Costs of domestic violence: a life satisfaction approach

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March 5, 2012

Abstract

This paper uses a life satisfaction approach to estimate the value of domestic violence and it is, as far as we are aware, the only study which estimates the costs of domestic violence using this approach. It draws on a unique data set which collects data on self-reported domestic violence, individual income and subjective well-being for a cross-sectional UK sample. It provides an estimate of the marginal utility of income and of the marginal utility of domestic violence. It discusses and proposes some ways of dealing with the endogeneity of both violence and income in a happiness equation. The cost of domestic violence is calculated as the average increase in income an individual needs in order to be indifferent between a baseline scenario of no violence and a baseline income, and a scenario of violence and added income. This is the compensating variation of domestic violence. Results show that the costs to individuals who have been victims of domestic violence are very substantial, and often represent amounts larger than household annual incomes. These results are in line with previous studies which cost other forms of violence using stated preference methods and places domestic violence as a major factor inhibiting well-being. In terms of social welfare loss, these results accumulate to a share of total GDP which is notoriously high, and much higher than in other studies which provide estimates of social costs of violence. We claim that it is the nature of a satisfaction approach, which accounts for total costs of domestic violence, which lead to such high costs to society.

1 Introduction

One of the major challenges of public policy is to value non-marketed goods and services, without which governments cannot make informed decisions about how to allocate public spending. The absence of a price determined by a relevant market means that valuation methods used to estimate the costs of non-marketable goods and services are fraught with difficulty.

There are three main valuation methods of non-marketable goods at the individual level, revealed preference methods, stated preference methods and hedonic regression analysis. Revealed preference methods have been used, for instance, in Rao et al. (2003) to estimate the cost of safe sex. It uses a natural experiment, where a random sample of prostitutes was sensitized about contraceptive methods and STDs. This increased the use of condoms amongst the treated group, knowing that the clients gain disutility from wearing condoms and will thus pay less for sex. As such, the cost of safe sex is estimated as the average difference in the price received by prostitutes who choose not to have safe sex and those who choose to. It is however difficult (and probably unethical) to devise natural experiments that could be used to value domestic violence.

Stated preference methods have been applied to assess the value of different types of crime. Atkinson et al. (2005) has estimated that different types of crime can cost each victim up to £36000 in the UK. However, asking individuals how much they would be willing to receive to be subject to domestic violence not only encourages strategic reporting, but it can also be morally and socially unacceptable. At the same time, asking individuals how much they are willing to pay to free themselves of violence, even if potentially less unethical, has been shown to produce different results in practice (see e.g. Knetsch, 2000).

Hedonic regression analysis has been used to estimate for instance, the value of public services and school quality, as in Gibbons & Machin (2008). It relies on there being a marketable good, such as housing, whose price changes systematically with the quality of public services. As long as house prices are in equilibrium, and as long as houses only differ to the extent that they are located in areas with differing quality of public services, house prices

will reflect how much people value improvements in public services. This approach relies on two main assumptions: market prices are in equilibrium and observed differences in house prices only reflect differences in the exposure to the non-marketable good we want to cost. Data also have to be such that they allow us to correct for positive selection of households with a stronger preference for this good to areas where there is more of it. In addition, it is not easy to find a good such as housing whose price changes systematically with the presence of domestic violence, and where selection does not underlie its consumption.

This paper estimates the cost of domestic violence at the individual level, a non-marketable good for which common valuation methods fail to be adequate. Most data on domestic violence come from self-selected samples of women that have sought help or that have been reported by third parties. In England and Wales, Walby (2004) has estimated the costs of domestic violence at the national level, following a methodology proposed in Brand & Price (2001). They combine accounting techniques and stated preference methods to estimate different types of costs. Economic costs were estimated mostly by modeling and costing the relations crime has with marketed activities, or with outcomes such as industry turnover and absenteeism. Human and emotional costs were estimated based on contingent valuation methods where people are asked about their willingness to pay for safety. Brand & Price (2001) estimate that the total cost of crime in England and Wales was 60 billion sterling in 2000. Walby (2004) finds that the costs of domestic violence alone were 20.06 billion sterling in 2006/7, out of which 13.88 billion were human and emotional costs, even if these were estimated using stated preference methods.

Recent years have seen an increased interest in the economic consequences of domestic violence and on its social and private costs. Bowlus & Seitz (2006) shows that abused women are more likely to divorce and less likely to be employed. With a dynamic model, it also suggests that once violence has taken place, increasing women's employment may in fact worsen the incidence of domestic violence. Morrison & Biehl (1999), in turn, shows how children that have been exposed to domestic violence tend to underperform at school, making the economic effects of domestic violence intergenerational and thus

long lasting. Pollak (2002) went one step further and modeled the propensity to tolerating and perpetrating violence as a function of previous exposure to violence. He concluded that violence does tend to stay in families previously exposed to it. Tauchen et al. (1991), Farmer & Tiefenthaler (1997) and Aizer (2007) also find that domestic violence is more likely to occur the lower the economic opportunities of the victims. Given that domestic violence is thus one of the most costly types of crime and one of the main sources of crime suffered by women in the absence of armed conflict, this paper provides an estimate of the total costs of domestic violence for the victims using a methodology that has not been used so far. Our approach requires data on general satisfaction, a measure of victimisation and a measure of income collected for a representative sample and this is seldom available. The approach is very simple. We model utility, measured by general satisfaction, as a function of income and domestic violence. Estimating such a utility function gives us a measure of the marginal utility of income and the marginal disutility of domestic violence. The value of domestic violence is the additional income needed to offset the disutility of violence. This is given by the compensating variation of domestic violence. This idea underlies the estimation of the tradeoff between unemployment and inflation discussed in Tella et al. (2001). Other applications of this approach now include a valuation of droughts and floods (Carroll et al., 2008), informal care (van den Berg & i Carbonell, 2007), death of a loved one (Deaton et al., 2009; Oswald & Powdthavee, 2007), urban renewal (Dolan & Metcalfe, 2008), air quality (Levinson, 2009; Luechinger, 2009; van Praag & Baarsma, 2001) and terrorism (Frey et al., 2004).

This valuation method overcomes some of the main limitations of common valuation methods (see e.g. Frey et al., 2004, for a review of the limitations of alternative valuation methods), in that it does not rely on assumptions about markets being in equilibrium, nor assumptions about costless mobility or perfect information. It also does not lead to strategic responses because the question is not directly linked to the good which needs valuing. Estimates range from £25000 up to £54000, which is in line with estimates obtained using stated preference methods Atkinson et al. (see e.g 2005). Furthermore, because it is estimated at the individual level, we can recover the costs of

domestic violence for victims at the national level. Our estimates suggest a cost of domestic violence of approximately £million 231000 in 2005, when the data were collected, which represents almost 20% of GDP that year.

While this approach is not subject to any of the limitations discussed so far, it has its own limitations. The first and widely discussed limitation is the use of happiness data as a measure of utility. As Kahneman & Krueger (2006) puts it, self-reported satisfaction "is a global retrospective judgement, which in most cases is constructed only when asked and is determined in part by the respondent's own mood and memory, and by the immediate context". Doubts have been cast on the content of this variable given that it is so vulnerable to error. There is now a very convincing literature that shows strong and robust relations between happiness and several economic variables (see e.g. Clark et al., 2006, for a recent survey). However, error also occurs because individuals adjust to life circumstances so that individuals with the same observed economic situation may feel very differently about it depending on how they got to where they are. The life satisfaction approach to valuing goods delivers a subjective valuation of the goods, which means that the valuation of a good estimated using this approach will only reflect the characteristics and impacts perceived and valued by the respondent. These can differ across respondents, and are often less widespread than the true economic value. A third issue related to the use of happiness as a variable measuring utility is the conflict between the ordinal nature of utility and the cardinal nature of interpersonal comparisons between individuals needed to estimate the compensating variation of domestic violence. Ferrer-i-Carbonell & Frijters (2004) have however shown that treating happiness as an ordinal or a cardinal variable tends to have very little effect on the coefficient estimates. In our case, because we are interested in ratios of coefficients, this issue seems to be of even lesser concern. They do show that accounting for individual heterogeneity is important, and for this reason, and given that we only have cross-sectional data, we include personality indicators in our happiness equations.

There are additional econometric issues with this approach this paper has dealt with. To begin with, it is very likely that there is endogenous selection of exposure to domestic violence. Pollak (2002) develops an inter-

generational model of domestic violence which explains the perpetuation of violence in homes where victims have been exposed to and therefore tolerate violence more. Part of the issue has to do with people conforming to their circumstances and there being personalities which tolerate abusive behaviour more than others (e.g Lundberg, 2010, shows how more agreeable people tend to divorce less). We assume that the personality variables will significantly reduce the impact of this source of bias. There is also a very large literature concerned with the endogeneity of income in happiness equations, because income is the outcome of a decision-making process made to maximise happiness. Luechinger (2009); Powdthavee (2009) use a predictor for household income as an instrument to overcome this problem. Aizer (2007) uses the fact that some industries are more populated with women and others with men and explores industry wage differentials to instrument for wages. We will, for reasons which will become clearer later, use a predicted measure of income as our measure of income, ameliorating the simultaneity bias between income and happiness, even though some of the variables used to predict income are themselves choice variables (e.g. Luechinger, 2009, matches wages on occupation and tenure, which are themselves endogenous). We will also include in the model the individual potential hourly wage rate because, as argued in Pollak (2005), this variable is a better indicator of bargaining power, and of the decision variable determining household decisions.

The next sections describe the data and the methodology, alerting to the challenges that the data available add to this exercise. Section 4 presents and discusses the estimation of the marginal utility of income and violence, together with the estimates for the individual costs of domestic violence. We will also present a rough estimate of the aggregate costs our estimates suggest. Section 5 concludes.

2 Data and methodology

The main dataset of this paper was developed and discussed in Anand et al. (2009). It was designed to demonstrate the notion that capabilities cannot be measured, taking a leap towards operationalising Sen (1993)'s capabilities approach. The design of the questionnaire relied on Nussbaum (2000)'s list of

capabilities, and contains a set of 65 capability indicators together with a rich array of socio-demographic and economic variables. The survey instrument was delivered to both men and women in 2005 in the UK, to a subsample of approximately 1048 individuals of the YouGov database. It was administered online and it is anonymous. This dataset also includes the first three digits of the respondents' postcode.

Most significantly, this dataset includes a question on whether the individual has ever been a victim of domestic violence. The actual wording is as follows.

> Have you ever been a victim of domestic violence (yes=1/no=0)
> (Domestic Violence ever)

Victims of domestic violence often do not report incidents either to conform with social norms, or for fear of consequences (Moreno et al., 2005), or because they may have altruistic preferences for their spouse and may not want to expose them. Because this survey is anonymous, it is less likely that respondents will misreport their domestic violence experiences than it is in other existing data sets. Jarvinen et al. (2008) claims 1 in 4 women will experience an act of domestic violence in their lifetime. Our data suggest a similar incidence of domestic violence for women, and a not so negligible incidence for men. 22.8% of women report having been a victim of domestic violence and this percentage is almost 10% for men. This question is however a bit unclear for the purposes of our paper because we do not know how long ago or how frequent and severe the incidents were, nor do we know whether they are still happening. The data set also includes a measure of vulnerability to domestic violence, which asks respondents to provide a number from 1 to 7 to represent how vulnerable they feel to future violence in their home (7 being the most vulnerable). Table 1 shows how respondents who report having been victims of domestic violence or not answer the question about vulnerability to domestic violence. Out of the non-missing value answers of 1033, only 174 respondents report having been victims of domestic violence and of these, only 78 report even the mildest vulnerability to future domestic violence (an answer larger than 1), and less than 10% reports extreme vulnerability (an answer at least of 6). From the 859 respondents who report no

past incidents with domestic violence, only 52 report a number higher than 2. This paper will use two measures of domestic violence. The binary indicator of ever having experienced domestic violence, together with a binary indicator describing individual perceptions about current domestic violence threats, even if no violence has yet occurred. This binary indicator will take the value 1 for all individuals who report vulnerability to domestic violence at least as high as 4, and 0 otherwise. According to Table 1, the percentage of people in this sample who are currently subject to domestic violence is 6.58%. This percentage is considerably lower than the original 16.84%, but ensures that domestic violence affects current evaluations of well-being.

Table 1: How vulnerable to current and future domestic violence is the sample?

Vulnerability at home	Not at al	2	3	4	5	6	Very vulnerable	Total
Never victims of DV	711	96	22	15	10	3	2	859
Victims of DV	96	28	12	12	10	11	5	174
Total	807	124	34	27	20	14	7	1,033

The self-reported measure of life satisfaction is the answer to the question

How satisfied or dissatisfied are you with your life as a whole?

This question is asked both at the beginning and at the end of the survey. Several studies (e.g. Pudney, 2010) show how values of satisfaction vary significantly with the location of the question in the questionnaire. This paper uses the second measure on the grounds that it should be less subject to idiosyncracies and current mood because it comes after the respondents had to reflect on several relevant areas of their lives. This will be our measure of utility.

The income variable included in this dataset to measure the value of domestic violence is household income, a more natural measure of income, specially for women living in traditional households. The questionnaire includes the following question

Gross household income is the combined money income of all those earners in a household including wages, salaries, or rents and BEFORE tax and contributions to national insurance are deducted. What is your gross household income?

Respondents then had to choose an income band presented either in terms of annual income or its weekly equivalent, e.g. "£1 to £9999 per year (£1 to £199 per week approximately)". However, we need a continuous measure of income to compute the compensating variation of domestic violence. To tackle this problem, Layard et al. (2007) uses the midpoint of each middle income band, then the second tercile of the lowest band and the first tercile of the highest, uncensored band. This procedure ignores the well-documented right skewness of the household income distribution, so we opted for an imputed income measure, which matches survey respondents' income to their equivalent counterparts in the BHPS. This survey was designed using very similar questions to the BHPS, which made this imputation exercise less problematic. We estimate a household income equation, for each income band, using a rich set of regressors to predict the income each respondent from our main dataset would have. We used BHPS data from 2000 until 2004, the closest available data[1]. Out of approximately 1000 observations, just over 100 individuals end up with a predicted household income outside their reported income band. For completeness, we then compute the mean value of each band and, not surprisingly given the positive skewness of the income distribution, these differ substantially from what we would have obtained if we had used Layard et al. (2007)'s rule.

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[1]The variables used were: UK fine regional data, gender, age, schooling, employment status, marital status, gross household income, number of dependents, ethnicity, religion, calendar year and life satisfaction. The BHPS does not include information about the victimisation status of individuals, which given the negative association between violence and income, may lead to an overestimate of the imputed income of victims. Attempts to correct for the endogeneity of violence in an income equation using satisfaction with sexual needs as the instrumental variable did not yield satisfactory results. We will present the results of this paper without any corrections. We checked the number of observations per household income bracket whose imputed value fell outside the reported bracket, and how many of these misimputed values related to victims. From brackets 1 to 6, the proportion of misimputed values of victims was 0/0, 3/20, 6/30, 0/21, 3/23 and 0/11.

3 Domestic Violence in the UK: a few descriptive results

Table 2 shows how the incidence of domestic violence changes with several socio-demographic and economic factors used in this paper. The income measures used here (personal and household gross income) are the original variables measured in brackets.

Table 2: Incidence of domestic violence

| | Victim of Domestic Violence | | |
	Yes	No	Total
	Victim of Domestic Violence		
	Yes	No	Total
Gross Household Income[g)]			
£0 up to £9,999 a year	22.30	11.76	13.57
£10,000 up to £19,999	31.76	22.69	24.25
£20,000 up to £29,999	15.54	24.23	22.74
≥ £30,000 or more a year	30.41	41.32	39.44
N	148	714	862

[g)]Wilcoxon rank-sum test of the equality of distributions returned a p-value of 0.0001.

	Yes	No	Total
Individual Personal Income[a)]			
No income	3.82	5.14	4.91
£1 up to £9,999 a year	39.49	27.54	29.59
£10,000 up to £19,999	34.39	31.23	31.77
£20,000 up to £29,999	15.29	20.55	19.65
£30,000 up to £39,999	5.10	9.75	8.95
£40,000 or more a year	1.91	5.80	5.13
N	157	759	916

[a)] Wilcoxon rank-sum test of the equality of distributions returned a p-value of 0.001.

	Yes	No	Total
Life Satisfaction[b)]			
Completely Dissatisfied	1.15	1.16	1.16
Very Dissatisfied	11.49	4.07	5.32
Fairly Dissatisfied	18.97	10.48	11.91
Neither Satisfied nor Dissatisfied	9.77	9.31	9.39
Fairly Satisfied	37.36	43.66	42.59
Very Satisfied	18.97	26.43	25.17
Completely Satisfied	2.30	4.89	4.45
N	174	859	1033

[b)]Wilcoxon rank-sum test of the equality of distributions returned a p-value of 0.000.

Ethnicity[c)]

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	Victim of Domestic Violence		
	Yes	No	Total
White British	86.47	91.12	90.33
Non-White British	13.53	8.88	9.67
N	170	833	1003

[c)]Wilcoxon rank-sum test of the equality of distributions returned a p-value of 0.0619.

Marital Status[d)]			
Married or co-habiting	59.77	67.17	65.92
Separated	18.97	6.52	8.62
Other living alone	21.26	26.31	25.46
N	174	859	1033

[d)]Wilcoxon rank-sum test of the equality of distributions returned a p-value of 0.3433.

Number of Dependents[e)]			
None	61.49	70.43	68.93
At least one dependent	38.51	29.57	31.07
N	174	859	1033

[e)]Wilcoxon rank-sum test of the equality of distributions returned a p-value of 0.0203.

Work Status[f)]			
Working	52.87	58.91	57.89
Not working	47.13	41.09	42.11
N	174	859	1033

[f)]Wilcoxon rank-sum test of the equality of distributions returned a p-value of 0.1419.

Psychological Distress[h)]			
0	27.59	40.86	38.63
1	13.22	16.30	15.78
2	17.82	12.69	13.55
3	12.64	8.96	9.58
4	6.90	8.85	8.52
5	7.47	4.89	5.32
6	7.47	4.89	5.32
7	6.90	2.56	3.29
N	174	859	1033

[h)]Wilcoxon rank-sum test of the equality of distributions returned a p-value of 0.0001.

Relative Bargaining Power[i)]			
low relative income	14.38	12.23	12.60
similar income	31.37	40.96	39.34
high relative income	54.25	46.81	48.07
N	153	752	905

[i)]Wilcoxon rank-sum test of the equality of distributions returned a p-value of 0.2472.

Predicted Hourly Wage Rate[j)]			

	Victim of Domestic Violence		
	Yes	No	Total
Mean Hourly Rate (/hour)	7.32	7.72	7.65
N	157	729	886

$^{j)}$Wilcoxon rank-sum test of the equality of distributions returned a p-value of 0.1146.

Crime Rate$^{k)}$			
Mean Crime Rate (number of crimes / 1000 people)	27.32	28.35	28.17
N	157	764	921

$^{k)}$Wilcoxon rank-sum test of the equality of distributions returned a p-value of 0.9082.

Personality indicators$^{l)}$			
Extraversion	0.15	0.28	0.26
Agreeableness	0.88	0.67	0.70
Conscientiousness	0.39	0.29	0.31
Emotional Stability	0.35	0.39	0.38
Openness	0.14	0.26	0.24
N	174	859	1033

$^{l)}$Wilcoxon rank-sum test of the equality of distributions returned the p-values:
0.0614, 0.0051, 0.2239, 0.3544 and 0.0657 respectively.

Table 2 also shows that victims of domestic violence are less happy than non-victims, which is key in this paper. Because domestic violence enters negatively in the utility function, while income enters positively, that we can estimate the costs of domestic violence using a life satisfaction approach. Compensating variation will be determined as the income needed to compensate individuals for the presence of violence.

Similarly, the ethnic composition of victims has more non-Whites than the composition of non-victims, which confirms findings stating the incidence of domestic violence is higher amongst Blacks, Asian and minorities, groups for whom data and the analysis of the causes and consequences of domestic violence are even scarcer. This higher incidence of domestic violence amongst non-Whites may reflect characteristics of the households which makes them more vulnerable to domestic violence.

To start with, non-Whites tend to live in poorer households, where the incidence of domestic violence is highest, even though it remains substan-

tial at all household income levels. Non-White women are also less likely to work and to be lower earners and the incidence of domestic violence is highest for non-workers and for lower earners. Also non-White women have on average a larger number of children, and are more likely to have children, factors which increase the incidence of domestic violence. This is in line with Agarwal (2006), which claims that children deter women from leaving a violent relationship. However, it may also reflect differences in environmental characteristics experienced by Whites and non-Whites. As suggested in Morrison & Biehl (1999), higher violent crime rates lower inhibitions against violent conduct, both via a demonstration effect (emulation of violent behaviour) and via erosion of social norms that regulate interpersonal relations. This data set also includes each individual 3-digit postcode, which we use to match each individual to the crime rate in their neighbourhood (as in Anand & Santos, 2007). We will use local crime rates to capture the strength of the violence norm. Local crime data were collected online from http://www.crimestatistics.org.uk/tool/. This variable measures the number of all reported crime offences per 1000 individuals in the first quarter of 2004. It is collected at the CDRP (Crime and Disorder Reduction Partnerships) level, throughout England and Wales only (we hence lost the 90 observations corresponding to the Scottish sample). It combines police records with the British Crime Survey self-reported questionnaire of individual experiences. There is no significant difference in the average crime rate between victims and non-victims.

Marital status is a key variable in this study. By definition, we often think of domestic violence as violence occuring by a member of the family or someone else living with the victim, but evidence does suggest that some of the worst cases of domestic violence happen to individuals right after a relationship breaks down. We have grouped individuals according to whether they are living with someone, separated, or whether they do not have a partner. The incidence of domestic violence is highest amongst separated respondents which may not only reflect the fact that respondents may have terminated an abusive relationship, but also the fact that separation, for whichever reasons, may have generated violence.

This paper constructed several indicators of bargaining power to account

for the fact that different households share household resources differently. We follow Pollak (2005)'s suggestion and use the individual predicted wage rate as a measure of the strength of one's threat point. This predicted wage rate was also estimated by matching individuals using BHPS. Data from 2000 until 2004 was used and the regressors of the wage equation were gender, age and age squared, the calendar year, educational attainment, employment status, marital status, number of dependents, ethnicity, religion, fine regional data, gross household and individual income bracket dummy variables. We also use the ratio of own income to total household income as a measure of relative bargaining power. The fact that both individual and household gross income are only available in brackets, and the fact that there is no additional information about the other adults in the household, has resulted in a very crude measure of bargaining power. We have assumed that there were never more than 2 earners in the household, including the respondent (in the UK, these account for over 92% of all households, according to the 2005 Expenditure and Food Survey). As such, we were able to infer whether the respondent was earning relatively more or less than the other potential earner for most of the cases. An example is when the household income is said to be in the $[£30000, £40000[$ bracket and individual income is said to be in the $[£20000, £30000[$ bracket. The only way in which the spouse could be earning the same as the respondent is when the respondent earns $£20000$, the lowest value in the reported bracket, so we assume that this happens with probability zero. In this case, we classify this combination of household and individual income as a case where the respondent has a relatively higher income. The situations where we could not draw any conclusion due to the width of the intervals, we classified relative power as equal. The relative power measure has three categories: bargaining power is higher than, equal, or lower than spouse's. Table 2 shows that victims of domestic violence have on average a lower predicted wage rate, but there is no systematic difference in relative power measure between victims and non-victims. That can partly be explained by the crudeness of this measure, but also by the fact that households where the incidence of violence is more likely are both when women earn too little or too much of the household income.

We also include measures of personality in the data. It has been argued

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that exposure to domestic violence is endogenous because people have different personalities which makes them more tolerant to domestic violence. These traits may at the same time influence responses to self reported satisfaction questions, as well as the likelihood of violence occurring. There is evidence that certain personality traits such as being sympathetic or not being quarrelsome are highly correlated with the presence of domestic violence (see e.g. Anand & Santos, 2007) and Lundberg (2010) shows that individuals with certain personality traits, such as agreeableness, are less likely to divorce. Pollak (2002) shows that under plausible assumptions, there is also a persistent intergenerational impact of domestic violence, which is partly determined by intergenerational transmission of personality and upbringing. Based on Gosling et al. (2003), the dataset includes ten questions on individual personality traits, which are combined to construct 5 personality dimensions with 2 opposing traits. For instance, extraversion is the combination of two polarised traits, i.e. extraverted and reserved. The remaining 4 dimensions result from a similar averaging of two opposite traits, and yield agreeableness, conscientiousness, emotional stability and openness. Each personality variable takes values from -6 to 6. Evidence does suggest that there are significant personality differences between victims and non-victims of domestic violence. Victims tend to be less extrovert, less open and more agreeable, confirming the result already found in Lundberg (2010). Victims of domestic violence are also more likely to be psychologically distressed than non-victims.

All in all, Table 2 shows that the incidence of domestic violence changes systematically with several factors raised in the literature, namely factors that increase the costs of leaving a relationship such as the number of dependents; and factors that strengthen the threat point such as the hourly wage rate.

4 Results

This paper estimates the compensating variation needed to make an individual indifferent between no violence and violence compensated by additional income. Assuming utility U depends negatively on domestic violence DV

and positively on personal income y, the compensating variation for domestic violence CV can be obtained by equating utility in a non-violent state 0 with utility in a violent state 1.

$$U^0\left(y^0, DV^0\right) = U^1\left(y^0 + CV, DV^1\right)$$

With a linear happiness equation

$$E\left(U_i \middle| DV_i, y_i, X_i\right) = \alpha_0 + \alpha_1 DV_i + \alpha_2 y_i + \alpha' X_i + \varepsilon_i \tag{1}$$

where X represents all additional covariates, CV will solve the equation

$$E\left(U_i \middle| DV_i = 0, y_i^0, X_i\right) = E\left(U_i \middle| DV_i = 1, y_i^0 + CV, X_i\right)$$

and it is equal to[2]

$$CV = -\frac{\alpha_1}{\alpha_2} \tag{2}$$

Table 3 shows the estimation results of happiness equations defined according to Eq. 1. The first three columns use the measure of experienced domestic violence DV and the last three columns use vulnerability to future threats of violence. Results for each of the two measures are presented for the whole sample, women and men.

We have added a gender dummy, a quadratic function of age, marital status, ethnicity, number of dependents, education, employment status. To account for bargaining power, we have added our indicator of bargaining power which results from comparing the individual personal income band with his household income band, and the log of predicted hourly wage rates. Personality indicators were added, together with local crime rates and our psychological distress index.

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[2]This model produces a very simple parameter of the cost of violence, mainly because the relation between happiness and income has been simplified. However, attempts to use log income produces parametric restrictions which are not confirmed by the data.

Due to small sample size, and to try and treat the categorical variables as such, categorical variables have had some categories collapsed. Employment status becomes a binary variable where the relevant factor is the amount of time spent at home, under the assumption that the longer one stays at home, the more vulnerable to domestic violence s/he is. Hence, it takes the value 1 if the person works less than 8 hours (this includes retired, unemployed, students, not-working for another reason and some PT workers) and 0 otherwise. Marital status was divided into 3 categories: individuals with a partner (married or not), separated (after having had a partner, whether the separation is a divorce or not) and those that never had a partner or the partner no longer exists (widowed individuals). The number of dependents collapses to having none or at least one dependent. The personality questions are still treated as continuous variables, mainly because they take too many values and given its abstract nature, interval data could be too arbitrary.

Table 3: Happiness equations: estimation results

	Domestic Violence ever			Domestic Violence recently		
	All	**Women**	**Men**	**All**	**Women**	**Men**
Domestic Violence	-0.239**	-0.259**	-0.190	-0.483***	-0.577***	-0.376
	(0.108)	(0.129)	(0.200)	(0.166)	(0.205)	(0.292)
Household income/10000	0.094***	0.097**	0.106***	0.089***	0.088**	0.105***
	(0.027)	(0.045)	(0.037)	(0.027)	(0.044)	(0.037)
Female	0.275***			0.253***		
	(0.085)			(0.084)		
age	-0.118***	-0.144***	-0.103***	-0.130***	-0.160***	-0.109***
	(0.021)	(0.029)	(0.032)	(0.021)	(0.029)	(0.032)
age^2	0.001***	0.002***	0.001***	0.001***	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Separated	-0.201	-0.251	-0.122	-0.212	-0.241	-0.149
	(0.151)	(0.201)	(0.244)	(0.146)	(0.194)	(0.240)
No partner	-0.537***	-0.550***	-0.522***	-0.556***	-0.555***	-0.545***
	(0.115)	(0.155)	(0.185)	(0.114)	(0.153)	(0.185)
Non-White British	-0.022	-0.099	0.205	-0.057	-0.149	0.194
	(0.143)	(0.196)	(0.221)	(0.142)	(0.195)	(0.220)
At least 1 child	0.071	0.088	0.003	0.097	0.129	0.000
	(0.099)	(0.138)	(0.152)	(0.098)	(0.136)	(0.152)
Vocational diploma	-0.012	0.245	-0.323	-0.022	0.247	-0.358
	(0.154)	(0.221)	(0.223)	(0.153)	(0.218)	(0.224)
CSE A level	0.078	0.235	-0.094	0.067	0.225	-0.110
	(0.150)	(0.210)	(0.223)	(0.148)	(0.205)	(0.223)
Graduate	-0.068	0.084	-0.301	-0.065	0.112	-0.336
	(0.165)	(0.235)	(0.243)	(0.164)	(0.231)	(0.244)
						Continued on next page

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	Domestic Violence ever			Domestic Violence recently		
	All	**Women**	**Men**	**All**	**Women**	**Men**
Not employed (at home)	-0.028	-0.089	0.090	-0.064	-0.136	0.083
	(0.102)	(0.135)	(0.169)	(0.101)	(0.132)	(0.169)
Extraversion	0.184***	0.139*	0.237***	0.190***	0.141**	0.249***
	(0.054)	(0.073)	(0.081)	(0.053)	(0.072)	(0.081)
Agreeableness	-0.026	-0.039	-0.028	-0.025	-0.032	-0.033
	(0.046)	(0.065)	(0.067)	(0.045)	(0.064)	(0.066)
Conscientiousness	0.076	0.118*	0.036	0.069	0.100	0.037
	(0.047)	(0.067)	(0.070)	(0.047)	(0.065)	(0.070)
Emotional stability	-0.024	-0.009	-0.007	-0.030	-0.021	-0.006
	(0.049)	(0.067)	(0.076)	(0.049)	(0.067)	(0.075)
Openness	0.017	0.111*	-0.112	0.022	0.110*	-0.107
	(0.046)	(0.062)	(0.069)	(0.045)	(0.061)	(0.069)
Similar relative income	-0.024	-0.207	0.520*	-0.039	-0.240	0.571*
	(0.150)	(0.187)	(0.307)	(0.149)	(0.185)	(0.303)
Higher relative income	0.063	-0.022	0.520*	0.059	-0.060	0.583*
	(0.159)	(0.218)	(0.308)	(0.159)	(0.215)	(0.304)
Predicted log hourly wage	0.415***	0.362**	0.454**	0.432***	0.376**	0.473**
	(0.120)	(0.158)	(0.199)	(0.120)	(0.157)	(0.198)
Distressed	-0.287***	-0.304***	-0.287***	-0.283***	-0.297***	-0.284***
	(0.020)	(0.027)	(0.032)	(0.020)	(0.027)	(0.032)
Local crime rates	0.002	-0.003	0.004	0.002	-0.003	0.004
	(0.003)	(0.005)	(0.003)	(0.003)	(0.005)	(0.003)
Constant	6.612***	7.643***	5.895***	6.861***	7.987***	5.971***
	(0.518)	(0.728)	(0.769)	(0.515)	(0.717)	(0.770)
R^2	0.375	0.371	0.379	0.386	0.393	0.381
N	681	371	310	689	379	310

Significance levels : ∗ 10%   ∗∗ 5%   ∗∗∗ 1% Standard errors in parentheses

Omitted categories: being a man, married, other schooling, lower relative income, White British, working at least 8hrs/week, and no dependents. Standard errors of income multiplied by 10000.

The marginal utility of income can be read as the coefficient of each income measure. Several studies have discussed the endogeneity of income in happiness regression equations (e.g Powdthavee, 2009). We account for this in two distinct ways. First of all, the psychological distress index should reflect the shocks to utility that lead individuals to revise their income generating decisions. Second of all, by constructing a continuous measure of income as the predicted income an individual with their characteristics should have, we mitigate the reverse causality of happiness on these decisions. We observe a strongly significant impact of income on happiness for all regressions, even if the order of magnitude of the impact of each pound is low. The measures of relative bargaining power tell us a more gendered story. While women seem

to prefer to live in households where their contribution to the household income is lower than men's (even if never significant), this is not the case for men, whose coefficients are instead positive and significant. Predicted hourly wages on the other hand increase both women's and men's utility.

The marginal disutility of violence is estimated as the coefficient of domestic violence. Its endogeneity is accounted for by including personality indicators and local crime rates. Being a victim of domestic violence reduces happiness by 0.24 when using experienced domestic violence in a regression with all individuals, and by more than double that magnitude when using a measure which represents current threats to domestic violence. While these estimates increase marginally for women and retain a very high statistical significance, results show no significant impact of domestic violence for men. This lack of significance can be explained by the presence of an index of distress, which aims to capture lifestyles and unobserved factors which affect individual happiness and potentially their ability to perform well in their jobs and to cohabit at home. Indeed, removing this index makes the estimates for men statistically significant and increases the coefficient estimates for all groups and for both measures of DV. The order of magnitude of domestic violence shows very clearly that it is a major impediment to human development and happiness. When using vulnerability to future DV, it can be seen to be as detrimental as having no partner and more detrimental than any other influence on utility.

Regarding the remaining coefficients, several stylised facts are confirmed by these results. Women are happier than men, the age-happiness profile is U-shaped, and education does not seem to have a significant impact on happiness. Not having a partner has a negative impact on happiness and some personality traits also seem to matter for happiness (in particular extraversion and to a minor degree and only for women, openness).

4.1 Estimating the costs of domestic violence at the individual and at the national level

Table 4 shows our estimates of the compensating variation of domestic violence according to Eq. 2. Using experienced DV, costs of DV are estimated to

be over £25000, and this value more than doubles when we use a measure of DV which reflects current exposure to violence in the home. This means that *individuals would be willing to give up a substantial fraction of their personal income, in some cases, almost all of their income or more, to live in a violent free environment.* These results are not far off from the results obtained in Atkinson et al. (2005) using revealed preference methods, and cast some doubt on economic models of domestic violence (see e.g. Tauchen et al., 1991; Aizer, 2007) - the transfers victims would need in order to stay in abusive relationships are often larger than what most households can afford.

Table 4: Income compensation for different income levels

	Domestic Violence ever			Domestic Violence recently		
	All	Women	Men	All	Women	Men
Individual costs (£)	25434.63	26825.65	17967.41	54216.32	65465.39	35922.83
National costs (£)	2.58e+11	2.02e+11	4.77e+10	2.31e+11	1.92e+11	4.75e+10
% of GDP	21.1	16.5	3.9	18.9	15.7	3.9

To compute a national estimate of the costs of domestic violence, the first step was to estimate the number of victims in the UK in 2005, the year this questionnaire was delivered. We used the proportion of victims in our sample as a measure of incidence of domestic violence in the whole of the UK (Scotland included). Then we used the estimates of the UK population available in Dye & Sosimi (2006) (over 60 million in 2005, p. 40) to find the number of victims of domestic violence in the UK in 2005. National costs of domestic violence are calculated as the product of number of victims and the individual costs of DV (Table 4, row 1). Results are in the second row of the table and show national costs as high as £billion 258. Our estimates are far higher than estimates obtained in previous studies (Walby, 2004). With a GDP of approximately £million 1,224,715 for the whole UK in 2005 (Dye & Sosimi, 2006, , p. 23), this estimate represents over 20% of the national GDP, 10 times higher than the percentage suggested in Walby (2004). Surprisingly, and because the percentage of individuals who feel vulnerable to domestic violence is lower than the percentage of individuals who have ever experienced domestic violence, the estimates of the national costs of DV are similar for the two measures of DV.

It is however worth emphasising the sensitivity of our estimates to the

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gender of the respondent, and the sensitivity of the self-reported satisfaction variable to numerous influences. Evidence suggests men and women use different sets of information to assess their satisfaction with life as a whole[3]. This approach is limited by the possibility that either violence or income are not a substantial part of each respondent's satisfaction. However, it overcomes fundamental limitations of other valuation methods, such as the need to have relevant markets in equilibrium and the incentive to reply strategically. In particular, given that most of the costs of domestic violence are held in private, and are likely to be emotional and human costs for which there are no relevant markets, this approach is, in our view, worth exploring further.

5   Conclusion

This paper provides an estimate of the costs of domestic violence at the individual and at the aggregate level. It uses a happiness equation where compensating variation is a function of the coefficients of income and domestic violence. It draws on a survey that includes data on whether the respondent has ever been a victim of domestic violence, household gross income and a self-reported life satisfaction variable. The analysis is conditional on socio-demographic characteristics, measures of bargaining power, a psychological distress index, personality and local crime rates. We use local crime rates and personality to account for the endogeneity of violence, assuming that these will capture the selection victims make into more violent households. The endogeneity of income is accounted for with the index of psychological distress, potential wage rate and our use of an imputed continuous measure of income.

This paper shows that a satisfaction approach produces estimates which are in line with estimates produced using stated preference methods, as in Atkinson et al. (2005). However, when we use a measure of domestic violence which aims to represent current exposure to domestic violence, we obtain

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[3]When we exclude the psychological distress index from the regression equation, the impact of domestic violence becomes more significant and larger both for men and women, but specially for men.

higher individual costs than other studies. In the end, our results suggest that domestic violence produces negative externalities and costs which are often unaccounted for and can be as high as 20% of the UK GDP. At the same time, we still have reasons to believe that these are underestimates. Self-reported satisfaction will fail to capture the cost of public goods which are unperceived or not valued by the individual or the intergenerational effects of domestic violence. This paper however invites an integrated cost-benefit analysis of domestic violence which takes satisfaction approaches to valuing non-market goods seriously, and shows how urgent this may be for a clearer assessment of the true impact of domestic violence and for a stronger effective support of families where domestic violence occurs.

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