Faculdade de Economia da Universidade do Porto

Master Dissertation in Economics

Willingness to pay for violent crime reduction: a contingent valuation study for higher education students

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Abstract

Criminal literature has often addressed the issue of estimating the costs of crime given its importance in cost benefit analysis. The calculation of the tangible costs of crime (e.g. medical costs and costs with the justice system) has been considered feasible but the estimation of the costs of pain, suffering or fear of crime has been seen as an unreasonable task by some and a challenging task by others given the intangible nature of these costs. However these costs cannot be ignored as they are an important component of the total costs of crime. Through the elicitation of public's willingness to pay (WTP) for reduction in crime risks, the contingent valuation method is one of the methodologies that have been used to estimate the intangible costs of crime.

A sparse number of studies exist resorting to contingent valuation methods being applied in high crime rate contexts (US and UK). In the present dissertation, we aimed at estimating the willingness to pay in a low crime rate context. Furthermore, our study involves a novel application of the contingent valuation method by being applied to a specific segment of the population – higher education students. Due to the higher level of education one might expect that these individuals have a better understanding of risk changes and are thus more capable of making informed decisions about the trade-offs between safety and its costs.

Based on the responses of 1122 higher education students from a wide set of courses (ranging from Economics to Psychology and Humanities), we found that our results are mainly in line with the existing literature except for the fact that we found that females were willing to pay more than male individuals for reducing violent crime rate and that having an avertive behaviour is positively associated with WTP. We additionally concluded that students enrolled in distinct courses present significant differences in the willingness to pay for crime reduction. In concrete, Economics and Management students appear as the ones willing to pay more whereas Arts, Sports and Law students emerge as those who were willing to pay less when compared to Health students. These precursor findings are likely to represent critical impact on crime and insurance policies.

Key words: Contingent Valuation Method; Intangible costs; Crime costs

Resumo

A literatura criminal tem abordado frequentemente a questão da estimação dos custos do crime dada a sua importância na análise custo - benefício. O cálculo dos custos tangíveis do crime (por ex: despesas médicas e custos com o sistema judicial) tem sido considerado passível de elaboração mas a estimação dos custos associados à dor, sofrimento ou medo do crime tem sido vista como uma tarefa insensata por uns e um desafio por outros dada a natureza intangível destes custos. No entanto, estes custos não podem ser ignorados visto serem uma parte importante dos custos totais do crime. O método da avaliação contingente tem sido usado para estimar os custos intangíveis do crime questionando para isso os indivíduos quanto à sua disposição a pagar pela redução dos riscos de serem vítimas de crime.

Existe um número escasso de estudos que aplicam o método de avaliação contingente sendo estes aplicados a países com altas taxas de criminalidade (Estados Unidos da América e Reino Unido). Esta dissertação tem como objectivo estimar a disposição a pagar num contexto de baixas taxas de criminalidade. Além disso, este estudo envolve uma nova aplicação do método de avaliação contingente ao ser aplicado a um segmento específico da população – estudantes do ensino superior. Dado o seu nível de habilitações, pressupõe-se que estes estudantes compreendam melhor variações no risco, sendo capazes de tomar decisões mais informadas sobre o trade-off entre custos e segurança.

Com base na análise de dados de 1122 estudantes de ensino superior que frequentam uma variedade de cursos (desde Economia à Psicologia passando pelas Humanidades), concluímos que os nossos resultados estão de acordo com os que são encontrados na literatura, excepto o facto de termos concluído que as mulheres estão dispostas a pagar mais para reduzir a criminalidade violenta do que os homens e o facto de se ter um comportamento preventivo face ao crime estar positivamente associado à disposição a pagar. Concluímos ainda que estudantes inscritos em cursos diferentes apresentam diferenças significativas na disposição a pagar pela redução de crime. Os alunos de Economia e Gestão são os que estão dispostos a pagar mais e os de Artes, Desporto e Direito são os que estão dispostos a pagar menos comparados com os estudantes da área da Saúde. Estes resultados inovadores poderão ter um impacto crítico nas políticas relacionadas com o crime e com os seguros.

Palavras-chave: Método de Avaliação Contingente; Custos Intangíveis; Custos do Crime

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Abbreviations

BSC	British Crime Survey
CV	Contingent Valuation
FBI	Federal Bureau of Investigation
FoC	Fear of Crime
EU	European Union
INE	Instituto Nacional de Estatística
MAI	Ministério da Administração Interna
MIETE	Mestrado em Inovação e Empreendedorismo Tecnológico
NBER	National Bureau of Economic Research
NICE	National Institute for Clinical Excellence
NOOA	National Oceanic and Atmospheric Administration
OLS	Ordinary Least Squares
QALY	Quality Adjusted Life Year
UCR	Uniform Crime Report
U.K.	United Kingdom
U.S.	United Sates of America
WTA	Willingness to Accept
WTP	Willingness to Pay

Introduction

Benefit cost analysis is considered an important tool to analyze the benefits and costs of criminal justice policies (Cohen, 2000). In a society of scarce resources that can be allocated to different alternatives, estimating the costs of crime can help policy makers make more informed decisions (Cohen, 2000; Streff et al., 1992). According to Cohen (2000), costs can be classified in general as tangible or intangible costs. Tangible costs are associated with monetary payments like medical costs, costs with the justice system, losses in property values and working days (Cohen, 2000). Intangible costs are not valued in the market (Cohen, 2000) and include the costs of pain, suffering, the loss of quality of life inflicted on crime victims (Atkinson et al., 2005), and the costs of fear of crime (Moore et al., 2006). It is more complicated to measure intangible costs of crime (Dolan et al., 2005) but the costs of the emotional and physical impact of crime may be greater than financial costs, particularly for violent and sexual offenses (Brand and Price, 2000). In the case of drug abuse programs, Rajkumar and French (1997) argue that the inclusion of intangible losses of victims in crime costs might considerably raise the benefits of avoiding criminal activity.

The available literature distinguishes several methodologies to estimate the intangible costs of crime (Cohen, 2000; Rajkumar and French, 1997). One of the methods that attempt to incorporate these intangible impacts of crime is the Contingent Valuation Method (Atkinson et al., 2005). This method uses surveys to ask respondents how much they would be willing to pay for a small reduction in a particular risk or how much they would be willing to accept as a compensation for a small increase in a particular type of risk (Carthy et al., 1999). The surveys are characterized by the fact that they present a hypothetical situation with which respondents are confronted with allowing to tailor the scenario to the needs of the researcher. The Contingent Valuation (CV) approach allows eliciting willingness to pay - a measure provided by the welfare theory (Mitchell and Carson, 1988) – and when applied to the criminal context allows the researcher to determine the value individuals place on the reductions in crime (Atkinson et al., 2005). Although this technique has been widely used in other contexts[1] it has not been generally applied to criminal research (Cohen et al., 2004; Atkinson et al., 2005).

[1] See for example Tyrvainen and Vaananen (1998) for an application to an environmental context, Alberini and Chiabi (2007) for a health context or Gerking et al. (1988) for a study in a workplace safety context.

Among the few studies that exist in this field the one by Ludwig and Cook (1999), presented in a NBER working paper, was the first study on eliciting willingness to pay in a crime context. In their study they determine individual's willingness to pay for a program aimed at reducing gun violence by 30%. Later, Cohen et al. (2004) use the contingent valuation method to estimate people's willingness to pay for crime control programs and Atkinson et al. (2005) use this stated preference approach to value the costs of violent crime. These studies use representative samples (Ludwig and Cook, 1999; Cohen et al., 2004) or sampling points (Atkinson et al., 2005) drawn from the whole population of two countries where criminality rate is relatively high, the US and the UK.

The study presented in this dissertation is, to our best knowledge, the first attempt to apply the contingent valuation method to estimate the amount that a specific group of the society, which is relatively prone to being victim of (violent) crime - students - is willing to pay to reduce the probability of being victims of a violent crime. In contrast to existing literature, our study focus on an underexplored context, Portugal, where criminality and violent crime incidence is relatively low by international standards, although observing an increasing trend.

University students are a pertinent population sample as one might assume that due to the higher level of education they would be more capable of making more informed decisions in estimating the trade-off between costs and safety. It is also considered a population with a high risk of becoming a victim of a violent crime (Walker et al., 2009).

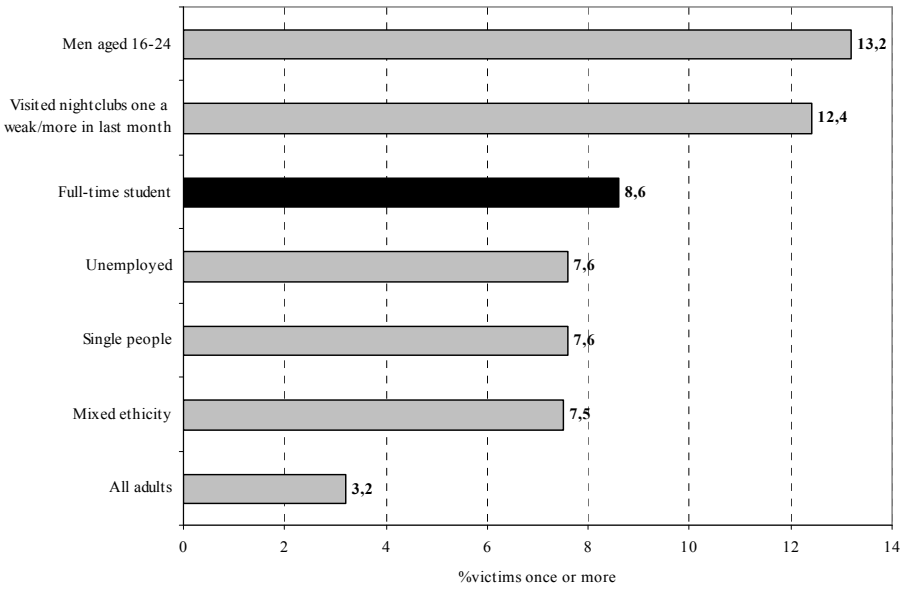

Figure 1: Risk of being victim of a violent crime, 2008/2009 BCS

Source: Walker et al. (2009)

According to Walker et al., (2009) in the Home Office Statistical Bulletin – Crime in England and Wales 2008/2009, full time students, single people and mixed ethnicity have a higher risk than the average of being victims of violent crime. Risk is also higher for men aged 16 to 24 (cf. Figure 1).

The current study is also, to our best knowledge, the first Contingent Valuation study conducted in a relatively low crime incidence context, Portugal, thus adding an empirical contribution to the few studies in the field.[2] As referred earlier, the available literature focuses on studies conducted in the U.S (Ludwig and Cook, 1999; Cohen et al., 2004) or the UK (Atkinson et al., 2005), where the rate of violent crime is substantially higher than in Portugal. According to a study of a European Consortium financed under the 6th Framework Programme (2007: 2), the "[r]isks of being assaulted were found to be highest in the UK, Ireland, The Netherlands, Belgium, Sweden and Denmark. Risks were lowest in Italy, Portugal, Hungary, Spain and France. Experiences with sexual violence were reported most often by women in Ireland, Sweden, Germany and Austria and least often in Hungary, Spain, France and Portugal."

FBI Uniform Crime Report (UCR)[3] reported the existence of 466.9 and 473.5 violent crimes in the US per 100,000 habitants in 2007 and in 2006, respectively.[4] Own calculations based on absolute values of violent crime (including homicide) and population reported in EUROSTAT, present evidence that the UK has a higher rate of violent crime than the US whereas Portugal has one of the lowest rates of violent crime in Europe. The weight of violent crime in total crime recorded is also lower in Portugal. According to the "Relatório Annual de Segurança Interna – Ano de 2008", the weight of violent crime in Portugal in total crime was 5.8%, representing an increase of 10.8% compared to 2007 (cf. Figure 2). Despite such raise this figure is significantly lower than the UK figure, which is over 20%.

The countries, where criminal intensity is high (US and UK) have been used to estimate the amount people are willing to pay to reduce the risk of victimization. It is important therefore to analyze whether such results are consistent with the ones found for a country where both the crime rates and the proportion of violent crime are lower.

[2] "In 2004 levels of crime were most elevated in Ireland, the United Kingdom, Estonia, The Netherlands and Denmark and lowest in Spain, Hungary, Portugal and Finland", The burden of Crime in the EU, Research Report: a comparative analysis of the European Crime and Safety Survey (EU ICS) 2005.
[3] http://www.fbi.gov/ucr/cius2006/offenses/violent_crime/index.html - accessed 19-08-2009
[4] The FBI considers that violent crime includes 4 offenses: murder and non-negligent manslaughter, forcible rape, robbery and aggravated assault.

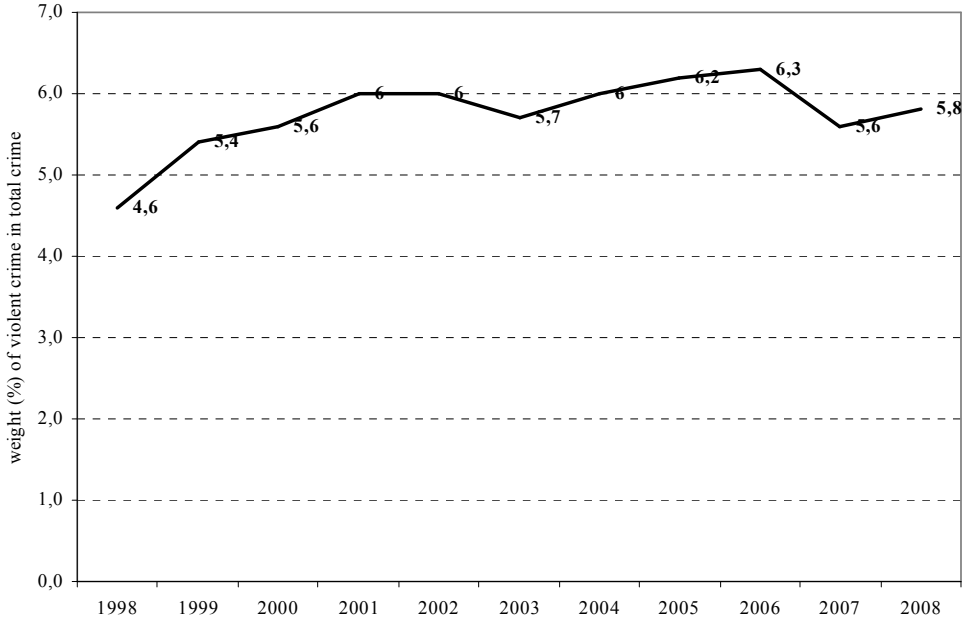

Figure 2: Evolution of the relative weight of violent crime in total crime, 1998-2008

Source: MAI (2009), Relatório Anual de Segurança Interna, 2008

Our respondent sample includes 1122 students of the largest Portuguese University (University of Porto), embracing individuals from a large scope of (32) courses and (14) faculties/schools, permitting to evaluate the extent to which students enrolled in distinct courses (e.g., economics vs. engineering vs arts or medicine), proxy for individual's distinct inclinations or psychological traits (Roeser, 2006), present different willingness to pay for violent crime reductions. We device an econometric model aimed at empirically assessing which are the most important determinants of students' willingness to pay for violent crime reduction.

This study is structured as follows. In Chapter 1 we present a review of the available literature on the methods of valuation of the costs of crime that incorporate the valuation of intangible costs. The following chapter (Chapter 2) focuses on the methodology used to design the questionnaire. Chapter 3 elaborates on the model specification and variables that are used for the estimation and provides an outline of the main results of the survey. A comparison of these results with the available literature is also addressed in this chapter. Concluding remarks are reserved for the end of the dissertation where some key findings of this work are summarized, their implications to criminal policy are discussed, and limitations and paths for future research are put forward.

Chapter 1. Categorization of the costs of crime and techniques used for the valuation of intangible costs of crime: a literature review

1.1. Initial considerations

Our research aim is to estimate the Willingness to Pay (WTP) of higher education students to reduce the risk of being victims of a violent crime using the contingent valuation approach. The existing literature in the field is confined to a few studies in two countries with high crime rates: UK and US. The samples used for the studies aimed at being representative of the population without attempting to verify whether different areas of knowledge (e.g., arts, economics, medicine, and engineering) affect the amount people are willing to pay. In the present chapter we present, in a first section (Section 1.2), a possible categorization in which the costs of crime might be divided and a brief explanation for the need to monetize the costs of crime and the ethical issues associated with using monetary metrics to value intangible costs like pain and suffering. The reasons for the choice to measure the monetary impacts of violent crime are also addressed in this section. In Section 1.3 we review the available literature on the techniques used for the valuation of intangible costs of crime and describe the contribution of our study to the literature.

1.2. Categorization of the costs of crime

There are several ways in which the cost of crime might be categorized. Following the typology presented by Czabánski (2008), the cost of crime is divided (cf. Table 1) in three categories: cost in anticipation of crime, costs of crime itself, and costs of society's response to crime.

Table 1: Categorization of the costs of crime

Costs in anticipation of crime	Cost of Crime Itself	Costs of society's response to crime
•Precautionary expenditures (e.g. burglar alarms, fencing, other security equipment, security services, lightning, insurances) •Precautionary behaviour (e.g. time to lock doors, avoidance of certain activities due to fear of crime such as going out at night, anxiety caused by fear of crime)	•Direct property losses (stolen, damaged or destroyed property) •Cost of lost time (lost productivity) •Health care expenses (includes physical and mental health care) •pain and suffering (includes all costs of psychological impact of crime on victims)	•criminal justice system (e.g. law enforcement agencies, courts, prison and other correctional facilities) •Costs of incarcerated offender (e.g. lost tax revenue, loss productivity, rehabilitation programs)

Source: Own systematization

Moreover it is also possible to find in literature the classification of crime costs according to who bears them (Brand and Price, 2000; Cohen, 2000).[5] Victims partially bear the costs of lost property and the emotional and physical impact of crime. Potential victims partially sustain the costs of fear of crime and the costs of precautionary behaviour and expenditures. Society is faced with costs related to running the institutions associated with the criminal justice system. Even offenders bear costs such as the value of lost freedom and lost wages.

For the development of the present study the distinction between tangible and intangible costs of crime (cf. Figure 3) is particularly relevant given that the method (Contingent Value) used to estimate the WTP has the advantage of incorporating intangible costs of crime. Out of pocket expenses, lost wages, property losses or administrative costs with the justice system are tangible costs that constitute only part of the total costs of crime. The reduced quality of life, the anguish, pain and trauma that accompany criminal events also imply costs that are not just easily measured and monetized.

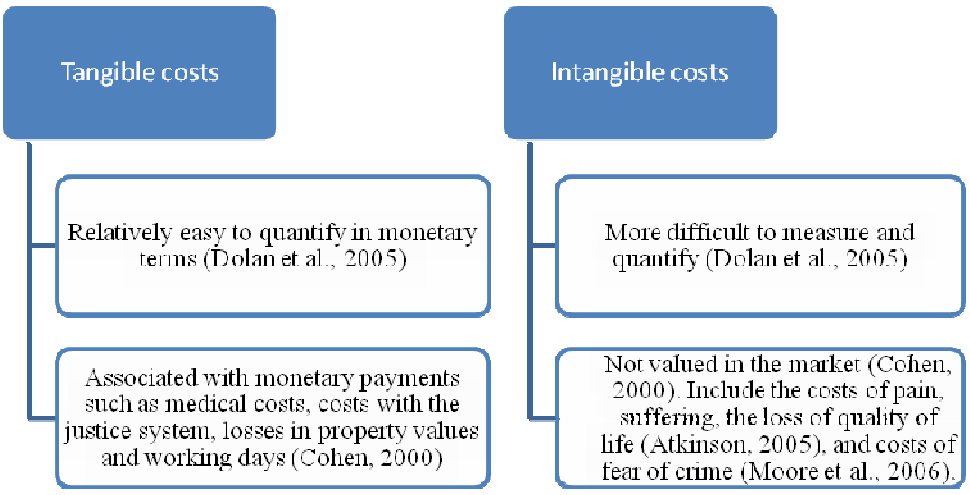

Figure 3: Tangible vs Intangible costs

Source: Own systematization

Multiple categorizations of crimes are possible but a unique metric to value these costs is needed (Miller et al., 1996).[6] Several reasons explain the use of monetary metrics to measure the costs of crime. One of them is comparability in the context of policy making and analysis between the harms caused by different types of crime (Cohen, 2000).

[5] For a comprehensive list of the bearers of the different costs of crime see Cohen (2000).
[6] The categories of costs mentioned are not listed exhaustively. See Cohen (2000) or Rajkumar and French (1997) for other classification of crime costs.

Quantifying the seriousness of a certain category of crime will allow policy makers to rank public action in the reduction of crime (Czabanski, 2008) allowing for guidance in allocation of resources between crimes (Miller et al., 1996). The comparison of the costs and benefits of a specific program or policy whose goal is to control a certain type of crime is also considered a reason for the use of monetization of costs (Cohen, 2000). By choosing to implement a specific program of prevention or crime control the policy maker is implicitly making an analysis of the costs and benefits of adopting that particular program and not an alternative policy. By doing so, a monetary value on crime is being attributed, even if it is done implicitly (Cohen, 2000; Atkinson et al., 2005). Furthermore, it is necessary to estimate the aggregate cost of crime to society in order to compare it to other social problems and better allocate resources (Cohen, 2000; Czabanski, 2008).

Public opinion might consider that the costs of crime are the ones expressed in the accounts of public spending and make judgments on the amounts spent. However only if the costs of crime are estimated will it be possible to know the benefits of crime avoidance and compare the costs and benefits of criminal policy. In this vein, and according to Czabanski (2008: 18), estimating the costs of crime will avoid the "bias toward an accountant perspective".

In spite of the need to monetize the costs of crime, this is not a consensual approach (Czabanski, 2008). Indeed, it is often defended that life is priceless (Jongejan et al., 2005; Viscusi, 2008) and putting a value on people's suffering is taken as "cold" and "impersonal" (Miller et al., 1996: 1). Measuring correctly the emotional and psychological impacts of violent crime is also considered "impossible" and "artificial" (Brand and Price, 2000).

However, it should be noted that the results presented in literature do not intend to value the pain and suffering of a particular individual in the sense that putting a value on the suffering of a crime victim in particular would be considered by most inadmissible. Rather, the studies are an attempt to measure ex-ante the value society places on preventing that suffering (Brand and Price, 2000). It is also worth mentioning that what is being analyzed is not the value of a single crime but the value of crime reduction (Czabanski, 2008). It is the monetary valuation of crime costs that allow policy appraisal and evaluation (Brand and Price, 2000).

The study presented in this dissertation focuses on the reduction of a particular kind of crime: the violent crime. This is explained by the relative importance of violent crime

when compared to other categories of crime. The UK Home Office Report (Brand and Price, 2000) estimate that the number of offenses involving violent crime in the UK constitute 25% of the total offences but their costs mount to almost 75% of the total costs of crime. In Portugal, although information on costs is not available, violent crime accounted for a much small percentage (about 6%) of the total crimes reported to the police in 2008 (MAI, 2009).

Given the distinct context of violent crime incidence, it seems therefore pertinent to analyze whether the amount individuals (specifically, higher education students) are willing to pay for reductions in the probability of being victims of violent crime in Portugal are in line with those estimated for contexts characterized by higher crime rates and whether the factors that influence WTP are similar.

1.3. Methods of estimating intangible costs of crime

1.3.1. A summary of the main methods

Several methods have been used to estimate the intangible costs of crime. Thaler (1978) presented the first study using the hedonic price methodology in the crime context. Because this method presented some disadvantages, Cohen (1988) pioneered in the use of crime jury awards in order to find more reliable estimates. Alternative methods like transference of values from other contexts and the QALY approach were also developed. In 1999 the contingent valuation approach – first used by Davis (1961) in the arena of environmental economics – was applied to the criminal context. Finally, an alternative method of valuation was proposed by Moore and Sheperd (2006). These authors use the shadow price methodology to value the costs of fear of crime.

A brief account of these distinct methods is presented, by chronological order, excluding the Contingent Valuation Approach, as the emergence of a given method was intent to overcome the previous method's pitfalls. We reserve the description of the Contingent Valuation Approach to the end giving it a more detailed account as it is the method used in the present study.

1.3.2. The Hedonic Price Methodology

One of the methods used to estimate the monetary value of intangible costs is the use of the hedonic price methodology to estimate people's willingness to pay for a safer neighborhood using the property values of houses (Cohen, 2000). Through the analysis of the differential in property prices explained by higher crime rates that are found by

controlling other variables that influence prices (e.g. proximity of a school), researchers are able to estimate the amount residents are willing to pay for lower crime rates in their neighborhood. The cost residents place on crime is inferred from these amounts (Rajkumar and French, 1997).

We find several studies that resort to this approach. Thaler (1978) was the first researcher to publish a study aimed at estimating the effect crimes have on property prices. The author concludes that crime does have a negative impact in housing prices. Using data from Rochester, New York, Thaler (1978) found that an average property crime lowers house prices by approximately $1930 (1995 prices) as stated by Lynch and Rasmussen (2001).

Tita et al. (2006) found that housing prices are lower in neighborhoods that show higher violent crime rates. The authors also note that the negative impact of crime in housing prices depends on the type of crime and neighborhood characteristics. This effect is more significant in low income neighborhoods when compared to high income neighborhoods. The importance of violent crime costs is also brought out as it is stated that it has the highest cost. Tita et al. (2006) estimated that the increase in housing prices due to the reduction in violent crime is approximately 39%.

Different results emerge from different studies and not all of them report an influence of crime rates on property houses. Lynch and Rasmussen (2001), for instance, report that in Jacksonville (Florida, U.S.) violent crime has a small impact on housing prices. A 10% increase in violent crime would only decrease the predicted sales price by $145. The annual WTP was estimated at only $15 for a violent crime. Gibbons (2004) also estimates the effect crime rates have on property prices considering this the measure of household's willingness to pay to avoid crime. The author finds that even though crimes like vandalism or arson have a considerable negative effect in housing prices it is not the case of burglary. One explanation presented in the study refers to the possibility that people perceive vandalism, graffiti and other forms of property damage as a signal of neighborhood deterioration and a possible evidence of higher crime rates.

Although these studies have the advantage of working with actual market transactions, they rely on assumptions on the competitiveness of the housing market and on the public's knowledge of the neighborhood crime rates (Cohen, 2000). Additionally Cohen (2007) argues that not all types of crimes have an impact on housing prices as some crimes are committed when people are away from home (for instance, when they are travelling) or when people are inside their homes (e.g. domestic violence).

1.3.3. Transferring values from other contexts

Transferring values from other contexts is an alternative approach (Dolan et al., 2005). It is possible to transfer the values of a statistical life calculated in other areas, such as transport, to the criminal context or adapt these amounts so that they can be used to estimate crime costs (Dolan et al., 2005). Phillips and Votey (1981) (in Cohen, 2000), included valuation of a statistical life from a non crime context to infer monetary values of crime specific nature. Brand and Price (2000) made a direct transfer of figures estimated using contingent valuation questions on road traffic accidents on their report on "The Economic and Social Costs of Crime". Even though these values are used in the report, the authors acknowledge that the direct transfer of these values to the criminal context is not ideal as the circumstances of the injuries sustained by violent crime victims are different from the ones sustained as a consequence of a road accident (Brand and Price, 2000). Furthermore, both the type of injuries suffered and the psychological consequences of a crime offense are different (Brand and Price, 2000; Dolan et al., 2005). This justifies the interest in estimating the costs of crime in a crime specific context (Atkinson et al., 2005).

1.3.4. Crime jury awards

Due to the pitfalls of hedonic price methodology to estimate the intangible costs of crime, Cohen (1988) used the verdicts emanated from the juries in civil cases (Czabanski, 2008). The amount of compensation the jurors awarded for similar injuries was used as a proxy for the costs of pain and suffering inflicted on victims. This methodology assumes that the jurors will award the injured citizens an amount that is higher than their financial losses. The difference would represent the costs of pain and suffering (Rajkumar and French, 1997). The total costs of crime involved the estimation of three key components: direct losses (out of pocket expenses taken from the national crime survey); pain and suffering (estimates based on jury awards) and risk of death (taken from previous studies on the value of human life). The estimates found by Cohen (1988), summarized by Czabanski (2008), are presented in Table 2.

Pain and suffering represent the highest costs accounting for more than 90% of all costs in the case of personal crimes (Czabanski, 2008).

The use of jury awards is not without limitations. Nagin (2001) (in Czabanski, 2008) notes that the jury awards are not representative as only the most complicated crimes actually reach court. Furthermore, this is a mechanism particularly used in the United States legal

system. In other countries it is the judge that awards the compensation to victims. As a consequence, the amounts may not be representative of society's view of pain and suffering. Czabanski (2008) also mentions the fact that not all categories of intangible costs are being valued (e.g. fear of crime) because the jury awards do not compensate potential victims. Costs with certain behaviour meant to avoid crime for e.g. locking windows, walking longer distances to get home (Dolan et al., 2007) or taking a taxi to avoid walking (Cohen, 2000) are not considered. Additionally, Rajkumar and French (1997) note that the injury suffered as a consequence of a criminal offense may not be the same type of injury sustained in a civil case. Miller et al. (1996) used data from jury awards on victims of physical and sexual assault to overcome this limitation. However, this method still does not account for non-victim losses.

Table 2: Cost of different types of crime in the US, 1988

Crime	Cost of crime to victims (US dollars)				**Aggregate cost** (thousand million dollars)
	Direct losses	Pain and suffering	Risk of death	Total	
Against person					
Rape	4 617	43 561	2 880	51 058	**9.1**
Robbery	1 114	7 459	4 021	12 594	**14.0**
Assault	422	4 921	6 685	12 208	**56.0**
Larceny	179	-	2	181	**2.5**
Against household					
Motor vehicle theft	3 069		58	3 127	**4.2**
Burglary	939	-	-	939	**5.3**
Larceny	173	-	-	173	**1.5**
Total aggregate cost (thousand million dollars)	**17.5**	**39.0**	**36.1**		**92.6**

Source: Cohen (1988) in Czabanski (2008)

1.3.5. Quality Adjusted Life Year (QALY) approach

Dolan et al. (2005) and Dubourg et al. (2005) use the approach known as Quality Adjusted Life Year (QALY) to estimate the costs of crime (including the intangible component). The QALY approach, which was developed in the health context, assumes that any profile of health can be stated in terms of years of life weighted by an index of health-related quality of life (Dolan, 2000 in Dolan et al., 2005). To full health is assigned a score of 1 and to death a score of 0. The measure of quality of life is thus comprised in the interval [0,1]. Dolan et al. (2005) and Dubourg et al. (2005) use data from several sources including the British Crime Survey (BCS) to calculate QALY losses for each type of

offence. Dolan et al. (2005) conclude that in terms of QALY's loss, rape has the worst consequences after murder involving a loss of quality of life 80 times higher than a common assault. For transforming the QALYs into monetary amounts Dolan et al. (2005) used two different methods. One possible measure of the monetary amount of a QALY is £30 000 based on the figure used by the National Institute for Clinical Excellence (NICE) to evaluate health care technologies. This is not a rigorous method as acknowledge by the authors as it is not based on the preferences of individuals but rather on the opinion of a small group of experts. Another approach refers to the use of an amount based on weighted averages of WTP and WTA (Willingness to Accept) for a base injury (W) elicited from the population. Based on Carthy´s et al. (1999) findings the amount used was £ 3 000 per QALY.

Dolan et al. (2005) use these two methods to estimate the monetary values of QALY losses for different types of crimes (cf. Table 3).

Table 3: Discounted QALY losses and money values for these losses (UK, 2005)

Offence	Discounted QALY losses	NICE threshold (£)	Carthy et al.'s weighted average W (£)
Murder	17 791	533 721	-
Serious Wounding	0.191	5 723	15 378
Other Wounding	0.031	945	2 539
Common assault	0.007	218	587
Rape	0.561	16 840	45 256
Sexual assault	0.160	4 790	12 872
Robbery	0.028	845	2 271

Source: Dolan et al. (2005)

Making use of available estimates on the annual incidence of each type of offence, Dolan et al. (2005) infer the total intangible costs of crime by crime category, which are presented in Table 4. Despite the absolute differences in the amounts found using distinct monetary measures to value a QALY, the relative cost of one crime compared to the other is not changed because the difference is in the multiplier used (Dolan et al., 2005).

Even though Dolan et al. (2005) consider that the methods for estimating the intangible costs of crime are not robust and that the revealed preference approach is not a practical way of valuing these costs, the QALY approach has some limitations. First of all, the QALY approach only values the costs of crime to victims. It does not incorporate any value of crime of costs to society (Cohen, 2007). Furthermore, Cohen (2007) also argues

that this approach only values a specific injury and does not contemplate avertive behaviour costs. Krupnick (2004) in Cohen (2007) defends that QALY is an approach that is suitable for measuring health changes but not for non related health outcomes. The estimates also depend on the assumption on the measure that is used to express a QALY in monetary terms.

Table 4: Total realized intangible victim costs of crime by crime category

	Annual incidence	Total cost using NICE value (£m)	Total cost using injury W value (£m)
Murder	1 100	587	1 100*
Serious Wounding	110 000	629	1 6 92
Other Wounding	780 000	737	1 980
Common assault	3 200 000	700	1 879
Rape	61 000	1 027	2 760
Sexual assault	69 900	341	916
Robbery	420 000	355	954
Total		4 375	11 280

*The authors assumed the amount of £1 m corresponding to the "pain, grief and suffering" part of the value of preventing a road accident fatality as the value of preventing a murder.
Source: Adapted from Dolan et al. (2005)

1.3.6. Shadow Pricing

Another method recently used to measure the intangible costs of crime, particularly the costs of Fear of Crime (FoC), is shadow pricing (Moore and Shepherd, 2006). Individual's daily routines are affected by the decrease in socialization, e.g. going out at night or travelling as well as by the reduction of the feeling of pleasure in work and recreation activities (Brand and Price, 2000). The costs associated with the fear of crime are thus an important factor in economic behaviour (Moore and Shepherd, 2006). Not including these costs underestimates the correct costs of crime (Dolan et al., 2007).

Moore and Shepherd (2006) stated to have developed the first study of shadow costing to value fear of crime. Their study is based on the assumption that income is positively related to happiness extrapolating this thought to the fear of crime. Thus, lower income is associated with higher levels of fear of crime. The shadow pricing methodology is consistent with happiness studies that estimate a price for negative life events. This methodology, that involves the estimation of a regression, was applied to British Crime Survey (2000) data to infer the amount of income people would require to be compensated

for the consequences of increased fear. Using as proxy measures of fear namely the fear of walking in the dark and the fear of being home alone, the authors found that people require an increase in their annual household income of 496% to offset the change from no threat to one threat of violence for walking in the dark. If the measure of fear involved is the fear of being home alone then people require an increase of 115% of their income.

Through the application of this method using data from the European Social Survey, Moore (2006) also found that an average European would require an increase of 13 358€ to be compensated from a transition from the state of "no fear" to "fear". This method was only developed in 2006 and still needs to be critically evaluated but some pitfalls can be identified. The authors argue that only the threat of violence and not the victimization itself is related to the fear of crime. Empirical evidence states otherwise (Czabanski, 2008).

1.3.7. The Contingent Valuation Method (CV)

A popular technique to measure the intangible costs of crime is the Contingent Valuation method (Moore and Shepherd, 2006). Ludwig and Cook (1999) presented the first study with the goal of estimating the benefits of reducing crime using the Contingent Valuation Method. In the survey, respondents were asked if they were willing to vote for a program aimed at reducing gun injuries by 30% that requested the payment of a certain amount of money, through the increase in annual taxes. The authors assume that the respondent's Willingness to Pay (WTP) does not value the risk reduction for the individual but for his entire household. On the impact of income on WTP, the results of the survey suggest that there is a positive relationship between these two variables. The amount of WTP is also positively influenced by the number of children that constitute the household.

The authors' estimates imply that the value of a gunshot injury is USD 750 000 (1998 USD) and societal WTP to reduce gun violence is approximately USD 23.8 thousand million dollars (1998 USD). As a limitation of this survey the authors acknowledge that the baseline risks of being a victim of a gunshot injury is not mentioned nor is which part of the population will benefit from the gun reducing program.

Cohen et al. (2004) use the Contingent Valuation Method to determine people's WTP for programs designed for crime control and provide new estimates of the cost of crime. The authors developed a survey, administered by telephone, in which 2228 respondents were asked if they were willing to vote for a proposal that demanded the payment of a certain amount of money to avoid one in ten crimes in their community. Each of the 1300

respondents that actually completed the interview was then asked if she was willing to pay a certain amount of money to continue a successful program in crime control for three types of crime randomly chosen out of five possible ones: burglary, serious assault, armed robbery, rape or sexual assault and murder. In this study respondents were not given any information regarding crime rates, risk of victimization, average losses or severity of injuries usually related to each type of crime. These details were omitted intentionally so that respondents could answer based on their own perception of these crimes. The authors found that respondents were willing to pay different amounts to avoid each type of crime (Table 5).

Table 5: Individuals' willingness to pay to avoid each type of crime (US, 2000)

Type of Crime	Nº of crimes associated with a 10% crime reduction	WTP for a 10% reduction (USD)	Implicit value of a statistical crime (USD)
Burglary	426 113	104	25 000
Armed Robbery	48 681	110	232 000
Serious Assault	177 836	121	70 000
Rape and Sexual Assault	54 747	126	237 000
Murder	1 553	146	9 700 000

Source: Adapted from Cohen et al. (2004)

A representative household would be willing to pay an average of between USD 104 (for burglary) and USD 146 (for murder) per year for crime reduction programs that diminished specific crimes by 10%.

Using an estimate of the number of crimes avoided with a 10% reduction in crime rates and considering the existence of 103 million households in the United States of America the authors were able to estimate the cost per type of crime (cf. Table 5).

Using the WTP amount of USD 146 in the case of murder, globally the American people would be willing to spend around 15 thousand million USD in the programe (USD146 x 103 million). Dividing this amount by the number of murders averted with a reduction of 10% in its number it is possible to estimate an implicit value of a statistical crime of USD 9 700 000 in the case of murder (Cohen et al., 2004).

Through the analysis of the data the authors were also able to conclude that WTP varies with the income level of the respondents. Low income respondents are usually willing to pay less to reduce crime victimization than higher income respondents even though they

have higher victimization rates. It is thus suggested that the ability to pay plays a role in explaining the amount of WTP. Cohen et al. (2004) further argue that WTP is negatively related to age. The amounts of WTP that result from this study using the Contingent Valuation Method are higher than figures estimated using other methods. A possible explanation suggested by the authors refers to the fact that respondents might overestimate the risks and the injuries sustained by violent crime, thus eliciting higher values of WTP. However, it is also possible that these figures are higher because they reflect aspects like the fear of crime and the willingness to live in safer communities making them a relevant contribution to evaluating the cost of crime.

Atkinson et al. (2005) developed a survey using CV method in the UK aimed at valuing the benefits of reducing violent crime, especially its intangible impacts. Their study focused on three different categories of offense: "common assault", "serious wounding" and "other wounding" and included a very detailed description of the probable health effects (physical and psychological) that a victim of each of these offenses might sustain. This comprehensive description of symptoms was given to respondents as they might have not been completely aware of the consequences of being a victim of a violent crime. Table 6 includes the description of the injury profiles used by the authors.

Table 6: Injury Descriptions

	Common Assault	Other wounding	Serious wounding
Physical injury	No injury profile	Moderate injury profile	Serious injury profile
	None	Cuts and grazes	Concussion
		Extensive bruising to body and face	Cuts (needing stitches)
		No medical attention required	Two broken ribs
		Bruising to body	Immediate medical attention required and two nights in hospital
		Minor physical discomfort for 3 weeks followed by complete recovery	Pain and discomfort for a month followed by complete recovery
Psychological distress	Short-term	Medium-term	Long-term
	Distress profile	Distress profile	Distress profile
	Repeated recollections of assault	Repeated recollections of assault	Repeated recollections of assault
	Feel shaken after a few hours after assault	Difficulty falling asleep or staying asleep (1 or 2 nights each week)	Difficulty falling asleep or staying asleep (1 or 2 nights a week)
	Symptoms last for 1-2 days	Difficulty concentrating on daily tasks	Difficulty concentrating on daily tasks
		Symptoms last for 2 weeks	Feelings of nervousness
			Symptoms last for 6 months

Source: Atkinson et al. (2005)

In the scenario used for the elicitation, the respondents were also informed of the probability of being a victim of each type of incident previous to the risk control policy: 1% for other wounding and serious wounding and 4% for common assault.

Corso et al. (2001) argue that one of the limitations of the CV method is the lack of accurate communication of the magnitude of the risk to the respondents taking the survey. If the respondents do not understand the proportion of the risk being reduced they will not evaluate their preferences correctly. They thus suggest the use of visual aids, like tables, pie charts or "risk ladders" as a possible method of overcoming this difficulty. Following Corso et al. (2001), Atkinson et al. (2005) opted to inform respondents of the risk change by using visual aids through the inclusion of two grids with shaded and non-shaded squares describing the likelihood of being a victim of the offense before and after the implementation of the risk reduction policy. In the survey, respondents were asked to elicit their WTP to reduce in 50% the probability of becoming victims of one of the three types of incidents over the following year. The payment vehicle would be an increase in local taxes for law enforcement (Atkinson et al., 2005). From a sample of 807 interviews, only 523 were used for the estimates - the authors excluded 279 responses classified as "protests" (respondents who were not willing to pay any amount at all to reduce the risk of being crime victims) and 5 responses considered extreme outlying values (responses in which the WTP is more that 10% of the respondent's income and the WTP is higher than £2500). Even though the proportion of protests was 30%, the authors determined that the sample had not been biased as the differences in the demographic characteristics of the protesters and the respondents that did not protest were not statistically significant.

The study of Atkinson et al. (2005) also includes variables reflecting the fear of crime, perception of neighborhood safety, effectiveness of police in reducing crime rates and the respondent's behaviour in avoiding crime. The analysis of the data of the survey allowed reaching the conclusion that willingness to pay (WTP) is very different across respondents and is higher for the crimes that cause the most serious consequences in the respondent's physical and psychological health. This means that WTP varies positively with the severity of the injuries caused by each type of offense. Aiming at examining the factors that determine the variations of WTP across respondents the data was modeled parametrically. Table 7 synthesizes the determinants that influenced individuals' WTP and their statistical significance.

Table 7: Determinants of WTP and their statistical significance

Variable	Influence on WTP	Statistically significant (level of significance)
Other wounding	+	5%
Serious wounding	+	10%
Sex		Not significant
Age		Not significant
Low education	-	5%
Income (log)	+	5%
Victim five years		Not significant
Fear of crime	+	10%
Neighborhood safety		Not significant
Policing	+	10%
Lock door at home	-	5%

Source: Own formulation using information from Table 8 in Atkinson et al. (2005)

One of the most important results is that the severity of the offense influences WTP positively, every other factor remaining constant. Moreover, higher levels of income, education and the lack of an avertive behaviour towards crime also have a positive impact on WTP, ceteris paribus. One characteristic of the respondents that was controlled for referred to the respondents having been victims of a crime in the past. Data analysis suggested that although this had a positive impact in the WTP, it did not have a significant influence in the amounts elicited. This could be explained by the small proportion of respondents in the sample that had been victims of a crime in the past. Table 8 summarizes the values of WTP and the implied cost of statistical crime per type of offence that resulted from the use of parametric estimates.[7] Based on the WTP amounts Atkinson et al. (2005) were able to estimate the cost of a statistical crime (cf. Table 8).

Table 8: Summary statistics of WTP and cost of statistical crime

	Willingness to Pay (in £)[8]		Cost of statistical crime (in £)	
	Mean	Median	Mean	Median
Common assault	105.63	18.00	5 282	913
Other wounding	154.54	27.00	30 908	5 342
Serious wounding	178.33	31.00	35 844	6 196

Source: In Atkinson et al. (2005), Tables 6 and 8 combined and shortened

[7] Parametric estimates were used in the table as Atkinson et al. (2005: 578) consider these a "better approximation of true WTP" than non parametric estimates.

[8] The mean and the median results are quite different as the results show that the mean estimates are skewed and driven by a small number of respondents willing to pay a high amount. Another possible explanation is the difficulty people have in measuring crime impacts.

According to Atkinson et al. (2005) the cost of a statistical crime, in the case of common assault, is £5,282. To reach this figure, the authors used the mean of the WTP, £105.63, assuming that the marginal rate of substitution for a 2% reduction is £52.82.

In the line of Atkinson et al.'s (2005) study, the present dissertation resorts to the contingent valuation method (CV) for estimating the willingness to pay (WTP) for violent crime reduction in the case of Portuguese university students enrolled in a wide diversity of courses and schools. Our contribution for the literature is twofold: firstly, to assess whether different areas of knowledge in which higher education students are enrolled, proxied for their distinct psychological traits, are a determinant factor of the corresponding willingness to pay to reduce the risk of being victims of violent crime. Secondly, to provide some insight as for the consistency of previous studies' estimates, obtained in contexts (US and the UK) where relatively high crime rates occur, in a context (Portugal) characterized by relatively low crime rates.

The next chapter describes the methodology used in the implementation of the questionnaire and the variables used in the econometric estimation.

Chapter 2. Willingness to pay for violent crime reduction: methodological considerations

2.1. Initial considerations

Our study was designed to assess the amount that higher education students are willing to pay for reductions in the risk of becoming victims of a violent crime. In this regard we have adopted the Contingent Valuation Method so that respondents could directly express the amount they would be willing to pay through answering a survey.

The present chapter details the methodology used to implement the survey and the variables used in the estimation of the regressions. Section 2.2 presents a brief characterization of the method, its merits and pitfalls. Then Section 2.3 addresses the methodology used to implement the questionnaire and explains the reasoning behind the questions included in the survey.

2.2. The Contingent Valuation Method

> All decision-making involves choices and all choices involve a sacrifice. (Bateman et al., 2002: 2).

In order to make choices it is necessary to use a common metrics to compare its costs and benefits. However certain goods and services are not marketed (e.g. pain and suffering or biodiversity in the environmental context) making economic valuation techniques needed to assign them monetary values (Bateman et al., 2002). Generally, two approaches are used to monetize these goods: the revealed preference approach and the sated preference approach. In the revealed preference approach economic agents preferences are inferred by economists by observing their behaviour when making decisions where risk is an important element: when individuals accept riskier jobs in exchange for higher wages (Viscusi, 1993) or decide the location of the house where they are going to live (Viscusi, 2000). The hedonic price methodology and averting behaviour analysis are examples of techniques used as revealed preference approach.

In the stated preference approach individuals are directly faced with a hypothetical situation and asked directly to indicate their preferences. A methodology used in stated preference approach is the Contingent Valuation method (CV). The CV method was first applied by Davis (1961) in the context of environmental policy (Marta-Pedroso et al., 2007). It is used to study trade-offs between money and small reductions in risk using surveys to elicit how much individuals would be willing to pay for an improved state of a

provision of a public good or how much they would be willing to accept to be compensated for its reduction (Pearce and Turner, 1990).[9] For instance, Alberni et al. (2007) surveyed the willingness to pay to reduce the risk of dying of cardiovascular and respiratory causes, whereas Persson et al. (2001) survey WTP to reduce the risk of dying in a road traffic accident.

The CV method has substantial advantages compared to the techniques of the revealed preference approach (Mitchell and Carson, 1988). One important advantage is the fact that it allows for the direct elicitation of the welfare measure of WTP. Another noticeable advantage refers to the use of hypothetical scenarios that allow researchers to analyze respondents WTP for goods that may not have been provided yet. These tailored scenarios also enable the study of the transaction of the good in specific contingencies defined by the researcher (Mitchell and Carson, 1988). Respondents may thereafter be informed of the baseline risks and the risk reductions they are requested to value (Alberini and Chiabi, 2007), as well as the payment method or any other information the researcher finds valuable to construct the scenario.

In 1993 a panel of distinguished social scientists chaired by two Nobel Laureates (Kenneth Arrow and Robert Solow) was appointed by the National Oceanic and Atmospheric Administration (NOAA) to assess if the CV method could provide reliable information. This panel concluded that this technique could produce useful information and suggested a number of guidelines to ensure the reliability of CV surveys (Carson, 2000; Arrow et al., 1993; Marta-Pedroso et al., 2007). CV has since then been used as a popular method to evaluate welfare changes in public policies or programs (Atkinson et al., 2005).

The CV method is not without limitations.[10] One of the criticisms associated with this method is that, because the scenario is hypothetical, individuals do not take into consideration their budget constraints resulting in overestimates of the true WTP (Arrow et al., 1993). Some studies have attempted to overcome this disadvantage reminding respondents of their budget constraint (Alberini and Chiabi, 2007). However, this is not a consensual matter as empirical studies have concluded that the budget constraint bias is not relevant and reminding individuals about their available income might even lead to errors

[9] The WTA approach has not been commonly used in criminal literature except for the case of jury awards, which incorporates this concept as people are compensated in an ex-post situation. For policy analysis it is considered more appropriate to elicit respondents about crime reductions and not infer the amount people would ask for a crime rate increase (Cohen, 2007).

[10] For a more comprehensive debate on the controversies of CV method, particularly applied to environmental economics, see Carson et al. (2001) and Arrow et al. (1993).

(Ahlheim, 1998). It is also argued that the hypothetical nature of the transaction leads to possible *hypothetical bias* – differences between the amount people claim to be willing to pay in a constructed scenario and the amounts people actually pay for the good. Efforts have been made by researchers to deal with this problem, e.g. Learning Design proposed by Bjornstad et al. (1997) or cheap talk (Cummings and Taylor, 1999).

The validity of the method has also been tested on the sensitivity of scope (Pouta, 2005). This refers to the fact that economic theory predicts that if individuals are willing to pay a certain amount for a good they desire, then they should be willing to pay more if the quantity of the good offered is increased (as long as the individual does not reach the point of satiation). Empirical evidence has shown in some cases insensitivity and in others sensitivity to scope (Pouta et al., 2005). Carson et al. (2001) consider that the main explanation for CV estimates not to vary systematically with the different characteristics of the good is the poor design and administration of the survey. They argue that the CV studies that demonstrate insensitivity to scope were not designed according to the guidelines of the state of the art surveys. Related to this problem are the possible difficulties respondents might have on understanding very small risks changes. Corso et al., (2000) try to overcome this limitation, once again, by changing the design of the survey adding visual aids. Furthermore, WTP estimates vary depending on the elicitation formats used in the surveys. However Carson et al., (2001) defend that these differences are not as significant as theoretical models predict.

Notwithstanding its limitations the CV method has been considered by government agencies an acceptable procedure in the context of environmental economics (Mitchell and Carson, 1988). Many of the problems encountered with CV studies "can be resolved by careful study design and implementation" (Carson et al., 2001:173) and the NOAA panel (Arrow et al., 1993) has endorsed this method considering it capable of providing reliable estimates.

2.3. The Contingent Valuation Method in the crime context

In order to directly elicit the WTP of high education students to reduce the risks of being victims of violent crime we resort to the CV method. We followed Atkinson et al. (2005) in applying this methodology to the criminal context. As this approach involves the direct elicitation of values using a questionnaire, the design of the survey and its wording are of utmost importance (Mitchell and Carson, 1988). Our survey started with socio-economic

questions that make it possible to characterize students according to their age, gender and family income. The monthly family income categories mentioned in the survey were calculated using the minimum wage as the range amount. It was also included a question where respondents were asked to state the field of study enabling us to confirm how WTP varies across respondents with different characteristics. Respondents were also faced with queries related to their personal experience in crime context. Following Atkinson et al. (2005), respondents were asked if they had ever been victims of a crime (violent or otherwise), the period in which the crime had occurred and the seriousness of the physical and psychological consequences of the crime. Having been victims of a crime might be a relevant variable affecting WTP as one might assume that WTP to avoid being victim of a violent crime is higher for individuals who previously have been victims of a crime when compared to the WTP stated by non-victims. We might also assume that victims of crimes that resulted in more serious injuries would be willing to pay more than individuals that suffered minor or no injuries as a consequence of a preceding crime (Atkinson et al., 2005). Respondents were requested to assess separately the physical and psychological seriousness of the injuries. The level of seriousness was classified in 5 categories ranging "no damages" to "very serious damages". Following Atkinson et al., (2005) we included questions to infer the individual's perception of safety, i.e., fear of crime and avertive behaviour (whether individuals lock the door of their home). Respondents were then asked to elicit their WTP to reduce the risk of being victims of violent crime:

> Considering the existence of 2,28 violent crimes per 1000 habitants, how much would you be willing to pay to reduce in 10% the probability of being the victim of a violent crime in the next 12 months (regardless of the payment vehicle)?

Information on the baseline risk and the amount of risk reduction was provided to respondents. Available literature regards the inclusion of the baseline risk and the level of risk reduction as crucial because individuals need a reference point and different levels of risk reductions imply different amounts of WTP (Norinder et al., 2001). The figure of 2.28 violent crimes per 1000 habitants is an approximation of the actual risks of being a victim of a violent crime in Portugal.[11] Information on the timing of the risk change was also supplied because it can be of significant importance. Given individual time preferences, goods provided today have a different value than goods provided in the future (Bateman et al., 2002). In our survey, it was considered that the risk reduction would take place in the

[11] Own calculation using data from Eurostat.

following 12 months. Following Atkinson et al. (2005) we also chose the payment card as the elicitation format providing respondents with a range of values from which to choose the amount they would be willing to pay to reduce the risks of being victims of a violent crime. However other techniques may be used in a CV survey to elicit the amount individuals are willing to pay. Table 9 presents the main elicitation techniques, its advantages and disadvantages. Different variants of these main techniques have also been proposed (Bateman et al., 2002).

The open ended format has been increasingly abandoned by researchers (Bateman et al. 2002). In contrast the closed ended format (or referendum) has been endorsed by the NOAA panel that considered it the technique of elicitation of choice (Arrow et al., 1993). Other elicitation techniques are possible, for instance the bidding game and the payment card. Considering the limitations and the advantages of each technique, Bateman et al. (2002) suggested the use of closed ended formats or payment cards. Following Atkinson et al., (2005) we used the payment card method to find WTP for risk reductions.

It should be noted, that following Cohen et al. (2004), our survey did not include a complete description of the scenario - it did not include the institution responsible for the risk change, the means used to achieve that alteration nor the method of payment (payment vehicle). The decision to omit the information on the payment vehicle or the policy used to reduce the risk of victimization is explained by the fact that this study aims at estimating the willingness to pay of higher education students to reduce the probability of being victims of a violent crime and not to evaluate a specific policy of crime control. However we must bear in mind that the payment vehicle is considered a relevant item of the CV method affecting the answers respondents offer (Morrison et al., 2000). Even though it was not our goal to evaluate a specific payment vehicle or instrument used to reduce victimization risks we decided to add a question specifying a payment vehicle (the increase in taxes) and a description of a policy instrument (increase in policing) to understand if these elements affect WTP. Considering we were interested in testing if there was a change in WTP, respondents were only asked to state if they would be willing to pay more, less or the same amount compared to the situation where no payment vehicle or instrument was provided.

Table 9: Advantages and disadvantages of CV method´s elicitation techniques

Elicitation technique	Description	Advantages	Disadvantages
Open ended	Individuals are asked their maximum WTP without being given any suggestion as to a value	- No anchoring bias – as no value is given to the respondent she is not "anchored" to any amount - Very informative as to what the maximum amount is	- Leads to many non-responses, zero answers or unreliable amounts – it is difficult for respondents to find an amount without any guidance particularly when they are not familiar with the good in question - Individuals are used to thinking in terms of prices of goods and not in maximum amounts
Bidding game	Individuals are suggested higher amounts of WTP consecutively (as in an auction) until the maximum WTP is found.	- Helps respondents think about their preferences through this process	- Anchoring bias: responses are affected by the starting values presented and the bids used. - Yea-saying: respondents are lead to accept paying the amounts included in the bid to avoid the social embarrassment of saying no.
Payment card	Presents respondents with a range of values in a card to choose the maximum WTP from. It may also indicate the expenditures of a representative household to help respondents with their answer.	- Avoids anchoring bias - Avoids yea-saying - Avoids starting bias	- Range Bias - Vulnerable to the ranges of amounts used
Closed ended format	Single bounded dichotomous choice – the respondent is asked if she is willing to pay a specified amount of money (the amounts usually vary across respondents)	- Easier for respondents to answer as they are already given a specific amount - Lowers the non response rates - Avoids outliers	- The amounts of WTP are higher than the ones found with other elicitation formats - Nay saying (protesting) - Less information provided by the respondent
	Double bounded dichotomous choice – after the first question respondents are given a follow up question where they are requested to answer if they would be willing to pay another amount. This second price is higher if respondents answered "yes" to the first question, and lower if the answer to the first question was "no"	- More information available from the respondent	- Inconsistent responses - Anchoring bias - Yea saying

Source: own formulation from information from Hanley and Spash (1993), Bateman et al. (2002), and Whynes et al. (2004).

The method used for the administration of the survey is also key in preventing errors (Mitchell and Carson, 1988). Surveys may be administered through a variety of instruments. The main survey modes are mail surveys, telephone interviews and face to face interviews (Bateman et al., 2002). However, variations of these instruments were used by combining different modes in an attempt to benefit from the advantages and overcome the difficulties of each instrument when used separately – e.g. combined mail-telephone surveys (Bateman et al., 2002).[12] Table 10 summarizes the main advantages and disadvantages of three basic instruments and includes one more that has emerged with the use of the internet: web based stated preferences surveys (Marta-Pedroso et al., 2007).

The survey used in our study was disseminated by e-mail that included in the message body a link to the web based survey. The primary reason for the choice of this method was the fact that respondents are students from the University of Porto. These students have free access to internet on campus and are also given an e-mail account at the time of the enrollment.[13] The technology is thus available without costs to all respondents. Secondly, the fact these respondents were higher education students results in the absence of problems associated with illiteracy. This was also the reason why no attempt was made to use visual aids as we assumed that high education students have a level of reasoning that allows them to understand the scenario and the risk reduction involved. Moreover in web based surveys like Google Docs Form the data is automatically collected into a spreadsheet that can be downloaded to an Excel spreadsheet. Errors in data collection and transcription are thus avoided.

The development of the questionnaire involved a pre-test as recommended by the NOAA panel (Arrow et al., 1993). The questionnaire was administered to students enrolled in the Innovation and Entrepreneurship Master (MIETE) from the Engineering School at University of Porto. The students taking this Master Degree come from different fields of study and the administration of this survey in the same format as the final survey allowed us to infer if the group understood the questions and to diagnose possible problems with the survey. This group did not report any difficulties in answering the questionnaire.

[12] Other mixed methods have been purposed as computer assisted interviews (Bateman et al., 2002)
[13] The Faculty of Architecture is an exception and students do not have an institutional e-mail account.

Table 10: Advantages and disadvantages of CV method´s survey modes

Survey Mode	Description	Advantages	Disadvantages
Mail Survey	The questionnaires are sent by mail to the respondents that complete them and send them back to the researchers	- Low cost - Permits the use of visual aids - Respondents can answer the survey on their own time - Easy to answer sensitive questions	- Low response rates - Require the respondents to read and understand the scenario – the level of literacy of the respondent may be a problem - Prevents the use of questionnaires where respondents should answer questions in a fixed sequence because they can read the whole questionnaire before starting to fill it in - Possible self-selection *bias* - the people who answer the questionnaires are more likely the ones that are more interested in the topic. This might lead to unrepresentative samples. - No control over who fills in the questionnaire (head of the household or another individual?)
Face to face interviews	The interviewer conducts an interview face to face with the respondent	- High response rates - Permits the use of visual aids - Allows the interviewer to explain complex scenarios and assist the respondent if he doesn't understand the questions - Allows the use of questionnaires where the information must be unfolded sequentially to the respondent.	- High costs - Time consuming - Possible interviewer bias – the interviewer may affect the respondent's answer
Telephone interviews	The interviewer telephones a sample of individuals and interviews them.	- Less expensive than face to face interviews - Intermediate level of response rate - Allow the interviewer to explain complex scenarios and assist the respondent if he doesn't understand the questions - Allow the use of questionnaires where the information must be unfolded sequentially to the respondent	- Do not allow the use of visual aids - Do not allow lengthy questionnaires - respondents may not be willing to answer a questionnaire for more than just a few minutes - Respondents who do not have a telephone will not be represented in the sample
Web based surveys	Surveys hosted on a web page	-Respondents can answer the survey on their own time -Easy to answer sensitive questions -Low costs -Possibility of designing an interactive survey (the respondent only has access to the next question if he has submitted the previous one - controls for question sequencing) - Answers may be downloaded directly into a database (e.g. Excel spreadsheet)	- Sample representativeness - There is no control over who fills in the questionnaire – The same person can fill it in several times and people who are not supposed to answer may have access - Sample selectivity - Difficult to use visual aids - Require the respondents to read and understand the scenario – level of literacy of the respondent may be a problem - Possible self-selection *bias*
	Surveys accessed following an e-mail message link or a link hosted in another website		

Source: Own formulation from information available in Bateman et al. (2002), Mitchell and Carson (1988) and Marta-Pedroso et al. (2007)

On the 20th of March 2009 an e-mail was sent to the e-mail addresses of students of 3 Faculties of the University (Faculty of Economics, Faculty of Engineering and Faculty of Food Sciences and Nutrition) inviting students to answer the survey. Another e-mail was sent this time addressed to the contacts listed at the University's website[14] as being the contacts of the Units of Communication, Image and Public Relations of the each Faculty and the university's business school[15]. These contacts were asked to forward the e-mail with the survey link to all students. These e-mails included a link to the survey and informed respondents of the goal of the questionnaire and the scope of the study. The limited time necessary to answer the questionnaire (approximately 3 minutes) was also mentioned as an attempt to increase the response rates. Other information was included namely the restricted use of the data.

To increase the response rate of some of the Faculties whose responses were inexistent, telephone contacts were established with their Units of Communication, Image and Public Relations to understand the reason behind the non-responses. We learnt that in some schools students do not have the habit of responding to questionnaires (e.g. Faculty of Medicine where the response rate was 0%) and in other schools, e.g. the Faculty of Dental Medicine, students are not willing to participate acknowledging being tired of receiving online questionnaires. One last attempt to boost response rates was made in May 2009 by sending an e-mail to all the Presidents of the Directive Councils of all Faculties requesting the dissemination of the questionnaire.

We considered the questionnaire response phase closed on the 7th of July 2009 with a total number of 1122 responses. Considering that the total number of students of the University is 29 896,[16] the response rate was approximately 4%.

The next chapter details the model specifications and the results of our survey.

[14] http://sigarra.up.pt/up/web_base.gera_pagina?P_pagina=122243 – accessed March 2009.
[15] We could not send the survey directly to the students as their e-mail addresses were not available.
[16] http://sigarra.up.pt/up/web_base.gera_pagina?p_pagina=122350 – accessed September 2009.

Chapter 3. Willingness to pay for violent crime reduction: results for Portuguese Higher Education students

3.1. Initial considerations

The present chapter details the analysis of the results of the estimation of the econometric regressions used to infer the willingness to pay of higher education students to reduce the risks of being a victim of a violent crime. We conducted a survey that included questions that allowed us to characterize our respondents in terms of some demographic indicators (e.g. age, gender) and fields of study. In Section 3.2 we present the specification of the model, the description of the variables and the methodology used in the econometric estimation. The descriptive statistics that resulted from our survey are reported in Section 3.3. The following section (Section 3.4) presents the results of the estimation of the regressions and, on the basis of those results, we focus on the similarities and differences found between our results and the ones found in the existing (scarce) literature.

3.2. Model specification and variable description:

Our study aims at estimating the WTP of higher education students to reduce the risks of being victims of a violent crime. The questions presented in our survey[17] included a set of variables that might influence WTP. Our theoretical model assumes that our dependent variable, Willingness to Pay (WTP), is a function of a large set of variables as stated by the existing literature in the field (cf. Chapter 2).

$$f(WTP) = \begin{pmatrix} age, gender, family\ income, number\ family\ elements, family\ dependents, \\ fieldstudy, crime\ victim, date\ previous\ crime, physical\ injuries, \\ psycho\log ical\ damages, fear\ crime, locks\ door, payment\ vehicle \end{pmatrix}$$

The description of the variables-proxies and the measurement adjustments undertook on the original questions in order to get these proxies are detailed in Table 11.

[17] See Appendix

Table 11: Variables Description

Variable	Description
Age	Age – The questionnaire included an open question that required respondents to state their age. The age of the students that answered the survey varied between 17 and 68 years of age. For estimation purposes, respondent's ages were grouped in 5 intervals: [17,19]; [20,22]; [23,25] ;[26,30] and [31,68].
Gend	Gender – This variable refers to the gender of the respondent: male or female.
Inc	Income – Represents monthly family income. The questionnaire referred 6 intervals of income, in euros, that were also used in our regressions: [0,450[; [450,900[; [900,1350[; [1350,1800[; [1800,2250[and more than 2250 .
Fam	Number of family elements – In the questionnaire respondents were asked to state how many individuals lived in their household; 1, 2, 3, 4 or more than 4. These were also the figures used in the estimation of our regressions.
Level of study	For a better characterization of our sample, respondents were asked to state their level of study: Undergraduate, Postgraduate, Master Programs, PHD/Doctoral Program, Other
Fam Dep	This variable incorporates the answers respondents gave about having individuals that were financially dependent from our respondents. The possible answers were "yes" or "no". This variable was not included in our estimation as over 90% of the students in the sample do not have family dependents. We thus lack observations for the case where there are family dependents to include in the estimation.
School of enrollment	The question regarding the school of enrollment of respondents was included in the questionnaire to have a better understanding of our sample.
Vcrime	Victim of crime - This variable represents if the respondent has previously been the victim of a crime.
FieldRed	Field of study (reduced) – Respondents were asked the area of their basic formation as a proxy for individual's distinct inclinations or psychological traits. A few adjustments were made in this variable. First of all, for the respondents who were aged less than 23 years that stated an area of formation different from the one provided by the faculty of enrollment, we assumed that the area of formation was actually the one available at the faculty of enrollment because the respondent might have interpreted the area of formation as the one he studied in high school. In the case of students that were aged more than 23 years we maintained the area of formation even if it was different from the areas provided by the Faculty of enrollment as the respondent might be enrolled in a second level of study in a different area. Finally, we grouped the responses from three areas and categorized them under "Other". This category includes the respondents from Arts, Sports and Law. This procedure was necessary to guarantee a minimum number of responses per category. Thus the areas of formation considered in the estimation of the regressions were Exact Sciences, Humanities, Economics and Management Sciences, Engineering, Psychology and Educational Sciences, Health Sciences and Other (Arts, Sports and Law).
Physical injuries	The severity of the physical injuries and psychological damages suffered in a previous crime could be stated by the respondent using five levels of severity ranging from "no injuries" to "very serious injuries". For practical purposes we decided to group them in three levels of severity: no injuries, some injuries and serious injuries. As 80% of respondents reported having suffered no damages we created a dummy variable that grouped both physical and psychological consequences of a previous crime: the variable represented the situation of "no injuries" vs "some injuries".
Psychological damages	
Fear	Fear of crime – This variable illustrates the answers respondents gave when asked if they worried about being victims of a violent crime. Three possible answers were presented: does not worry, worries moderately, worries a lot.
LockDoor	Lock the door -Respondents could answer yes or no to usually locking the door of their home
PV	Payment vehicle and policy – Respondents could state to pay more, the same or less when confronted with the possibility of risk reduction being achieved by increasing policing financed by higher taxes.

We estimate three set of models, two [(1) and (2)] by OLS, and one [(3)] resorting to a logistic estimation. The models (1) and (2) differ as the latter includes age and income as continuous variables instead of categorical as in the case of model (1).

$$\ln WTP_i = \alpha + \beta_1 AGE_i + \beta_2 GEND_i + \beta_3 INC_i + \beta_4 FAM_i + \beta_5 AREARED_i + \beta_6 VCRIME_i + \beta_7 FEAR_i + \beta_8 LOCKDOOR_i + \beta_9 PV_i + e_i \quad (1)$$

$$\ln WTP_i = \alpha + \beta_1 \ln AGE_i + \beta_2 GEND_i + \beta_3 \ln INC_i + \beta_4 FAM_i + \beta_5 AREARED_i + \beta_6 VCRIME_i + \beta_7 FEAR_i + \beta_8 LOCKDOOR_i + \beta_9 PV_i + e_i \quad (2)$$

In order to infer if results were robust, we resort to a different method of estimation - the logit model (3). Using as the dependent variable *Y*=WTP_dummy= 1 in the case WTP assumes a positive value and 0 in the case *Y*=WTP=0€, that is, a discrete variable, the method to be used falls under the general probabilistic models as it is not reasonable to assume, for instance, that the error distribution will be regular. Moreover, the predicted values cannot be interpreted as probabilities as they are not restricted to the interval between 0 and 1.

$$\left(\Pr ob\ event\ j\ occurs\right) = \Pr ob\left(Y = j\right) = F\left[relevant\ effects : parameters\right]$$

Where $Y = 1$ in the case WTP > 0€ and $Y = 0$ if WTP=0€

In our model the set of variables that explain the amount that higher education students are willing to pay to reduce the risk of being victimized by a violent crime are included in vector X where:

$$\Pr ob(Y = 1) = F(\mathrm{X}, \beta)$$

$$\Pr ob(Y = 0) = 1 - F(\mathrm{X}, \beta)$$

The parameters represented as β reflect the impact of the changes of the independent variables on the probability of the respondent expressing an amount of willingness to pay higher than zero.

For a certain vector of regressors it is expected that:

$$\lim_{X'\beta \to \infty} = \Pr ob(Y = 1) = 1$$

$$\lim_{X'\beta \to -\infty} = \Pr ob(Y = 0) = 0$$

The logistic distribution is given by:

$$\Pr ob(Y=1)=\frac{e^{X'\beta}}{1+e^{X'\beta}}=\Lambda(X'\beta).$$

The probability model is a regression:

$$E[Y|x]=0[1-F(x'\beta)]+1[F(x'\beta)]=F(x'\beta).$$

Whatever distribution is used the parameters of the model are not necessarily the usual marginal effects. For the logistic distribution, $\frac{d\Lambda(\beta'X)}{d(\beta'X)}=\frac{e^{\beta'X}}{(1+e^{\beta'X})^2}=\Lambda(\beta'X)[1-\Lambda(\beta'X)]$

In the logit model: $\frac{\partial E[Y|X]}{\partial X}=\Lambda(\beta'X)[1-\Lambda(\beta'X)]\beta$

The parameters for the logistic regression are estimated using the maximum likelihood method (ML). Given the assumptions about the error distribution, the coefficients that make the observed results more probable are selected.

3.3. Some descriptive results

A descriptive analysis of our data indicates that most of our respondents were aged 20 to 22 and were female (52.9%). As 52%[18] of Porto University students are female there is no overrepresentation of the female students in our respondents. The majority of our respondents has the highest level of income mentioned in the questionnaire (over 2250€/month) and is integrated in a family of four elements (cf. Table 12). They were mostly undergraduate students (50.3%), with no family dependents (92.9%), studying Engineering (35.8%), Economics and Management (22.5%) or Health Sciences (17.3%).

[18] http://sigarra.up.pt/up/web_base.gera_pagina?p_pagina=122350 (accessed in 06 – 09- 2009)

Table 12: Descriptive statistics

Variable		Frequency (%)
Age (N=1122)	[17,19]	16.8
	[20,22]	42.1
	[23,25]	20.7
	[26,30]	11.1
	[31,68]	9.4
Gender (N=1122)	Male	47.1
	Female	52.9
Income, in € (N=1122)	[0;450[	4.0
	[450;900[	13.8
	[900;1350[	21.7
	[1350;1800[	15.2
	[1800;2250[	14.9
	More than 2250	30.4
Nº Family elements (N=1122)	1	7.7
	2	11.4
	3	29.2
	4	37.6
	More than 4	14.1
Family Dependents (N=1122)	No	92.9
	Yes	7.1
Level of Study (N=1122)	Undergraduate	50.3
	Integrated Masters	18.0
	Postgraduate	0.6
	Master Programmes	23.7
	PHD/Doctoral programme	6.9
	Other	0.5
Field of study (N=1122)	Exact Sciences	4.7
	Humanities	11.1
	Economics and management sciences	22.5
	Engineering	35.8
	Psychology and Educational Sciences	6.0
	Health Sciences	17.3
	Other (Arts, Sport, Law)	2.7

(…)

School of enrollment (N=1122)	Faculty of Fine Arts	1.2
	Faculty of Sciences	1.6
	Faculty of Nutrition and Food Science	8.0
	Faculty of Law	0.7
	Faculty of Economics	23.1
	Faculty of Engineering	38.4
	Faculty of Pharmacy	5.6
	Faculty of Psychology and Education Science	6.6
	Institute of Biomedical Sciences Abel Salazar	4.2
	Faculty of Arts	10.5
Victim of a previous crime (N=1122)	No	67.0
	Yes	33.0
Date of previous crime (N=376)	Less than 1 year	20.2
	Between 1 to 5 years	40.7
	Over 5 years	39.1
Severity of physical injuries related to the crime (N=374)	No injuries	78.9
	Some injuries	13.1
	Serious injuries	8.0
Severity of psychological damages related to the crime (N=374)	No damages	78.9
	Some damages	19.5
	Serious damages	1.6
Worries about being the victim of a crime (N=1122)	Does not worry	9.6
	Worries moderately	52.8
	Worries a lot	37.6
Locks the door of the residence (N=1122)	No	16.6
	Yes	83.4
Willingness to pay, in € (N=1122)	0	25.5
	[0;50[	42.1
	[50;250[	20.8
	[250;750[	5.5
	[750;1250[	1.9
	[1250;1750[	0.7
	[1750;2250[	0.8
	[2250;2750[	0.2
	More than 2750	2.6
Willingness to pay if there is an increase in policing financed by an increase in taxes – payment vehicle and policy (N=1122)	More	13.4
	The same	58.6
	Less	26.6
	No answer	1.5

Source: Author calculation based on direct survey, March – July 2009

The Faculty of Engineering and the Faculty of Economics have the highest number of respondents followed by the Faculty of Arts and the Faculty of Nutrition and Food Science. Our respondent sample is overrepresented (compare columns 3 and 5 of Table 13) in the following courses: Engineering, Economics, and Nutrition. It under represents Architecture, Sports, Medicine, and Dental Medicine, courses where we fail to obtain valid answers.

Table 13: Percentage of responses per total number of Faculty students at the University of Porto (UP)

Faculty	Nº of students enrolled at the UP [1]	% students enrolled at the UP by faculty [1]/29896	Nº of responses by faculty [2]	% of responses by faculty [2]/1122	Response rate per faculty [2]/[1]
Faculty of Architecture	1000	3.3%	0	0.0%	0.0%
Faculty of Fine Arts	800	2.7%	14	1.2%	1.8%
Faculty of Sciences	3648	12.2%	18	1.6%	0.5%
Faculty of Nutrition and Food Science	449	1.5%	90	8.0%	20.0%
Faculty of Sport	1494	5.0%	0	0.0%	0.0%
Faculty of Law	998	3.3%	8	0.7%	0.8%
Faculty of Economics	2859	9.6%	259	23.1%	9.1%
Faculty of Engineering	6922	23.2%	431	38.4%	6.2%
Faculty of Pharmacy	1306	4.4%	63	5.6%	4.8%
Faculty of Medicine	2357	7.9%	0	0.0%	0.0%
Faculty of Dental Medicine	506	1.7%	0	0.0%	0.0%
Faculty of Psychology and Education Science	1579	5.3%	74	6.6%	4.7%
Institute of Biomedical Sciences Abel Salazar	2257	7.6%	42	3.7%	2.1%
Faculty of Arts	3721	12.5%	118	10.5%	3.2%
Total	**29896**	**100%**	**1122**	**100.0%**	**3.8%**

Source: Own formulation using data from the report "Ensino_Estudantes Inscritos na U. Porto 2008" (31st December 2008)

Regarding the crime related responses, 33% of our respondents have been crime victims in the past and most of these crimes occurred over a year ago. The crimes resulted mostly in neither physical nor psychological injuries. The majority of our respondents worry moderately about being victims of a crime (52.8%) and 37.6% worry a lot. This result is consistent with the fact that almost 84% of our respondents usually lock the door of their residences when they leave. When asked how much money they were willing to pay to reduce the probability of being victims of a violent crime by 10%, 42.1% of our respondents were willing to pay a positive sum but less than 50€ and 20.8% were willing to pay between 50€ and 250€. It is also worth mentioning that 25.5% of respondents are

not willing to pay any money at all. We can speculate several reasons to have obtained such high number of protesters: respondents might object to the scenario considering it unrealistic or they could have considered that a reduction in 10% in violent crime rates is negligible when the violent crime rate is so low in Portugal. The high percentage of protesters is a problem that has been previously reported in the literature - Atkinson et al. (2005) have encountered more than 30% of protesters in their study and future research should focus more in explaining this phenomena.

Using the Kruskall – Wallis[19] test to assess if there is evidence of statistically significant differences in the mean of WTP between the different categories of the relevant variables (cf. Table 13), we conclude that there are statistically significant differences in mean WTP for the categories in all variables except for 'students' degree', 'having been victim of a crime in the past', 'the date of the previous crime', and 'the injuries caused by that crime'. This means, for instance, that although at a first glance data suggest that different categories of students degrees imply different amounts of willingness to pay, on average this difference is not statistically significant. The age variable, although being statistically significant, shows a non-linear relationship with the mean WTP. The respondents aged 23 to 25 years old are willing to pay the highest amount on average and the eldest respondents are the ones willing to pay the smallest amount. Female respondents have, on average, more propensity to pay than male respondents. Additionally, students with the highest family income category (over 2250€) are willing to pay, on average, the highest amount. Once again, however, the relationship between the two variables is not linear as we cannot sate that the higher (smaller) the family income, the higher (smaller) the median WTP.

The respondents that have family dependents are surprisingly willing to pay less on average than the ones that have no family dependents. Indeed, we would expect an opposite result as we speculate that individuals with family dependents would be more worried about the financial burden they would impose on their relatives, not only because of incurring in more costs associated with crime victimization but also because there could be a decrease of family revenues due to possible days lost at work.

Respondents that study Psychology and Educational Sciences are the ones willing to pay the highest amount on average, followed by Economics and Management. Respondents that study in the fields of Arts, Sport or Law present the lowest mean of WTP.

[19] The Kruskall Wallis tests the null hypothesis of the median of the populations being equal (Sheskin, 2007).

Table 14: Differences in the mean of WTP for the different categories (in euros)

Variables	Variables' categories							Qui2	p-value and level of significance
Age	[17;19]=190.69	[20;22]=161.76	[23;25]=251.08	[26;30]=251.01	[31;68]=112.50			8.920	0.063*
Gender	Female=246.71	Male=127.03						18.624	0.000***
Income	[0;450[=210.00	[450;900[=169.52	[900;1350[=178.19	[1350;1800[=87.43	[1800;2250[=232.93	[2250:+∞[=236.44		10.362	0.066*
Family elements	1=159.01	2=149.41	3=189.63	4=225.83	More than 4 =146.84			8.700	0.069*
Family dependents	Yes=63.13	No=200.05						8.786	0.003***
Degree	Undergraduate=199.47	Integrated Masters=170.79	Postgraduate=35.71	Master Programs=180.83	PhD/Doctoral program=156.82	Other=1012.50		5.734	0.333
Field of study	Exact Sciences = 162.26	Humanities=160.08	Economics and Management Sciences=228.37	Engineering=172.51	Psychology and Educational Sciences=275.00	Health sciences=189.95	Other (Arts. Sport. Law)=95.83	25.729	0.000***
Crime victim	Yes=165.20	No=202.63						2.573	0.109
Crime time	Less than a year=116.77	[1 year;5 years]=148.20	Over 5 years ago=202.89					1.461	0.482
Physical damages	No damage = 164.24	Some damage=165.82	Serious damage=154.17					0.090	0.956
Psychological damages	No damage = 164.24	Some damage=164.38	Serious damage=125.00					1.060	0.588
Lock Door	Yes=199.95	No=141.67						6.723	0.010***
Payment vehicle and Policy	Less=310.00	The same=153.35	More=217.53					30.724	0.000***
Fear	No fear=47.45	Some fear=128.46	Lots of fear=313.60					58.541	0.000***

Legend: ***(**)[*]statistically significant at 1% (5%)[10%] level

In our sample, respondents that usually lock the door of their residence are willing to pay, on average, a higher amount. Those who state not to worry about being victims of a violent crime, tend on average to report a lower WTP. These results are in line with what is expected as people who lock the doors of their residence reveal an avertive behaviour towards crime that is consistent with higher fear of crime.

Statistically significant is also the difference in the mean of WTP elicited for the question regarding the payment vehicle and policy used to reduce crime. The respondents who stated they would be willing to pay less than the amount they previously claimed if the mechanism used to reduce the risk of violent crime victimization was an increase in policing financed by rising taxes are the ones that present, on average, the highest WTP. In contrast, the ones that claim they would pay the same amount with the new description of policy present the lowest WTP.

An analysis of the correlation matrix of the variables presented in Table 15 reflects a positive and significant correlation between the variable income and the number of family elements in the household, without controlling for the other variables. Thus households with the highest income are associated with the higher number of family members and the families with the higher number of elements are related to the highest income households. Therefore, the variable number of family elements was not considered in the estimation of our regressions as it would lead to multicollinearity. A significant and positive correlation was also found between the variable that represented having been the victim of a previous crime and the time when the crime occurred. Again, a strong correlation was found between the variables having been the victim of a previous crime and the severity of the injuries suffered. Thus the variable that represented the time when the crime occurred and the severity of the injuries were not considered in our estimation.

Table 15: Correlation matrix

Variables	lnWTP	Age	Gender	Income	Family elements	Field reduced	Crime victim	Fear of crime	Lock Door	Payment vehicle	Victim past 5 years	Dummy _ injuries
lnWTP	1	-0.069**	0.146***	0.043	0.025	0.051*	-0.050*	0.244***	0.082***	-0.045	-0.065**	-0.007
Age		1	-0.078***	0.056*	-0.287***	-0.135***	0.018	-0.001	0.018	0.006	-0.061**	0.025
Gender			1	-0.144***	-0.006	0.080***	-0.243**	0.149***	0.053*	-0.113***	-0.166***	-0.079***
Income				1	0.316***	0.065**	0.078***	-0.66**	-0.008	0.025	0.035	-0.053*
Family elements					1	0.144***	0.003	-0.006	-0.076**	-0.18	0.026	-0.002
Field reduced						1	-0.028	0.016	0.012	-0.031	0.009	-0.003
Crime victim							1	-0.052*	-0.001	0.031	0.689***	0.387***
Fear of crime								1	0.151***	0.043	-0.058*	0.049
Lock Door									1	0.049	-0.016	0.026
Payment vehicle and policy										1	-0.004	-0.007
Victim past 5 years											1	0.299***
Dummy_injuries												1

Legend: ***(**)[*]statistically significant at 1% (5%) [10%]level

3.4. Determinants of higher education students' willingness to pay for violent crime reduction: results from the estimation of the econometric models

The three models estimated present a reasonable quality of adjustment (goodness of fit). The OLS estimated model albeit presenting a low adjusted R^2 figure (which is normal in micro data sets), reveals a global significant model as reflected by the F-statistics. Regarding the logit model, the Hosmer and Lemeshow test indicates that we can accept the null hypothesis that the estimated model represents the reality well. Moreover, more than 75% of the estimated values of the dependent variable are correctly predicted by the model.

Taking the three models as a whole we are able to observe that estimates are quite robust, evidencing similar signs and significance levels regardless the estimation method. Demographic variables – age and gender – are key determinants of the willingness to pay for violent crime among Portuguese higher education students. On average, all the other determinants being held constant, senior students present a lower WTP, whereas female students are more prone to pay for avoiding being victim of a violent crime than their male counterparts. The first result is in line with the findings of existing literature. Cohen et al. (2004) also found that WTP decreases with age thus in this regard Portuguese higher education students are not different from the general individuals living in more developed and highly crime incidence countries. This does not seem to be the case for the impact of gender on WTP as this is not statistically significant factor in the available literature on crime costs. However our results are in accordance with psychological literature that suggests that traditional female gender roles are associated with avoidance (Rubinstein, 2005).

Results concerning the relationship between income level and WTP are mixed – only in model II, we might conclude that students with higher income levels tend, on average, and other things remaining constant, to pay more to avoid being victim of a violent crime. The existing evidence in literature concerning such relationship indeed suggests that higher incomes influence positively WTP (Atkinson et al., 2005; Ludwig and Cook, 1999). Cohen et al. (2004) further reinforces this evidence claiming that the ability to pay plays a role in explaining the amount in WTP as low income individuals, despite having higher victimization rates, are willing to pay less.

Table 16: results of model estimation

Variables	Categories	OLS – Ordinary Least Squares		Maximum Likelihood
		Model 1	Model 2	Model 3
AGE – default: [17;19]	[20,22]	-0,055		
	[23,25]	0,014		
	[26,30]	0,021		
	[31,68]	-0,127*		
AGE (ln)			-0,143*	-0,811**
GEND - default: Male	Female	0,114***	0,110***	0,520***
INC – default: [900;1350[	[0;450[	-0,082		
	[450;900[	-0,074		
	[1350;1800[	-0,080		
	[1800;2250[	0,028		
	[2250;+∞[	0,066		
INC (Ln)			0,099***	0,236
FAM – default :3	1	0,025	0,067	0,745**
	2	-0,057	-0,058	-0,040
	4	0,015	0,006	0,131
	More than 4	-0,061	-0.058	0,013
FIELDRED – default: Health Sciences	Exact Sciences	-0,105	-0,090	-0,510
	Humanities	-0,062	-0,066	-0,516*
	Economics and Management Sciences	0,096**	0,082*	0,202
	Engineering	-0,057	-0,056	-0,475**
	Psychology and Educational Sciences	0,026	0,027	-0,556
	Other (Arts, Sport, Law)	-0,167*	-0,195**	-1,106**
VCRIME – default: No	Yes	-0,007	-0,006	-0,036
FEAR – Default: no fear	Some fear	0,230***	0,223***	1,099***
	Lots of fear	0,400***	0,393***	1,454***
LOCKDOOR (default: No)	Yes	0,065	0,068*	0,386**
PVP (default: the same)	Less	0,242***	0,248***	1,290***
	More	0,100***	0,104***	0,543***
Constant		0,325	0,616	1,595
N		1122	1122	1122
WTP>0€		-	-	836
WTP=0		-	-	286
Goodness of fit				
Adjusted R^2		0.120	0.120	-
F-statistics (significance)		6.863 (0.000)	8.686 (0.000)	-
Hosmer-Lemeshow Test (significance)		-	-	6.388 (0.604)
% corrected		-	-	75.8

Legend: ***(**)[*]statistically significant at 1% (5%)[10%] level

The relationship between the number of family elements in the household and WTP is also mixed showing a positive and statistically significant association only in the model estimated using the maximum likelihood method. The positive impact of household size on WTP is also reported by Ludwig and Cook (1999) and might be explained for altruistic reasons as individuals in families with several elements would be willing to pay more than individuals who live alone. This altruistic factor might also explain Ludwig and Cook's (1999) findings that WTP is strongly associated with the number of children in the household.

In comparison to Health sciences students, and considering that all other variables remain constant, only students in the field of Economics and Management are willing to pay more. Another statistically significant result is that students from the field of Arts, Sport and Law are willing to pay less than Health sciences students, other things being equal. This result is achieved regardless of the estimation procedure that is used. Literature does not account for the impact of the field of study as a determinant of WTP but our results suggest that this variable has an important role in the elicitation of WTP. Researchers have found evidence of an existing relationship between people's personalities and their interests areas (Tokar et al., 1998). Several authors have found an association between the field of study of university students and personality traits (Rubinstein, 2005; Silver and Malone, 1993; Kline and Lapham, 1992). Silver and Malone (1993), for instance, found that engineers tend to be mostly obsessive,[20] accountants are predominantly paranoid,[20] and students of medicine are particularly narcissistic.[20] Psychological literature uses the field of study as a proxy for personality characteristics of individuals. By estimating that distinct fields of study are associated with different amounts of WTP, we suggest that different personality characteristics might have a determinant role in the elicitation of WTP to reduce violent crime victimization.

After controlling for all other variables likely to impact on the WTP, worrying in a higher extent about being a possible victim of a violent crime is associated to a higher WTP, on average, which corroborates the findings in literature (Atkinson et al., 2005).

[20] Silver and Malone (1993) focus on different personality styles. Among them are the obsessive, the paranoid and the narcissistic style. Individuals with an obsessive style usually look for perfection and are never completely satisfied with what they accomplish. They have a rigid mode of thinking, pay great attention to technical details and have a need to control everything around them. Paranoid individuals are good observers characterized by an acute form of attentiveness and a constant sense of anticipation. They have a particular advantage in highly competitive settings like corporations. Narcissistic personality is characterized by a high sense of self, a need for attention and acceptance.

Another pertinent aspect to take into account is that having an avertive behaviour towards crime, reflected in locking the door of the residence, is positively associated with the WTP. This evidence is not in line with the estimates presented by Atkinson et al. (2005) that suggest that people who do not lock the door of their residence are actually willing to pay more. The authors speculate that people whose behaviour puts them more at risk are willing to pay more for a policy that reduces their probability of victimization. Our estimates, on the contrary, might be explained by the fact that people that lock the doors of their residence might be more concerned about the crime issue and thus willing to pay more.

Payment vehicle and policy emerge as a strongly significant variable in explaining Portuguese higher education students' WTP. However, results are not clear cut, both groups of students that would pay less and more (relative to those that would pay the same) in the case the payment was made through higher taxes to increase policing reveal higher willingness to pay for avoiding being victims of a violent crime. We suggest that students with a strong opinion on policies and payment vehicles that might be used to reduce crime risks are willing to pay more than students who are neutral to these variables. CV literature emphasizes that the payment vehicle and policy are considered relevant variables that should be included in the surveys given their impact on individual's responses (cf. Section 2.3). In crime costs literature, Ludwig and Cook (1999) do not address this issue directly in the survey by changing the payment vehicle or the policy and requesting the elicitation of the amounts of WTP. However, they used as a proxy of respondents that did not agree with the payment vehicle the answers of individuals that stated "that taxes are too high". By removing these responses from the sample the estimates of WTP were 13% higher (Ludwig and Cook, 1999).

Regarding the policy used to reduce risks of being victimized, Atkinson et al. (2005) estimate that the belief in the effectiveness of policing has a positive impact on WTP. We provide further evidence in the support of the hypothesis that this/these variable(s) is (are) an important determinant in explaining WTP for crime risk reduction.

Table 17 summarizes the main results obtained by comparison with the scarce studies available in the literature in the field.

Table 17: Comparison of the present study with some existing available studies in the literature

	Prior studies			Current study
	Ludwig and Cook (1999)	**Cohen et al. (2004)**	**Atkinson et al. (2005)**	
Risk reduction	Gun violence (injuries) by 30%	Several crimes by 10% (burglary, serious assault, armed robbery, rape or sexual assault, murder)	Violent crime by 50% (categorized in three different types of offences – common assault, other wounding, serious wounding)	Violent crime by 10%
Policy	Programme to reduce gun thefts and illegal gun dealers	n.c.	Raise in policing	n.c.
Payment vehicle	Tax Increase	n.c.	Rise in local charges	n.c.
Variables				
Age	n.c.	-	0	-
Gender (default: male)	n.c.	0	0	+
Income	+	+	+	0/+
Family elements	+	n.c.	n.c.	0/+
Field of studies	n.c.	n.c.	n.c.	Significant
Victim of a previous crime	n.c.	n.c.	0	0
Fear of crime	n.c.	n.c.	+	+
Lock Door	n.c.	n.c.	-	+
Payment vehicle and policy	+	n.c.	+	+
Severity of injuries/crime type	n.c.	+	+	n.c.

Source: Own formulation

Legend: 0 – not statistically significant; n.c - not considered

Conclusion

In a society of scarce resources that can be allocated to different uses, the need to find instruments to analyze the costs and benefits of different policies will help policy makers make more informed decisions (Cohen, 2000). Crime policy is no exception and estimating the costs of crime is part of the benefit-cost analysis. Tangible costs have been calculated but not including estimates of pain, suffering or changes in life style – that are particularly important in violent crime - has resulted in biased estimates of the total costs of crime (Czabanski, 2008). Several methodologies have been used to incorporate the intangible costs of crime (cf. Chapter 1) and the Contingent Valuation method offers a "fresh perspective" (Czabanski, 2008: 122) to this problem. Our study applied the contingent valuation method to estimate the amount high education students are willing to pay to avoid being victims of a violent crime.

The present study contributes with two main elements to the existing literature. Firstly it is, to our best knowledge, the first study conducted in a relatively low crime country. Our research indicates that even though crime rates are lower in Portugal, the main elements that have an impact on WTP in countries like the U.K. or the U.S. – with high crime rates - are the same Portuguese university students present (cf. Table 17). They have in common the positive influence of characteristics such as higher income, the number of family elements and fear of crime on willingness to pay to reduce the risk of violent crime. The negative impact of age is also common to both types of countries. The payment vehicle and the policy used to reduce this risk are also strongly significant in both contexts. However, unlike the results presented for high crime rate countries, our results show that gender is a statistically significant variable and female individuals are willing to pay more to reduce the risk of being victimized. Psychology literature supports our results by explaining the different gender roles and confirming that women are more prone to avoidance (Rubinstein, 2005). Locking the door of the residence was found to have a negative impact on WTP in the UK whereas we found that in Portugal, individuals who lock the doors of their homes are willing to pay more to reduce their risks. We explain the opposite findings of our study by suggesting that people who lock the doors of their home demonstrate a crime avoidance behaviour that is compatible with a higher WTP.

Our study also contributes to the existing literature by being the first study that uses the contingent valuation method to estimate the amount that a particular sector of the

population - university students - is willing to pay to reduce the risk of being victims of a violent crime. Literature on WTP to avoid crime victimization does not discuss the impact of different fields of study of individuals on WTP. By conducting this study we have concluded that psychological traits, as indicated by the field of study, play a key role in determining the amount people are willing to pay. We found that Economics and Management students are willing to pay more than Health Science students and Art, Law and Sport students are willing to pay less.

The fact that our results suggest a relationship between the field of study and WTP might have an impact on policy particularly in insurance policy. In light of these results insurance companies might be interested in designing different insurance packages for individuals depending on their psychological traits indicated by their field of study. These packages would be tailored to include different benefits and costs depending on individual's preferences that should include some features based on the individual's field of study.

Governmental policy might also be affected as crime policies aimed at reducing victimization risks are perceived differently by people with different educational background. Individuals with a background study in Economics and Management Sciences are willing to incur in more costs than individuals in other fields. Governments should be aware of this distinction to tailor crime policies depending on the geographical distribution of the individuals with different educational backgrounds in the city/country. Different locations with the same crime rates might benefit from different crime reduction policies that should also be tailored in accordance with its population field of study.

Despite the results that were obtained in this study we also acknowledge some limitations. Firstly it should be noted that we had a low response rate to our questionnaire. This low participation rate in our survey could be explained by the lack of interest higher education students demonstrate in answering surveys due to the high number of questionnaires they are asked to answer. Other methods of conducting the survey could be used to achieve a higher number of respondents, particularly the face to face interview as recommended by the NOAA panel (Arrow et al., 1993).

It should also be mentioned that to tailor our scenario we used official statistics on violent crime in Portugal – EUROSTAT – to present respondents with the baseline risk. However official statistics underreport the number of criminal offenses as it is estimated that a high number of crimes are not reported (MacDonald, 2002), particularly sex crimes (Rice et al.,

2006). Future research should focus on the impact of different baseline risks and different percentages in the change of risk reduction on WTP so that reliable and robust estimates can be produced and used in the definition of crime policy.

Moreover as stated by Cohen et al. (2004) different results could have been obtained if a detailed description of the consequences of victimization had been provided. Future research should investigate if different amounts of WTP would be reported in those circumstances.

In our study we reported 25.5% of protesters and Atkinson et al. (2005) stated having more than 30% of responses classified as protests. Even though this high percentage of protesters did not bias our results as the logistic regression estimated using the maximum likelihood method produced the same results as the ordinary least squares estimation, several explanations can be suggested such as the fact that respondents object the valuation scenario (e.g. the percentage of risk reduction involved) but a comprehensive study of the reasons behind the protests should be conducted. Future research should thus focus in trying to explain the high percentage of protesters that are encountered in the CV studies applied to the costs of crime.

Finally, an in depth analysis of the relationship between individual's background education (used as a proxy for psychological traits) and WTP to avoid being victims of crime should also be conducted. We have suggested that there is an association between these two variables but given the implications it might have in crime policies further research is recommended.

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Appendix

Inquérito: Disposição a pagar pela redução da criminalidade violenta

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* Obrigatório

Idade *

Sexo *

- Feminino
- Masculino

Rendimento familiar mensal *

- Até 450€/mês
- De 450€ até 900€ mês
- De 900€ até 1350€
- De 1350€ até 1800€
- De 1800€ até 2250€
- Superior a 2250€

Número de membros do agregado familiar *

Algum dos membros do agregado familiar depende financeiramente de si? *

- Sim
- Não

Actualmente frequenta: *

- Licenciatura
- Pós - Graduação
- Mestrado
- Doutoramento/Programa Doutoral
- Outro:

Qual é a sua área de formação base? *

- Artes e Arquitectura
- Desporto
- Economia e Ciências Empresariais
- Ciências Humanas e Sociais
- Psicologia e Ciências da Educação
- Direito
- Engenharia
- Saúde
- Ciências Exactas e Naturais

- ☐ Outro: ____

Actualmente está inscrito na(o): *

- ☐ Faculdade de Arquitectura
- ☐ Faculdade de Belas Artes
- ☐ Faculdade de Ciências
- ☐ Faculdade de Ciências da Nutrição e Alimentação
- ☐ Faculdade de Desporto
- ☐ Faculdade de Economia
- ☐ Faculdade de Engenharia
- ☐ Faculdade de Farmácia
- ☐ Faculdade de Letras
- ☐ Faculdade de Medicina
- ☐ Faculdade de Medicina Dentária
- ☐ Faculdade de Psicologia e Ciências da Educação
- ☐ Instituto de Ciências Biomédicas Abel Salazar
- ☐ Escola de Gestão do Porto
- ☐ Faculdade de Direito
- ☐ Outro: ____

Alguma vez foi vítima de um crime (violento ou não)? *

- ☐ Sim
- ☐ Não

Se respondeu sim à questão anterior, o crime ocorreu?

- ☐ Nos últimos 12 meses
- ☐ Entre 1 ano e 5 anos
- ☐ Há mais de 5 anos

Se já foi vítima de crime, como o classificaria em função das suas consequências em termos de danos físicos? 1 - Sem danos; 5 - Danos muito graves

	1	2	3	4	5
Danos Físicos	☐	☐	☐	☐	☐

E em termos de danos psicológicos? 1 - Sem danos; 5 - Danos muito graves

	1	2	3	4	5
Danos Psicológicos	☐	☐	☐	☐	☐

Numa escala de 1 a 3 diria que se preocupa com o facto de poder vir a ser vítima de um crime violento (que pressuponha o uso de violência contra a pessoa)? * 1 - não se preocupa; 2 - Preocupa-se moderadamente; 3 - Preocupa-se bastante

1 2 3

Costuma fechar a porta à chave antes de sair do seu local de residência? *

- Sim
- Não

Havendo 2,28 crimes violentos por cada mil habitantes, quanto estaria disposto a pagar para reduzir em 10% a probabilidade de ser vítima de um crime violento nos próximos 12 meses (independentemente da forma de pagamento) ? *

- 0€
- 0 até 50€
- 50€ até 250€
- 250€ até 750€
- 750€ até 1250€
- 1250€ até 1750€
- 1750€ até 2250€
- 2250€ até 2750€
- 2750€ ou um valor superior

Se o pagamento fosse feito sob a forma de aumento de impostos para suportar o acréscimo de policiamento estaria disposto a pagar

- Mais
- Menos
- O mesmo

Enviar