be further visualised by plotting a nonparametric regression. Hence, let y_i be the perceived probabili-

ty of arrest and x_i be age. The conditional expectation function $E(x_i|y_i)$ is estimated nonparametrically, using the LOWESS local linear regression method (see Cleveland 1979; Hardle 1990) by a tricubic weighting function and bandwidth of 0.1. Although the results are not presented here, we find that the expected probability of arrest does not change notably with the age of the individual.

10. To test the IIA, the outcome 'pay a fine' was excluded from each model. The results of the Hausman test ($x^2(49) = 0.15$ and $\chi^2(49) = 0.94$ for each model, respectively) suggest no systematic change in the coefficients when all outcomes are considered in each model.

11. The effect of dichotomous variables represents a discrete change from zero to one.

12. The observations were also grouped according to peak values. Interval regression and ordered probit models were estimated. Inferences drawn from these models are similar to those reported here.

13. The standard error for this turning point was obtained through use of the "delta method" (see Greene 2000).

14. Approximately 80 per cent of those involved in the education system are between the ages of 16 and 20 years.

15. For the two-limit Tobit model, the R^2 is the McFadden's R^2. However, it should be noted that Tobit estimates maximise the log-likelihood function and not the R^2.

16. 19.77 per cent (std. err. 0.52) of the income distribution is below £10,000.

17. Simple cross-tabulation between the education and shoplifting variables shows that the majority of post-school individuals who admitted to an assault hold an educational qualification. For example, 29.68 per cent (std. err. 1.34) and 34.56 per cent (std. err. 1.39) of those who admitted to an assault were found to have higher and GCSE qualification levels, respectively.

18. We have assumed exogeneity between offending and victimisation. This assumption, however, is open to criticism. Deadman and MacDonald (2004) provide a deeper analysis of this issue.

19. The importance of delinquent peer relations dates back to the writings of Sutherland (1942).

20. However, we acknowledge that drug users may be more likely to defend themselves against violence due to the environment in which they operate, and future research should shed more light on this issue. We have, however, run separate regression models for drug users and non-drug users, although the former category consists of only 7.44 per cent of our whole sample. These models show no evidence of the deterrence hypothesis.

21. We have also estimated instrumental probit models using the police force areas as instruments, but the deterrence coefficients remain individually and jointly statistically insignificant.

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