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# Gratuitous Violence and the Rational Offender Model

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August 2009

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## Gratuitous Violence and the Rational Offender Model

**Abstract** Rational offender models assume that individuals choose whether to offend by weighing the rewards against the chances of apprehension and the penalty if caught. While evidence indicates that rational theory is applicable to acquisitive crimes, the explanatory power for gratuitous non-fatal violent offending has not been evaluated. Lottery-type questions elicited risk attitudes and time preferences from respondents in a street survey. Admitted violent behaviour was predictable on the basis of some of these responses. Consistent with the rational model, less risk averse and more impatient individuals were more liable to violence. Such people were also more likely to be victims of violence. In line with a 'subjective' version of the rational model, respondents with lower estimates of average violence conviction chances and of fines were more prone to be violent.

*JEL Classification:*

D81 - Criteria for Decision-Making under Risk and Uncertainty; D9 - Intertemporal Choice and Growth; K14 - Criminal Law;

*Keywords:* Violence, alcohol, risk, intertemporal choice, rational offending

# 1. Introduction

If offenders are rational then they consider the associated costs and benefits before deciding to offend. Usually the costs include the chance of detection and punishment, combined with the value of the expected penalty. Against these would be weighed the benefits, the chance of securing material or psychic gains and the value of the expected payoffs. This simple 'rational offender' (Becker 1968 ; Ehrlich 1973) or 'economic' framework implies that changes to the likelihood of conviction or the size of punishment alter the incidence of crime. Less remarked upon, it also indicates that individuals' attitudes to risk will influence the decision to offend, because crime is a type of gamble. Different risk appetites (and time preferences, when punishment is delayed) then should in part explain the distribution of offending in the population.

Criminological Routine Activity Theory (RAT) similarly looks at crime from the reasoning offender's point of view (Cohen and Felson 1979; Felson and Clark 1998). RAT postulates that a crime will only be committed if a likely offender believes a victim or target is suitable and a 'capable guardian' (such as a CCTV camera) is absent. The actual or potential offender's assessment determines whether a crime will be committed.

There is a great deal of international evidence supporting the broad outlines of this 'rational' approach. So the prospect of heavier prison sentences on Italian repeat offenders reduced the likelihood of re-offending (Drago et al 2009). US burglars target houses where they will more probably find richer pickings and with lower chances of detection (Shachmurove et al 2001). Even allowing for drug involvement, property crime in Germany is responsive to deterrence (Entorf and Winker 2008).

The international association of greater national income inequality with higher homicide rates may well reflect the bigger payoffs of richer victims to poorer offenders with little to lose (Fajnzylber et al 2002a). This interpretation presupposes homicide is in support of robbery or other material gain. But in some cases violence can itself be the purpose of the offence, rather than instrumental. Markowitz's (2000) study of domestic violence included violence in the preferences of potential offenders.

Rational offending theory in the simplest version may be less appropriate for understanding gratuitous violence. Yet violent offending imposes considerable economic and social costs (Dubourg and Hamed, 2004). Understanding the decision to assault a person should also suggest how deterrence and other interventions can reduce this crime. In Germany deterrence was found ineffective for violent crimes (Entorf and Winker 2008). One possibility is that perceptions diverge more from reality in the case of violent offending. Sah (1991) developed a rational model of the evolution of individual perceptions of punishment chances, but without formal empirical support. Recent advances in the behavioural sciences suggest that in practice, individuals appear to discount future events at rates which may lead them to act inconsistently or to

show lack of self-control; preferences may depend upon reference points so that individuals behave differently in the face of a possible loss from the mirror image of a comparable possible gain. They may also exhibit unwarranted optimism and make different choices in similar circumstances, simply because of the way the opportunities have been presented (Kahneman and Tversky 1979; Lowenstein and Pralec 1992; DellaVigna 2009).

Such behaviour could have implications for the explanatory power of a violent rational offender model, which we explore in this paper. The model may also require modification if offenders' perceptions are influenced by drugs or alcohol. Victimization and hospital data confirm a link between broad categories of violence and the price of alcohol in the US and the UK (Markowitz 2005; Matthews et al 2006). But these studies do not necessarily indicate that alcohol plays a direct role in violent offending, rather than, say, in selection of the victim. Certainly a natural experiment with zero-tolerance drink-driving legislation (Carpenter 2007) concluded that although, alcohol consumption was associated with nuisance and property crimes, it was not linked with crimes of violence in the US.

Studying individual offending behaviour on the basis of attitudes, preferences and dispositions as well as environment, as rational offender models require, is usefully undertaken at the individual level. Offenders' individual characteristics typically cannot be inferred accurately from those convicted (Maguire 2007). Self-reporting surveys of offending therefore have a considerable advantage in this respect. Although there may be difficulties in persuading respondents to admit to crimes, or to a propensity to offend, even anonymously, this must be weighed against bias and under-reporting in police statistics. The present study of gratuitously violent city centre offending behaviour is therefore based upon a street survey. Crime prevention must consider the interaction between offenders and their victims, so a rational offender model is here supplemented with a model of the rational selection and self-selection of targets

In presenting the analytical framework for the study, Section 2 points out a contradiction for the basic rational offender (expected utility) model between the empirical evidence of risk attitudes and aspects of offending behaviour. It suggests how these might be resolved by comparatively recent findings from behavioral psychology. Section 2 also examines the consequences for the rational offender model of how individuals actually discount time. Section 3 specifies a testable model of rational gratuitous violence that addresses the anomalies discussed in section 2. The street survey that provides the data with which the model is tested is described next in section 4. Section 5 presents the results of the tests and elucidates the implications of the parameter values estimated. The concluding section (6) summarises the findings of the estimated model and touches on policy implications.

## 2. The Objective versus Subjective Rational Offender

The simplest (expected utility, EU) theory of rational offending assumes that behaviour depends upon the objective likelihood of apprehension and the penalties if convicted of a crime. Some of these full information or 'objective' rational offenders are therefore deterred from crime by higher penalties and higher probabilities of conviction. Other individuals do not need deterring because their preferences are such that their payoffs from successful offending (perhaps including the pleasures of violence) are zero or negative. In principle this could apply to gratuitous violence as much as to any other offending. Violent offending is then simply another choice under uncertainty or risk (Becker, 1968; Polinsky & Shavell, 2000).

### *Risk Attitudes*

A person who is risk averse would decline the offer of a fair gamble, such as a single toss of a coin determining an equal loss or gain depending on whether a head or a tail is obtained. Those who are less risk averse will be more inclined to undertake the gamble of offending, other things being equal. EU rational offending theory also predicts that risk averse offenders will respond more to a change in the punishment than to a change in the chances of detection; the elasticity of offending with respect to punishment is greater than with respect to detection or conviction (Appendix 1).

Most people are risk averse, over gains. Although Dutch, German and Italian surveys (Cramer et al., 2002; Diaz-Serrano and O'Neill, 2004; Dohmen et al., 2005) found substantial inter-personal variation in risk attitudes, only a small proportion of the sampled population were risk-preferers. Cramer et al. (2002) estimated that 1.39 percent of employees and 2.58 percent of entrepreneurs were risk preferers, Diaz-Serrano and O'Neill (2004) found 6.5 percent were risk preferers in 1995 but the percentage fell to 0.85 percent in 2000. Dohmen et al. (2005) identified 9 percent as risk preferers. Since the proportion of offenders in Western populations is considerably higher, in England and Wales 41 percent of 10 to 65 year-olds had committed at least one of the twenty core offences at some time in their lives (Budd and Sharp, 2005), most offenders must be risk averse.

But this contradicts a supposed empirical finding. Becker (1968) pointed out an observation, also confirmed subsequently (for instance with British aggregate data by Carr-Hill and Stern (1973) and for US college students by Nagin and Pogarsky (2003)), that estimates of the detection elasticity of offending are greater than those of the elasticity of punishment. According to the rational offending (EU) model, offenders must therefore be risk preferers, contrary to the implications of the survey evidence. Recent analysis of British offending yields ambiguous results on offending elasticities. Reilly and Witt (1996) observe their burglary elasticity estimates are consistent with risk aversion. For residential burglaries Pudney et al. (2000)

find that the short run conviction elasticity is greater than sentence length and imprisonment rate elasticities, but that this result is reversed in the long run.

A second difficulty with risk attitudes in EU theory concerns sentencing uncertainty. If offenders are risk preferers as Becker maintained then sentencing uncertainty encourages offending, because offenders enjoy the gamble (Appendix 2). This seems less plausible than the risk averse case where sentencing uncertainty reduces offending. Sometimes 'rational offender' analysis has posited risk neutrality (e.g. Polinsky and Shavell, 2000; Fajnzylber et al., 2002a). In this case there is no effect of uncertainty but it is difficult to square with the survey evidence of risk aversion and the pervasiveness of offending.

Responses to these paradoxes include modifications of EU theory, for example by introducing state dependent or rank dependent utility (Neilsen and Winter, 1996). These alterations can allow the likelihood of detection to matter more than the weight of punishment for risk averse offenders. Alternatively, Polinsky and Shavell (2000) abandon the 'objective' or full information EU approach. They note that substantial imperfect knowledge of probability of conviction and level of sanctions means that varying the average probabilities and punishment may have little effect. Sentencing variation simply induces a high ratio of noise to signal, concealing the signal.

Another possible resolution, preferred here and based upon empirical evidence, is sought in the implications of psychological and behavioural research for the rational offender model. What matters is perceptions rather than actuality. Psychological theories of rational action, such as Prospect Theory, have drawn attention to general perceptual and framing biases that raise questions about the objective or full information approach to choice under uncertainty (Kahneman and Tversky, 1979; Hey and Orme, 1994; Moore et al. 2003). Prospect Theory indicates that individuals have different preferences over gains and losses; value functions then replace utility. Perceptions of probabilities are also systematically biased; people over-estimate small probabilities and under-estimate high. Decision weights substitute for objective probabilities.

An individual's reference point can cause a divergence from EU offender predictions. Dahlback (2004) illustrates the principle with tax evasion. If the state is regarded as unreasonably taking a person's money then the decision to evade taxes may be made in the face of greater risk than choosing to acquire (non-tax) money illegally. An individual may then be risk preferring over losses, while risk averse over gains in this case.

In short, Prospect Theory indicates that an individual can be risk-averse, risk neutral or risk preferring depending on whether choices involve gains or losses, and whether the chances of gains or losses are large or small. Risk preferring behaviour over losses and risk aversion for gains is a strong possibility. This could be sufficient to generate detection elasticities greater than punishment elasticities. A punishment is a loss, and a successful crime is a gain. An increase in punishment could have relatively little effect for an

individual who was risk preferring over losses while an equivalent increasing in detection chances would substantially reduce the wellbeing from successfully offending, if they were risk averse over gains. The subjective approach to rational offending, or Prospect Theory as an instance of it, makes more sense of the empirical evidence.

### *Time Preference*

Attitudes to time, or the degree of impatience, may also influence the reasoning of the potential offender. Individual time preference rates, particularly of deviant groups such as drug addicts, record very high discounting compared with what is conventionally assumed in economic modelling (e.g. Kirby et al. 1999; Gomme, Kydland, and Rupert, 2001)<sup>1</sup>. When the penalty is time discounted in rational offending theory, the subjective valuation of the payoff from offending is larger relative to the future possible punishment. So discounting has the same effect as a reduction in the penalty. The second prediction of interest here then follows; the probability of offending is greater the higher is the rate of time preference or impatience<sup>2</sup>.

As with risky choices, empirical investigation has found possible inconsistencies in choices at different dates. Instead of the exponential, and therefore time-consistent, discounting, individuals in practice discount hyperbolically (Loewenstein and Pralec, 1992). Whereas with exponential discounting, discount factors decline at a constant rate with futurity, with hyperbolic discounting the rate at which discount factors diminish declines with futurity, so that the steepest decline is in the immediate future. A consequence is that individuals are likely to make time inconsistent choices, unless they commit themselves in advance<sup>3</sup>. To make consistent goal directed choices – to be rational in the sense posited here - the person must choose to inhibit themselves, or exercise self-control, from a considered assessment of the benefits and costs of not adopting behavioural constraints. If they do not do so, then policy may need to impose constraints for them.

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<sup>1</sup> For comparison with Table 3 below, the implied 30 day (hyperbolic) discount factors (for \$50) were 0.57 for heroin addicts, 0.72 for the controls and 0.83 for US undergraduates, reported in Kirby et al (1999). Even the last figure is higher than reported in Table 1, which may reflect cultural differences between Britain and the US. The annual (hyperbolic) discount factor implied by the undergraduate choices is  $(1/(1+(.007*365)))=0.281$  and the implied annual (exponential) discount rate is  $((1/0.281)-1)=355$  percent This contrasts with the 6 percent real discount assumed by Gomme et al (2001).

<sup>2</sup> Nagin and Pogarsky (2004) found that only 'poor impulse control', not high discounting, predicted violent offending among respondents in the US National Longitudinal Survey of Adolescent Health. 'Impulsivity' is often taken to mean that some people do not choose to act, they are impulsive. One interpretation is that they are inconsistent in their choices because they are too impatient to reflect and this impatience is different from the impatience measured by time preference. Someone could be too impatient to reflect on their action and yet in other spheres, such as spending and saving behaviour, exhibit low time preference behaviour. Even so it could be said that time preference and risk aversion differ between spheres. The important point for rationality is consistency within a sphere. The null hypothesis is random utility, where the constraint determines outcomes exclusively without intervention of preferences.

<sup>3</sup> An example of hyperbolic discounting occurs when an individual prefers £5 now to £10 in one month's time, and the same person prefers £10 in six months rather than £5 in five months. If first offered the second option, after the elapse of five months this individual would 'change their mind' about the initial choice.

### 3. Rational offender theory and inter-personal violence

#### *Perpetrating Violence*

While in principle, it is possible to distinguish between the offences of gratuitous (unprovoked) violence, instrumental violence – mugging for instance – and reactive violence (‘He hit me so I hit him’), for each in the fully rational model there will be an underlying preference for violence (Machlin, 2004). Those with the taste for violence are both more likely to react violently to provocation, and to find provocation where there is none (‘What are you looking at me for?’). There is a positive payoff to violence for a person with a taste for violence<sup>4</sup>. This approach differs from the modeling of Markowitz (2005) and Matthews et al (2006) where violence is an unintended byproduct of consuming alcohol. They postulate that there is a violence production function or ‘structural equation’ in which alcohol consumption is a variable.

Alcohol consumption is often implicated in gratuitous violence (Moore, Flajšlik, Rosin, and Marshall, 2008). It may be a complement to violence in some individuals’ preference functions. Or instead, alcohol may shift preferences, reducing risk aversion (Lane et al. 2004), either way encouraging violence from those already inclined to it. When inhibitions are the commitment necessary to prevent time-inconsistent behaviour by hyperbolic time discounters, alcohol may be consumed to release these constraints. Individuals choose whether to inhibit themselves, or exercise self-control, from a considered assessment of the benefits and costs of abandoning behavioural restrictions. Individuals might conclude there are advantages from dropping these inhibitions temporarily in certain times and places. Alcohol is then the instrument of rational action, where the agent takes into account the difficulty of switching inhibitions on and off.

In each of the above behaviour patterns alcohol consumption is a positive influence upon violence. In contrast is the hypothesis that alcohol is an ‘innocent bystander’, correlated across persons with violence because of a third factor causing both alcohol and violence. Heavy drinkers are more impatient (Vuchinich and Simpson, 1998), which may imply that it is impatience rather than alcohol that triggers violence. There is indeed evidence that neuropsychological factors link strong time discounting with a propensity for violence (Coccaro and Siever, 2002; Lee and Coccaro, 2001; Rahman et al., 2001). Impatient people drink more and instigate more violence.

In all cases there is an aggregate implied violence perpetration equation dependent upon prices, broadly defined, and wealth/incomes, time preference and risk attitude. The ‘price’ of violence is the penalty if apprehended and the chances of conviction, actual or perceived. For given penalties and conviction chances, greater risk aversion reduces crime chances. Individuals with higher discount rates will find given

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<sup>4</sup> A taste for violence does not commit a person to violent behaviour any more than spectators of boxing or wrestling matches are committed to violent behaviour.

chances of detection and penalties less of a deterrent. Possibly alcohol consumption or the price of alcohol also enters the equation.

A subjective rational offender approach replaces objective measures of the 'price' of violence in the above models. The EU model assumes an objective detection probability and the actual punishment, whereas an alternative is that the potential offender perceives or believes they take different values. In addition, this subjective approach suggests asymmetries over perceived gains and losses may matter, along with high rates of time discounting. Separate measures of time preference, loss aversion and risk aversion therefore should be included in the model.

Those with higher wealth or income are likely to have more opportunities for achieving their ends and therefore be less likely to resort to violence. Their opportunity cost of a custodial sentence would be higher, but that of a given fine would be lower. In this study the proxy for wealth or low income is unemployed status. But it might instead or also reflect high leisure preference. Either way the unemployed have less to lose from a custodial sentence and, with little ability to pay fines, may be more prone to chose gratuitous violence, according to the rational theory.

Where  $V$  is the probability of an individual's violent behaviour, penalties ( $f$ ) and detection chance  $p$ ,  $W$  is wealth,  $A$  is alcohol consumption,  $r$  risk attitudes and  $i$  time preference rate, the individual violence choice equation is:

$$V=h(p,f, A, W, r, i)$$

Assuming higher values of the risk attitude index measure less risk aversion, the risk and alcohol consumption associations with violence should be positive. Measuring time preference by the reduced sum acceptable for early payment so that a smaller sum indicates greater impatience, the expected signs on time preference, penalties, detection chances, and wealth are negative.

#### *Victims of violence*

Aggregative studies of violence, looking at injury data, such as Matthews et al (2006), consider the consequences of offending behaviour rather than the behaviour itself. Of course instigators of violence need victims and studies of male youths show strong associations between violence, victimization and a range of problem behavior, including impulsive decision making and substance abuse (Farrington, 1998). Moreover, victims are more likely to be male and to have past convictions; 18 percent of 10 to 16 year old assault victims, and 40 percent of 17 to 24 year olds, in one study (Rivara, Shepherd, Farrington, Richmond, and Cannon, 1995). According to Jensen and Brownfield, (1986) violent offenders are more likely also to become victims of violent crime, putting themselves more frequently at risk by mixing with other offenders. On the other hand Wittebrood and Nieuwebeerta (1999) contend that a positive correlation between victimization rates of violent crime and rates of offending is not based on behaviour but merely stems from both sets of people living in the same area and possessing similar social and demographic characteristics.

Because of their social milieu, some individuals run a higher risk of becoming victims of violence. But there are not necessarily behavioral similarities with perpetrators of violence. Although there is a considerable overlap across victims and perpetrators of violence characteristics are not identical.

Rational (pure) potential victims should minimize the probability of injury, subject to constraints and the achievement of other objectives. Risk attitude and time discounting may affect the willingness of potential victims to put themselves in the way of harm. And wealth could influence the type of recreational activities in which they engage and therefore their chances of victimization. Frequency of drinking in the city centre may be a measure of exposure to risk of gratuitous violence, as well as an alcohol consumption variable, in contrast to the perpetrator equation. Potential victims' assessment of risk may be affected by alcohol. If alcohol consumption locations are high risk areas for violence then simply visiting them frequently will increase the chances of violent victimization, regardless of whether alcohol has affected risk minimization tactics. Risk assessment by potential victims may also depend upon experience, perhaps measured by their age (a).

The individual's victimization chances (T) equation is then:

$$T=g(A, W, r, i, a)$$

As in the violence perpetration equation, the expected signs on risk attitude and alcohol consumption are positive. The coefficients on impatience (stronger time preference measured by greater willingness to accept a smaller sum, and by implication a larger discount), age and the wealth proxy should be negative.

Individuals' functions are aggregated across the population. The probability of the discrete events of being an offender or a victim is then modeled as a probit (or logit) relationship. Proximity (time and place) to violent offenders is a necessary condition of being a victim. So the disturbance terms of offender and victim equations should be correlated and the model to be tested and estimated is ;

$$V=h(p, f, A, W, r, i, e_1)$$

$$T=g(A, W, r, i, a, e_2)$$

$$\text{Corr}(e_1, e_2) > 0$$

#### 4. Data

To test this two equation model of gratuitous violence, a sample was created of persons most likely to socialize in the city centre in the evenings, and therefore to have opportunities both for perpetrating gratuitous violence and to become victims. Participants were recruited from an area of Cardiff densely populated with licensed premises in the late afternoon and early evening (up to 9 pm) on Thursdays, Fridays and Saturdays (days especially popular with drinkers). Pedestrians were approached at random and asked if they would participate in a survey on attitudes to disorder in the city centre in return for a chance to win

£100. 422 men and 428 women took part. They then responded to questions from the interviewer who completed a paper survey<sup>5</sup>.

A range of measures suggested by the theoretical discussion were collected. Eliciting whether a respondent was prone to violence was a delicate matter, even though the questionnaire was anonymous. A person who resorts to gratuitous or unwarranted violence will have a subjective reason or 'provocation'. The definition of gratuitousness stems from a notional dispassionate observer. So the approach chosen was to ask whether interviewees had resorted to violence because of 'provocation' in the last 12 months. This is not the same as violence for defensive purposes (which might not constitute offending) or, strictly, violence to acquire something (which would). However a question was asked about in the last 12 months using or threatening violence to get something. All those answering 'yes' to this question also answered in the affirmative to the first violence question. Here we use only the answer to the 'provocation' question<sup>6</sup>. The violence questions were asked towards the end of the survey.

A few persons refused to answer these questions. This could suggest that omitting them from the analysis would under-estimate violence and bias conclusions. Therefore some analysis is conducted of refusers and of models that include refusers as if they had answered 'yes' to the violence question. There remains the possibility that some of those who answered in the negative, should truthfully have answered 'yes'. While this would affect the sample proportions allocated to each category, it should no more affect the parameter estimates of the propensity for violence than omitting 'refusers', for which we test.

Victims of violence were identified by their answer to the question "in the past twelve months, has anyone been violent towards you for no reason?" Table 1 presents descriptive statistics. 3.3 percent of participants claimed to be prone to violence and more than twice the percentage (7.5) maintained they had been victims. 1.8 percent were both victims and perpetrators of violence.

Risk attitude questions replicated those of a Dutch study (Donkers et al 2001). We were therefore able to compare our street sample results with this larger telephone survey and found they yielded broadly similar results. The exception was one question (Q4 below) involving large probabilities of small winnings. Fewer respondents in the current survey selected the risky option (20 compared with 40 percent).

Five risk questions were asked (Table 1). The first offered a (hypothetical) choice based on the toss of a coin:

'(a) you will receive £1,000 with either heads or tails or (b) with heads you receive £2,000, with tails you don't receive anything at all'.

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<sup>5</sup> The key questions are reproduced in Appendix 4.

<sup>6</sup> Since the purpose is to model violence which is probably criminal this is the best question we could devise that might elicit an honest answer. Official data of recorded offenders and offences are almost certainly biased because they exclude those not successfully prosecuted and A&E data are likely to cover victims rather than perpetrators.

Those preferring option (a) were identified as risk averse or risk neutral and those preferring option (b) were classified as risk preferring or risk neutral. According to the answers to this question almost 85 percent of the sample was risk averse or risk neutral (Table 1).

The second question allowed more precise discrimination of risk attitudes towards possible gains of quite large sums of money with small probabilities; participants were asked:

‘Which of the following two options would you choose? (a) You draw a lottery ticket with a 2% chance to win £3,000, if you lose you don’t get anything. (b) You draw a lottery ticket with a 1% chance to win £6,000, if you lose you don’t get anything.’

The sample split approximately equally between the two choices

The third question introduced the possibility of losses from the choice. Participants were told: ‘We toss a coin once. Would you accept the following gamble? Heads, you win £1,500 but with Tails, you **lose** £1,000’.

The sample proportion divide was 83 percent for the risk free and 17 percent for the risky choice, broadly comparable to the split for question 1 where over a gain, 85 percent preferred the risk free choice. More than one half of those who were risk neutral or risk preferring (question 1) would not accept the risky option of Q3. This may indicate loss aversion among such respondents, for the expected value of the choice of Q3 is positive.

The fourth risk question offered the following two options:

‘(a) You draw a lottery ticket with a 80% chance to win £45, but if you lose you don’t get anything or (b) You win £30, no matter which ticket is drawn.’

Consistent with risk aversion, four out of five in the sample preferred the risk-free option, despite the high chance of winning half as much again with the risky choice.

Respondents to the final risk question (Q5) were invited to choose between drawing a lottery ticket with a 25% chance to win £100, (if you lose you don’t get anything) and drawing a lottery ticket with a 20% chance to win £130, (again if you lose you don’t get anything). The virtually equal divide between the less and the more risky options indicated the differential levels of risk and return were too small to affect behaviour.

For the time preference questions, participants were asked to imagine they had a lottery ticket that had won £87 but they would not receive the £87 immediately. Instead they must wait unless they sold the ticket for cash now. They were asked about the smallest sum of money, to the nearest pound, that they would sell the ticket for today if they must wait D days before claiming their prize. Values for D were 7, 30 and 90 days.

Respondents’ discounting was better described by a hyperbolic, rather than an exponential, function of time. Table 1 presents the discount factors from which implied 30 day discount factors can be calculated. On average £87 in 7 days was valued at £84.8, a discount of 2.5 percent or a discount factor of 0.975. For 30 days at this 7 day rate the discount factor would be  $0.975^{30/7}$ . The 30 day discount factors are for seven days, 0.90, thirty days, 0.94 and ninety days, 0.97. These implied rates across the three time periods shows that as

the delay increases the discount factor and the rate of discount decreases; that is, discounting is hyperbolic (see also Table 3 below).

**TABLE 1 Survey descriptive statistics**

	Percent or mean (SD)
<b>Violent Crime</b>	
Violent:	3.33%
Victim	7.85%
<b>Risk attitude</b>	
Q1 Risk averse or risk neutral	84.4%
Q2 Prefer more risky gain of larger substantial sum	47.0%
Q3 Risk averse over losses	83.2%
Q4 Risky choice with high probability	20.8%
Q5 Riskier choice small proportionate probability difference	50.4%
<b>Attitude to time</b>	
£87 in 7 days	£84.80 (10.01)
£87 in 30 days	£81.47 (13.77)
£87 in 90 days	£78.33 (18.79)
<b>Crime: likelihood and retribution</b>	
Estimated fine	£234.7 (356)
Estimated probability of violence	2.42%
Estimated probability of arrest given violence	19.16%
Estimated probability of conviction given arrest	18.59%
<b>Drinking</b>	
Frequency of city centre drinking	
Daily	0.45%
More than once a week	22.27%
Once a week	24.22%
Once every other week	10.91%
Once a month	18.83%
Less than once a month	23.32%
Drink problem	12.00%
<b>Age</b>	
Men	28.60 years (11.48)
Women	30.54 years (13.09)
Male	49.65%
Smoker	31.88%

In order to estimate whether victims or perpetrators of violence experienced systematic biases in perceptions of probabilities that might influence their choices, all respondents were asked to estimate crime likelihoods and retributions. Table 1 gives the mean values. Consistent with Prospect Theory, the risk of violence was overestimated (the objective figure is around 0.2 percent, see Appendix 3.)

Again consistent with Prospect Theory, the probability of arrest given violence is also underestimated, assuming the combination of CCTV, A&E and police records used to estimate the objective rate cover all violent incidents (objective estimate 40 percent), as is the probability of conviction when arrested. The fine estimate is difficult to compare with an objective figure because of the way the official data are aggregated. There is no variation in objective probability of detection or penalty recorded in the sample.

Just under half of the sample went drinking in the city centre once a week or more. Historical alcohol drinking patterns were also determined by the answers to the question:

‘In the last year, has a relative, friend, doctor or other health worker been concerned about your drinking or suggested you cut down?’ (‘Drink problem’). This was coded no=0 and all other answers including refusals =1.

Other variables are traditionally associated with public violence –smoking, age, male, and unemployment. But along with heavy alcoholic drink consumption, most if not all of these variables are likely to reflect risk attitude (Donkers et al 2001) and time preference. So including them in a model that adequately measures these theoretical variables should be unnecessary. But insofar as the risk and time preference measures are imperfect, or they are associated in an offsetting fashion with smoking, drinking, gender and unemployment, the less theoretical variables will add to the explanatory power of the violence and victim model.

## 5. Results

A first test of the rational offender model for gratuitous violence is to see whether the variables deemed relevant by the theory are associated with violence. Violent persons are significantly more impatient, have lower estimates of conviction chances and of fines, higher drinking frequency, greater likelihood of problem drinking and are more likely to be unemployed (Table 2) They are more likely to be risk neutral or risk preferring as identified by answers to lottery-type question (Q1) in accordance with simple rational theory, but not significantly so. But those liable to violence are significantly less risk averse as measured by their answer to risk question 2. Also they are significantly more likely to choose the risky option in question 4<sup>7</sup>..

**TABLE 2 Violent versus non-violent and victims versus non-victims: bivariate comparisons (means and t statistics).**

	<b>Non-violent</b>	<b>Violence Violent</b>	<b>t-statistic</b>
Risk preferring/neutral (Q1)	0.15	0.18	-0.48
Relative risk low prob (Q2)	0.54	0.26	2.93**
Loss Aversion (Q3)	0.16	0.18	-0.22
Risk high probability (Q4)	0.20	0.37	-2.19*
Risk small propn prob dif (Q5)	0.50	0.52	-0.17
Time preference (7 day)	85.60	79.20	4.00**

<sup>7</sup> Attitudes of those who declined to answer the violence question shows them significantly less risk averse on four questions, and more impatient, than the sample as a whole.

	<b>Non-Refusers</b>	<b>Violence Refused Violent Question</b>	<b>t-statistic</b>
Risk preferring/neutral (Q1)	0.15	0.36	-2.00*
Relative risk low prob (Q2)	0.46	0.82	-2.33**
Loss Aversion (Q3)	0.16	0.54	-3.38**
Risk high probability (Q4)	0.20	0.54	-2.79**
Risk small propn prob dif (Q5)	0.50	0.64	-0.81
Time preference (7 day)	85.60	61.9	7.54**

Probability of arrest	0.20	0.19	0.20
Probability of conviction	0.20	0.08	2.02*
Estimated fine	230	100	1.70* <sup>a</sup>
Drink frequency	3.54	4.07	-2.53**
Problem drinking	0.25	0.50	-2.49**
Smoker	0.31	0.64	-3.78**
Age	31.10	28.10	-1.21
Unemployed	0.06	0.21	-3.04**

**Victims**

	<b>Non-victim</b>	<b>Victim</b>	<b>T</b>
Risk preferring/neutral (Q1)	0.15	0.19	-0.90
Relative risk (Q2)	0.54	0.40	2.09*
Loss Aversion (Q3)	0.16	0.26	-2.19*
Risk high probability (Q4)	0.21	0.19	0.38
Risk small propn prob dif (Q5)	0.50	0.51	-0.21
Time preference (7 day)	85.4	81.9	2.85**
Probability of arrest	0.20	0.21	-0.25
Probability of conviction	0.20	0.17	0.71
Estimated fine	226	207	0.45 <sup>a</sup>
Drink frequency	3.53	4.03	-3.41**
Problem drinking	0.24	0.47	-3.8**
Smoker	0.30	0.48	-3.00**
Age	31.4	25.8	3.31**
Unemployed	0.07	0.14	-2.10*

Notes: \* =5%, \*\* =1%; <sup>a</sup> outlier > £2,000 removed

Victims differ from violent individuals in that their estimated probability of conviction and estimated fine are similar to the sample as a whole. They are also significantly younger ( $t=3.31$ ). They are more impatient than non-victims but not as impatient as violent persons. In some respects victims have similar risk attitudes to violent persons (Q2) and the divergence from the rest of the sample is significant at the 5 percent level for Q2 and Q3. Victims are apparently more loss averse than either perpetrators of violence or the sample as a whole (Q3). They are also more willing than the full sample to take risky choices for gain (Q2). Drink frequency and problem drinking distinguishes victims from the sample as a whole. Victims are not differentiated from the rest of the sample by higher education, although violent persons typically do not have degrees.

Further analysis of time discounting factors shows that, for those who are violent, on average a reward in 90 days is worth only 77 percent of an immediate payoff (Table 3). By contrast the remainder of the sample reduces their value for the same delay to only 92 percent. In the violent group, the implied monthly discount factor for the first seven days delayed reward is very high at 67 percent.

**TABLE 3 Time discounting factors grouped by violence**

	Non-violent *	Violent *	Implied 30 day factor (exponential) Non-violent	Implied 30 day factor (exponential) Violent
7day	0.98	0.91	0.93	0.67
30 day	0.95	0.86	0.95	0.86
90 day	0.92	0.77	0.97	0.91

Note \*(1-Discout)/£87

Model estimates are constrained by non-responses to some questions, which can reduce the number of cases very substantially. Consequently a general to specific modelling strategy, starting with all possible variables in the model, could be misleading. Instead we begin with a simple test of the rational offender model in which all participants know they face common penalties and detection chances and decide to be violent or not, or become victims, on the basis only of their risk and time attitudes (Table 4)<sup>8</sup>.

**TABLE 4 Violence and Victim Risk Attitude and Time Preference Biprobits: Marginal Effects at Means**

	1a Violence	1b Victim	2a Violence+refuse	2b Victim	3a Violence
Risk (Q2)	0.0320*** (3.15)	0.03572** (2.03)	0.0461*** (4.19)	0.0371** (2.10)	0.0286*** (2.89)
Risk (Q4)	-	-	-	-	0.0209** (2.12)
Time preference	-0.0007*** (3.02)	-0.0014*** (-3.27)	-0.0008*** (-3.35)	-0.0013 *** (-3.11)	-0.0007** (3.08)
Rho (SE)	0.69 (0.08) chi2(1) = 39.809		0.64 (0.08) chi2(1) = 36.87		0.71 (0.08) . chi2(1) = 41.5149
No. of obs	785		792		784
Wald chi2	25.43		32.79		29.19

Notes: Z statistics in parentheses. Constants estimated but not shown. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Eq 3b not reported because specification and results same as 1b.

Table 4, estimated by seemingly unrelated biprobit, shows the marginal effects of greater risk and time preference on the chances of being violent or becoming a victim. Some of the predictions of the rational offender model are born out by this simple specification. Those who are less risk averse and more impatient are likely to be both perpetrators of violence and victims. In eq1a being less risk averse, according to Q2, increases violence chances by 3.2 percent compared with a sample absolute chance of 3.3 percent.

<sup>8</sup> Rare Event Logit (King and Zeng 1999, 2001; Tomz, King and Zeng 1999) was used initially to estimate the violence and victim model because of the relatively small number of V, T =1 cases. However the results were very similar to those from standard logit. Therefore because bivariate probit estimation is more efficient if the two equations' residuals are correlated, this approach was preferred.

Every £1 discount on the £87 of the time preference question increases the violence risk by .07 percent and the victimisation risk by 0.14 percent, according to 1a and 1b.

The correlation between the violence and victim equations ( $\rho$ ) is highly significant, justifying the biprobit specification. Two definitions of perpetrating violence are employed in Table 4. The first (eqs. 1) is simply the affirmative answer. The second also adds in those who refused to answer the question, slightly increasing the sample size. The violence equation with the second specification shows a greater responsiveness of this measure of violence to risk attitude, so that the difference in the risk coefficient is now significantly different from that of the Victim equation at the 2.8 percent level. Less risk aversion as measured by Q2 is associated with a 4.6 percent higher absolute chance of admitting to violence or refusing to answer the question. This is a large relative effect because the sample average for this category is only 4.5 percent. The time preference or impatience effect is not much changed by the second definition and is not significantly different between perpetrators of violence and victims (although greater for this second group).

Only one other risk measure was significant at the five percent level in the violence equation (with both dependent variable specifications). This was Q4 which offered a choice between a safe payoff and a high probability of a larger reward. Those who chose the safe prospect were 2.09 percent less likely to be violent, while slightly reducing the independent violence association of preferring the riskier option in the first question also to 2.86 percent (eq.3a). The question that allowed the risk of loss was not significant even for victims. There is then no evidence here of (prospect theory's) differential response to possible losses compared with pure gains.

Because refusal to answer the violence question was also linked to lack of answers to other questions, most fuller model specifications do not differ much between the two definitions of violence dependent variables. Subsequent modelling is therefore restricted to the simpler definition of violence.

Fuller model specifications are tested and specified in Table 5. Answers to the relative risk question (Q2) (2 percent chance of £3000 preferred to 1 percent chance of £6000) continues to be a significant predictor of the violence propensity at the one percent level. A preference for the one percent chance, the riskier option, raised the likelihood of being violent or a victim by between two and three percent (eq1 and eq 5 table 9). Since the sample mean violence propensity is only 3.3 percent, and the victimization chances are 7.85 percent, this constitutes a large increase in relative risk.

The time preference 'marginal effect' of  $-.0006$  (equation 1a) indicates that a person who preferred £80 now to £87 in three months (an 8.7 percent three month rate<sup>9</sup>) was 0.42 percent more likely to be violent. High discounters, willing to accept only £40, increased their chances of being violent by 2.8 percent,

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<sup>9</sup> Discount factor=  $0.9195=80/87$ , discount rate=  $(1/\text{discount factor})-1$

by as much as those who chose the high risk option. Victims are even more impatient but not significantly so.

Even though the coefficients on problem drinking (not reported) are significant in the more parsimonious specifications, such as 1 in Table 5, the marginal effects at the mean are not significant at the 5 percent level.

Differences between risk and time preference coefficients of the two categories of persons were not significant, but age was a significant contributor to the victim category. A 30 year old has a 2.1 percent lower chance of becoming a victim than a twenty year old, according to the age coefficient in 1b – a substantial relative risk difference.

The subjective value of the chances of conviction is significant and correctly signed but markedly reduces the sample size, and therefore also the significance of other variables. The marginal effect of -.06 (equation 2a) indicates that a 10 percent supposed higher chance of conviction is associated with a 0.6 percent lower violence probability, consistent with a subjective version of the rational offender model. Similarly the fine estimate is significant and correctly signed in equation 4. The marginal effect indicates that a difference of £100 between respondents in their estimates of the fine if convicted of city centre violence was associated with a 0.9 percent lower chance of being violent.

**Table 5 Violence and Victims Biprobits: Marginal Effects at Means**

	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b
	Violent	Victim	Violent	Victim	Violent	Victim	Violent	Victim	Violent	Victim
Risk (Q2)	0.0311*** (2.70)	0.0371** (2.11)	0.014 (1.31)	0.0521** (2.05)	0.0171 (1.36)	0.0572** (1.95)	0.0114 (1.35)	0.0612** (2.39)	0.0192*** (2.55)	0.0285* (1.72)
Time (90)	-0.0006*** (-2.85)	-0.0011*** (-2.71)	-0.0006*** (-2.69)	-0.0013** (-2.41)	-0.0006 (-2.56)	-0.0011* (-1.81)	-0.0005** (-1.99)	-0.0014** (-2.12)	-0.0003** (-2.16)	-0.001** (-2.43)
Drinkprob	0.0502* (1.87)	0.071* (1.88)			0.0254 (1.3)				0.027 (1.47)	0.0489 (1.49)
Age		-0.0021*** (-3.00)		-0.0027*** (-2.89)		-0.002* (-1.67)		-0.0017* (-1.79)		-0.0019*** (-2.79)
Prob convict			-0.0585** (-2.35)		-0.0536 (-1.97)					
Fine est							-0.00009*** (-2.95)			
Drink freq						-0.0193** (-2.12)				
Unemp								0.0298 (1.17)		
Smoke								0.0224** (2.01)	0.0417** (2.10)	
Gender								-0.0235*** (-2.69)	-0.0448*** (-2.70)	
Wald chi2	41.55		26.95		30.21		28.6		58.04	
Biprobit correlation (rho)	0.6735		0.89613		0.8932		0.87		0.639813	
SE rho	0.0859		0.0614		0.067		0.07		0.095669	
Obs	785		528		432		453		785	

Notes: Z statistics in parentheses. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Constants estimated but not shown

Higher values of the risk exposure/ alcohol consumption variable drink frequency measure lower frequencies of city centre drinking visits. This variable reduces the effective sample size, but is significant and correctly signed in the victim equation.

Increasing the explanatory variable set to include gender, smoking and unemployment status reduces the size of the risk and time preference effects, because some of these are captured by the additional variables. Being female reduces violence and victim chances by as much as smoking increases them; respectively by a little over 2 percent and 4 percent (equations 5a and 5b). Discrete changes in unemployment status at the other variable means is not a significant contributor to violence (or victimization, equation not reported), perhaps because it is a poor proxy for the theoretical variable, wealth.

A test of whether the determinants of the chance of being a victim or a violent person are different is if equality of all coefficients can be rejected across the two equations. In a specification for both equations with time preference, conviction chances, drink frequency, problem drinking, unemployment status, smoker, and male, a test of equality of the coefficients yielded a significant result ( $\chi^2(8) = 38.89, p < 0.001$ ), indicating that it is unlikely that the same relations pertain equally to both groups.

## 6. Conclusion

Risk attitude, as measured by a lottery question, influences the chances of a person being gratuitously violent. This is a prediction of a rational offender model that represents crime as a choice under uncertainty, or a type of gamble. Lower risk aversion also increases the likelihood of becoming a victim of such violence. Again, consistent with a rational offender model, time preference is a significant determinant of gratuitous violence; more impatient people surveyed are more likely to be violent. Rational offenders heavily discount future consequences relative to the instant gratification of violence. The sample showed strong hyperbolic, rather than exponential, discounting. This implies that choices are likely to be time inconsistent; violent people are even more likely than others to take contradictory actions they come to regret, unless they make commitments - or commitments are made for them.

In contrast to the simplest, full information, rational offender theory, the subjective approach predicts that perceptions of conviction probabilities and penalties influence offending. Violent persons surveyed are shown to have lower fine estimates and lower estimates of the probability of conviction. These differences are in the direction implied by the subjective theory; individuals believing that the chances of punishment and the penalties are lower are more likely to offend.

Possibly violent persons might already have acquired more information than others because of prior contact with the criminal justice system. If punishment is more lenient than most survey participants believe, as seems likely, then this is a possibility. But the reverse appears to be the case for the chances of punishment. Hence this experience argument against the subjective rational offender model does not seem cogent.

Alcohol consumption is often associated with violence. Although there is a bivariate association between 'problem drinking' and perpetrators of violence this does not carry over strongly to the multivariate analysis. On these grounds we conclude that impatient people drink alcohol heavily and impatient people are prone to violence but the alcohol does not significantly cause the violent behaviour. On the other hand, victims of violence are likely to be in the high frequency drinking category, which may measure reduced ability to assess risk, or simply risk exposure. That victims are more at risk the younger they are, is compatible with experience reducing the chances of avoiding danger. Or violent persons may simply prefer

to target younger victims. At the mean unemployment status, employed in this research as a measure of wealth, has no discrete change effect on violence chances.

A victim must come into contact with a violent person. The correlation of disturbance terms of the victim and violence equations found in the present study is consistent with opportunities for contact randomly distributed across the sample, and explicitly measured in the two equation model. Age is not relevant to the violence equation and estimated conviction chances are immaterial to the likelihood of becoming a victim, so the groups as a whole are different, despite overlap.

In summary the simpler objective expected utility formulation of rational offending requires substantial modification to include time discounting and perceptions. But subject to this caveat, the rational offender model has significant explanatory power for gratuitous violence. A corollary is that policy for reducing gratuitous street violence that presupposes instigator rationality can hope to have some success. But a focus on changing perceptions of potential offenders may be more effective than objective alterations to the environment. The systematic perceptual biases about the chances of city centre violence and the probability of arrest of offenders, consistent with Prospect Theory, suggest considerable scope for such a strategy.

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## APPENDIX 1 Risk Aversion and relative elasticities of detection and penalty

Consider an individual with wealth  $W$  and utility  $U$ , facing a penalty of cash equivalent  $f$ , of probability  $p$  and a successful payoff with money equivalent  $s$ , with a probability  $1-p$ . Suppose the benefits of crime are kept regardless of being caught

$$p \cdot U(W-f+s) + (1-p)U(W+s) = EU \quad 1$$

$$\frac{\partial EU}{\partial p} = U(W-f+s) - U(W+s) < 0 \quad \text{and} \quad \frac{\partial EU}{\partial f} = -p \cdot U'(W-f+s) < 0$$

$$\epsilon_p \equiv \left(\frac{\partial EU}{\partial p}\right) \left(\frac{p}{EU}\right) = \left(\frac{p}{EU}\right) (U(W-f+s) - U(W+s))$$

$$\epsilon_f \equiv \left(\frac{\partial EU}{\partial f}\right) \left(\frac{f}{EU}\right) = - \left(\frac{f}{EU}\right) (p \cdot U'(W-f+s))$$

$\epsilon_f > \epsilon_p$  if

$$- (f \cdot U'(W-f+s)) > (U(W-f+s) - U(W+s)) \quad \text{or}$$

$$U'(W-f+s) > (U(W+s) - U(W-f+s)) / f \quad 2$$

The right hand side of Equation 2 is the increase in utility over the range of wealth given by the monetary equivalent of the penalty. Since  $U(W-f+s) < U(W+s)$ , diminishing marginal utility (necessary for global risk aversion) implies that that inequality (that the elasticity of punishment  $\epsilon_f$  is greater than the elasticity of conviction  $\epsilon_p$ ) holds,

## APPENDIX 2 Sentencing Uncertainty and Risk Attitude

Consider an individual who is indifferent between offending with a penalty  $f$  of probability  $p$  and a successful payoff  $s$  with a probability  $1-p$ .

The expected utility where  $W$  is initial wealth is then

$$p \cdot u(W-f) + (1-p)u(W+s) = U(W)$$

Now suppose the penalty depends upon, say, in which court the offender appears and this is randomly determined. With a probability  $r$  the offender receives a penalty  $f_1$  and a penalty  $f_2 > f_1$  with a probability  $1-r$ . Expected utility is then

$$(1-r)p.u(W-f_2)+rp.u(W-f_1)+ (1-p)(W+s) =E(U(r))$$

Suppose also that the expected value of the penalty is the same in both the random and the non-random cases. Then

$$W-f=(1-r)(W-f_2)+r(W-f_1)$$

With risk aversion

$$u(W-f) >(1-r)u(W-f_2)+ru(W-f_1)$$

Without loss of generality set  $u(W-f_2)=0$

$$p.u(W-f) >rp.u(W-f_1)$$

The expected utility of wealth with a certain penalty is greater than the expected utility with an uncertain penalty. Therefore

$$U(W) >E(U(r))$$

and there is less utility from offending under uncertainty.

### **APPENDIX 3 The Offender's Price of Violence**

The objective probabilities of arrest, conviction and the penalties for violence against the person in Central Cardiff on an average Saturday night were calculated with two data sets. One was collated by South Wales Police as part of the 'Tackling Alcohol Related Street Crime' (TASC) initiative (Maguire and Nettleton 2003). The other set, conviction data, was available from Home Office Sentencing Statistics.

In 2004 approximately 40,000 people socialised in the city centre on a typical Saturday evening, giving rise to an average of 25 recorded incidents between the hours of 11pm and 3am. Thus, for revellers in the city centre, there is apparently a very small chance of involvement in a violent incident on any Saturday night. How large that chance is depends on the average number involved in an incident. If two people were typically involved the probability for any person would be 50/40,000 or a 0.13 percent chance. If four people were involved on average the probability would be 0.26 percent. TASC data suggests that the average number of people involved in an incident is 3.92 (SD = 3.25), placing our estimate at 0.20%.

Almost 40% of recorded violent or disorderly events in Cardiff city centre led to an arrest. An interpretation is that for perpetrators of street violence there is a probability of 40% that they will be arrested. It should be noted that these probabilities are for one evening. A person who visits the City centre to socialise on 20 Saturday evenings a year, will have 20 times the probability of experiencing a violent incident in the course of the year – assuming each Saturday event is independent. However respondents were asked about only one evening ‘About 40,000 people will visit the Cardiff City Centre on a typical Saturday evening. Of these 40,000 how many people do you think will become victims of violent assault?’

#### APPENDIX 4 Selected Survey questions

##### VIOLENCE

**Not used** In the past twelve months, have you used or threatened violence to get something you want from another adult? For example to make someone to do something or give you something. (1)

Yes	1
No	2
Refused	3

**Used** In the past twelve months, have you ever been violent towards someone because they provoked you in some way? (2)

##### VICTIM

In the past twelve months, has anyone been violent towards you for no reason? (3)

Yes	1
No	2
Refused	3

##### RISK

You are probably familiar with games shown on television, where people win prizes and can choose between several options. For example, they can choose to keep a certain prize, or they can choose to take a chance to get a much bigger prize, at the risk of losing the prize all together. The following questions present similar choices, concerning amounts of money. Some of the amounts are certain for you to have, others you can win in a lottery. We would like to know which choice you would make. Please select either A or B in each.

**Q1 SHOWCARD 7** We toss a coin once. Which of the following two options would you choose? (4)

A.	You get £1,000 with either head or tails	1
B.	With heads you get £2,000, but with tails you don't receive anything	2

<b>Q2 SHOWCARD 6</b>	Which of the following two options would you choose?	(5)
A.	You draw a lottery ticket with a 2% chance to win £3,000, if you lose you don't get anything	1
B.	You draw a lottery ticket with a 1% chance to win £6,000, if you lose you don't get anything	2
<b>Q3 SHOWCARD 8</b>	We toss a coin once. Would you accept the following gamble? Heads, you win £1,500 but with Tails, you <b>lose</b> £1,000	(6)
A.	Yes I would Gamble	1
B.	No I would not Gamble	2
<b>Q4 SHOWCARD 4</b>	Which of the following two options would you choose?	(7)
A.	You draw a lottery ticket with a 80% chance to win £45, but if you lose you don't get anything	1
B.	You win £30, no matter which ticket is drawn	2
<b>Q5 SHOWCARD 5</b>	Which of the following two options would you choose?	(8)
A.	You draw a lottery ticket with a 25% chance to win £100, if you lose you don't get anything	1
B.	You draw a lottery ticket with a 20% chance to win £130, if you lose you don't get anything	2

## TIME PREFERENCE

### INTERVIEWER INSTRUCTIONS: PLEASE READ

We often make choices between a prize that we can get hold of immediately and a larger prize we can only get hold of at a later date. These questions will ask you to compare immediate and delayed options.

Imagine you had a lottery ticket and had won £87 but would not receive the £87 immediately, instead you had to wait a while before you could cash in the winning ticket.

- A** What is the least amount of money, to the nearest pound, you would sell the ticket for today if you had to wait 30 days before claiming your prize.

Don't know 1 (9)  
 Wouldn't sell 1 (10)

£ 

Tens	Units
------	-------

 (11) (12)

- B** What is the least amount of money, to the nearest pound, you would sell the ticket for today if you had to wait 90 days before claiming your prize.

Don't know 1 (13)  
 Wouldn't sell 1 (14)

£ 

Tens	Units
------	-------

 (15) (16)

**C** What is the least amount of money, to the nearest pound, you would sell the ticket for today if you had to wait 7 days before claiming your prize.

- Don't know 1 (17)
- Wouldn't sell 1 (18)

£

Tens	Units
------	-------

(19)                      (20)

**ESTIMATED CHANCES OF CONVICTION**

For every 1,000 people arrested for committing a violent crime in Cardiff City Centre. How many do you think are convicted in Court?

- Don't know 1 (21)

**ESTIMATED FINE**

If someone is found guilty of an alcohol related violent crime, what do you think is the usual amount they are fined?

- Don't know 1 (22)

**ALCOHOL**

Do you ever go for an alcoholic drink in Cardiff City Centre (23)

Yes	1
No	2

**SHOWCARD 2** If yes, how often in the past 12 month, have you been for a drink in Cardiff City Centre? (24)

A.	Daily	1
B.	Once a week	2
C.	Once every other week	3
D.	Once a month	4
E.	Less than once a month	5
F.	Varies / Don't know	6

In the last year, has a relative, friend, doctor or other health worker been concerned about your drinking or suggested you cut down? (25)

No	1
Yes, on one occasion	2
Yes, on more than one occasion	3
Refused	4

How often do you have eight or more drinks on one occasion?

**(INTERVIEWER PLEASE INFORM RESPONDENT THAT ONE DRINK IS ½ A PINT OF BEER, A MEDIUM GLASS OF WINE OR ONE SHOT OF SPIRIT.)**

(26)

A.	Never	1
B.	Less than monthly	2
C.	Monthly	3
D.	Weekly	4
E.	Daily / almost daily	5
F.	Varies / Don't know	6