Recorded Crime and Victimisation: An Analysis of Burglary Data from 18 EU countries

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1 Introduction

Measuring the volume of crime is an inexact science. The methods available, which include using police recorded crime numbers and basing estimates on findings from victimisation surveys, all have their limitations. Further, the two most widely used methods can produce conflicting indications as to whether crime is rising or falling. The purpose of this paper is not to propose a new measure but to explore the relationship between the estimates produced by the principal methods. Empirical evidence from a cross-sectional study of European countries is used to examine the degree to which the predictions of models of the relationship between the two measures can explain variation across countries in the ratio between estimates derived from the two methods.

Of the two approaches that are widely used to measure the volume of crime, the one most commonly used in practice has been the **volume of crime recorded** by law enforcement agencies, usually the police. This measure has various advantages. It is well-documented, so that it is often possible to get detailed breakdowns by offence type and local area running back for many years or even quarters. In most countries there are recording standards or protocols or counting rules to ensure consistency in the way in
which incidents are recorded. The principal disadvantage is that the propensity of victims of crimes to report their offences may vary systematically by offence type and through time. The propensity may move in response to factors such as the size of the police force in relation to the population, a smaller force being under greater pressure with longer reporting queues, depressed capacity to investigate and detect crime. The result is that the recorded crime rate may not be a reliable proxy for the underlying rate at which crimes are occurring.

The second approach to crime measurement is to conduct sample surveys of the population and to estimate the proportion who report having been victims of crime over the previous year or five years. This approach is being increasingly widely used as awareness grows of the limitations of recorded crime rates. Interest in measuring the quality of life, and the contribution to it of criminal victimisations, has also played a role in encouraging the use of surveys to explore not just victimisation but also the incidence and role of fear of crime. In addition there is growing interest in comparative analysis of incidence rates and this has encouraged the development of standardised methodology for measuring incidence across countries.

There are other methods for estimating the volume of crime, but these are not so commonly used because they tend to be less reliable. Various surveys invite respondents to provide self-reports of the amount of offending for which they have been responsible: see for example the findings from the Offending, Crime and Justice Survey conducted in England and Wales ([19]). It is possible to use these findings, provided the findings are based on large, nationally-representative samples, to make estimates of the volume of underlying crime. This can be particularly helpful in relation to offences that are not widely-reported because they do not have direct victims or have diffuse effects, such as prostitution, gambling or drug dealing.

Returning for the moment to victim surveys of the incidence of crime, there have been a number of surveys of crime affecting households. The European Social Survey[10] (ESS hereafter), for example, asks respondents whether they have been victims of burglary in the last five years. Other sources include a Home Office international crime survey study published in 1996 covering England & Wales, Scotland, France, USA, Canada, Netherlands, Sweden, Northern Ireland, Switzerland, Finland and Austria.[13] The most important survey on victimisation across the EU, however, is the one recently published by UNICRI[17], where victimisation percentages are reported for ten offence types. These offence types, moreover, match the categories used for classifying reported crime in the comparative work of WODC.
The importance of using victimization data is that in some countries recorded crime might be showing an increase while in reality people are becoming safer and less likely to experience being a victim, and vice versa. Better recording systems or more resources going into policing might account for increases in reported crime in a country even while underlying crime there is falling. But in another country sparse policing or weak incentives for individuals to report crimes could conversely result in recorded crime declining even though victimisation is actually on the rise. According to the International Crime Survey [18] there is cultural bias that results in countries reporting similar experiences differently. The ICVS survey is weighted so as to bring the samples in line with the distribution by age, gender and region within the country according to census data.

Efforts to make international comparisons of crime rates face further complications. Differences in the definition and classification of offence types are the most obvious source of variation, although there have been efforts by the WODC to match offence types. There are also differences in recording systems and in the number of police per capita. The net result is that there is great variability in recorded offence rates due not only to differences in levels of crime among countries but also to differences in reporting and recording behaviour.

The inescapable conclusion is that the number of crimes recorded by the police does not present a true or accurate measure of the real volume of underlying crime. Our purpose in this paper is to argue that the greater availability of victimisation data opens up the possibility of exploring more explicitly the relationship between estimates of the volume of crime derived from the two sources. A better understanding of this relationship can help policy makers reconcile apparently contrary indications as to what is happening to the amount of crime and it can also inform the debate about the total costs imposed by crime.

2 The Model

In order for an event to be recorded as an offence two conditions have both to be satisfied. (See Figure:1). First the incident needs to come to the attention of the police either because an officer has witnessed an incident or, more often, because it has been reported to the police by a victim (V) or witness. The police officer (P) has then to make a determination as to whether the incident meets the criteria for it to be recorded as an offence. This second-stage decision will normally involve the application of guide-
lines or reporting standards, although there may be organisational incentive structures that influence recording decisions, a matter we pursue elsewhere.

At the third stage, once an offence has been recorded and a suspect identified the public prosecutor (PR) has to decide whether it is worthwhile taking the matter to court. In the event that charges are brought there is a fourth stage at which the suspect (O) may consider intimidating the victim in the hope of persuading them not to give evidence at a court hearing. If confronted with intimidation the victim (V) has to decide whether to press on or to withdraw from giving evidence.

From a decision theory perspective it can be seen that the first stage of the process in particular leaves wide scope for the victim or witness to use their personal discretion. Reporting crime can take considerable time and can be personally distressing and may open the victim to reprisals or intimidation. In the event of a prosecution being brought there is the prospect of giving evidence in court, with its risk of hostile cross-examination and intimidation from the friends or family (O) of the accused. The payoffs to the victim from reporting may come in the form of private benefits if the offender is identified and/or compensation is received or insurance cover can be recovered. Other benefits may also come in the form of feeling that a victim has contributed to the public good by passing on information that might prevent similar offences in the future. This kind of 'social obligation' motivation is one element that is likely to vary across countries. It might reflect the degree of 'fellow feeling' or 'social solidarity' that citizens feel.

The balance between the various costs and benefits varies by type of offence. A person involved in a fight may be reluctant to report an offence because of the risk of opening themselves up to arrest. But a person whose car has been stolen may need to obtain a police report on the accident before they can claim from their insurer the value of the car, meaning that there may be a strong incentive to report the theft. The net result is that the proportion of incidents being reported and recorded as crimes may vary widely. Institutional differences across countries may result in wide variation in this proportion even for a particular type of offence.

Our main objective in this paper is to explore the degree to which we can find cross-country evidence to support the contention that the proportion of underlying incidents being recorded as crime will depend systematically on the various kinds of influence on reporting and recording decisions. For example, if it is conjectured that an insured motorist is more likely to report the theft of a vehicle then (other things equal) we would expect the recording rate to be higher in countries where car insurance is more widespread. Since the reporting decisions and the pressures influencing them cannot be
observed directly, we have to construct a variety of proxies to represent the influences and their outcomes.

As supporting evidence we also present findings from an analysis of reported crime from a dataset referring to a single country (England and Wales). We investigate why "reporting" occurs and if it is associated with other variables such as insurance status, value of the property, etc. For both applications we have focused on property crime, because it only involves the taking of money or property, and does not involve force or threat of force against a victim. The proportion of loss accounted for by pain and suffering is typically smaller for burglary than for other types of crime such as those involving violence and physical injury.

A useful device to capture the relationship between recorded crime and victimisation is the notion of a 'multiplier', as used by the UK’s Home Office[2],[8]. Multipliers are calculated by comparing estimates of the number of victims of crime derived from victimisation surveys with the number of crimes recorded in police data. The multipliers derived in this way
be used as a means of 'scaling up' recorded crime levels to get an estimate of the volume of total crime.[8].

The multipliers are defined as:

\[ \text{Mult} = \frac{V}{R} \]

where:

\( R \): Number of offences recorded (often expressed in terms of offences per 100,000 population)

\( V \): Number of victims in total estimated from random victimisation samples (sometimes expressed in terms of a number of victims per 100,000 population).

The multipliers also vary across countries, as can be seen in Figure 2.

Figure 2: Multipliers for Domestic Burglary across EU sample

Multipliers vary between crime types and also from year to year, even within countries. These variations reflect recording and reporting practice as well as movements in the underlying crime rate. For example in the case of England and Wales it can be seen that the multipliers (derived from comparisons of recorded crime with findings from the British Crime Survey, BCS) have been on a downward trajectory in recent years. See Figure(3)[9].

There are three underlying problems in analysing recorded crime and victimisation. There is variation across (a) countries, (b) time and (c) offence types. For the purpose of this paper we will focus on the first two.
Another way of characterising the relationship between recorded crime and victimisation is to use the inverse of the Multiplier. The resulting ‘Crime Ratio’ is defined as:

\[ CR = \frac{R}{V} \]

where:
- \( CR \): Crime Ratio
- \( R \): Total offences recorded (or the number of offences per 100,000 population)
- \( V \): Estimated total victims (or the number of victims per 100,000 population)

If this ratio is equal to unity then both sources, victimisation and recorded crime, give the same estimate of the number of crimes. The underlying assumption, however, is that not all crimes that occur are reported and that recorded crime never exceeds victimisation

\[ 0 \leq CR \leq 1 \]

We aim to model the relationship between crime rate and GDP per capita, Police per capita and the Gini Index of Inequality. The dependent variable is modelled as the ratio CR. The model is applied to cross-section data on a number of European countries. There are no countries that fail
to fulfill the condition \(0 \leq CR \leq 1\) in our sample. The observed \(CR_i\) is defined as:

\[
CR_i = \begin{cases} 
\alpha + \beta_1 GDP_{PC} + \beta_2 POLICE_{PC} + \beta_3 GINI_i + u_i & \text{for } CR_i > 0 \\
0 & \text{for } CR_i \leq 0 
\end{cases}
\]

(1)

where:
- \(i = 1, 2, \ldots, 18\) : Country
- \(GDP_{PC}\) : GDP per capita 2003
- \(POLICE_{PC}\) : Police per capita 2003
- \(GINI\) : Gini Index of relative income inequality

This is known as the Tobit model (Tobin’s Probit). It is also known as a censored normal regression model because some observations on \(CR_i\) are censored. Our objective is to estimate parameters \(\beta\).\(^{[14]}\) We could have used a standard multiple linear regression model of the following type:

\[
CR_i = \alpha + \beta_1 GDP_{PC} + \beta_2 POLICE_{PC} + \beta_3 GINI_i + u_i
\]

(2)

The difference between the models relies not only on the estimation model but the statistical implications. Using a multiple linear regression model with truncated values as we have for the crime rate (CR) implies that the disturbance term \(u_i\) does not have a zero mean. This violates the assumption of the classical model. Using the Tobit model as specified in equation (1) avoids this problem by estimating the parameters not by OLS but by Maximum Likelihood. We present the results of both estimation procedures, since the model can be (although need not be) estimated by either procedure.

As supporting evidence we also have a model of reporting behaviour for domestic burglary in England and Wales using data from the British Crime Survey (BCS). The model is:

\[
RB_i = \alpha + \beta_1 INS_i + \beta_2 VALUE_i
\]

(3)

where:
- \(i = 1, 2, \ldots, 407\) : Individuals that responded to question RB in the BCS
- \(RB = \begin{cases} 
1 & \text{if individuals reported} \\
0 & \text{if individuals did not reported} 
\end{cases}\) : Reported Burglary

\(^{[1]}\)The Gini index is a measure of income inequality. Zero means perfect equality (everyone has the same income) and 100 means perfect inequality (one person has all the income, everyone else has nothing).
\[
INS = \begin{cases} 
1 & \text{if individuals were insured} \\
0 & \text{if individuals were not insured} 
\end{cases}
\text{: Insurance}
\]

\[VALUE \text{ : What was the total replacement value of what was stolen (in Sterling Pounds).}\]

As shown the dependent variable is a dichotomous variable that can take a value of 0 or 1 and thus for estimation purposes we used a Logistic regression model.

### 3 Hypotheses

Returning to the cross-national study, there is plenty of empirical evidence of a positive link between deprivation and crime, with more crime occurring in poorer districts of a country. Indeed recorded crime rates are one of the principal components of measures of deprivation such as the Index of Multiple Deprivation used in the UK. There is a bit of a complication here however. Our conjecture thus far has been that rising income levels produce two conflicting effects.

Higher income levels may result in a higher proportion of the offences committed being captured in the recorded crime data. For example if people become more inclined to insure losses or face greater financial losses associated with crime as their incomes rise then their propensity to report any particular offence might increase. But these same higher income levels should be producing a lower underlying crime rate, and thus be reflected in declining victimisation rates[6]. The volume of underlying crime (and thus the proportion of a sample we would expect to have been victimised), particularly property offences, we might expect to be quite sensitive to economic conditions. At times of unusually high unemployment, or in areas where deprivation is high, 'economic necessity' may drive the economically disadvantaged to offend. These pressures, and the possibly related 'social exclusion' effects, may be somewhat similar in their effect, leaving a group of people who for various reasons feel they have little stake in conforming with the law.

The net result is that the relationship between recorded crime levels and income per capita is ambiguous; its direction will depend on the strength of the 'better recording' impact of rising income. If the effect is strong, then the recorded crime and victimisation measures may be moving in opposite directions. If the effect is weaker, both may be falling although we would still expect the crime multiplier to be declining with income. As income rises we expect the number of victims to fall while the number of recorded
crimes will rise, possibly (but not necessarily) by an amount sufficient to offset the fall in the number of victims.[16]

There are variables other than income that we would expect to play a role. Increases in the number of police per capita will tend to reduce the delays and frustrations a citizen experiences when reporting a crime. An increasing density of police may also result in an improvement in detection ratios and this may act as a further incentive to the reporting of crime, since it improves a citizen’s prospects of their crime being resolved and their receiving some amount of compensation as a result. So increases in the number of police per capita we would expect to increase the proportion of offences being reported, other things equal. Income inequality is another possible influence on the reporting propensity[11]. The conjecture here is that lower levels of inequality will occur in countries where there is more concern for the possible losses to other people if a crime goes unreported. The greater ‘social solidarity’ is associated with a higher proportion of offences being reported, and thus with a higher crime ratio or, conversely, a lower multiplier.

Supporting evidence from the BCS illustrates the decision of reporting crime based on monetary outcomes such as insurance and total value of replacement of the property. We believe that if individuals are covered there is an incentive to report the crime, and we expect a positive relationship between insurance and reporting. The higher the value of the replacement the higher the probability of reporting.

4 The Data

We have used reported crime data published by WODC in 2006 in the European Sourcebook of Crime and Criminal Justice Statistics. This gives information for 35 European countries on offences per 100 000 population between 2000 and 2003. We have incorporated into the database figures on GDP, unemployment, Gini Index and a measure of victimisation from the ICVS that reports victimisation in the year preceding the survey (percentage victimised once or more). We selected recorded crime for only those 18 countries included in the victimisation survey in order to match the two sources. Unfortunately, of the 18 countries in the ICVS, data are missing for three countries in the WODC recorded data. We are focusing only on domestic burglary.

The descriptive statistics for recorded crime in 2003 are:

The great variability in rates across countries is due in part to the fact
that countries differ radically in their recording systems. The descriptives for the victimisation percentage presented in the next table (2) show the substantial difference in findings from the two victim surveys on which we rely. The ICVS survey finds much higher rates over a 5 year window than over the 12 months prior to survey. There is a significant difference in the proportion reporting victimisation as between the ICVS and ESS 5 year findings, suggesting the responses involve different wording of questions or that one is asking about individual victimisation and the other about household victimisation.

Table 1: Descriptive Statistics for Recorded Crime 2003 Source: WODC

<table>
<thead>
<tr>
<th>Country</th>
<th>Domestic Burglary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>165</td>
</tr>
<tr>
<td>Belgium</td>
<td>674</td>
</tr>
<tr>
<td>Denmark</td>
<td>628</td>
</tr>
<tr>
<td>Estonia</td>
<td>481</td>
</tr>
<tr>
<td>Finland (MIN)</td>
<td>142</td>
</tr>
<tr>
<td>France</td>
<td>360</td>
</tr>
<tr>
<td>Germany</td>
<td>261</td>
</tr>
<tr>
<td>Hungary</td>
<td>193</td>
</tr>
<tr>
<td>Ireland</td>
<td>411</td>
</tr>
<tr>
<td>Italy</td>
<td>298</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>339</td>
</tr>
<tr>
<td>Poland</td>
<td>169</td>
</tr>
<tr>
<td>Portugal</td>
<td>210</td>
</tr>
<tr>
<td>Sweden</td>
<td>193</td>
</tr>
<tr>
<td>UK: England &amp; Wales (MAX)</td>
<td>762</td>
</tr>
<tr>
<td>Mean</td>
<td>352.40</td>
</tr>
<tr>
<td>Std</td>
<td>200.50</td>
</tr>
</tbody>
</table>

Table 2: Descriptive Statistics for Victimisation Rates Source: ESS

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage Victimised</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICVS one year previous</td>
<td>18</td>
<td>0.70</td>
<td>3.30</td>
<td>1.66</td>
<td>0.73</td>
</tr>
<tr>
<td>ICVS 5 years previous</td>
<td>18</td>
<td>3.50</td>
<td>13.60</td>
<td>7.75</td>
<td>2.99</td>
</tr>
<tr>
<td>ESS 5 years previous</td>
<td>17</td>
<td>9.31</td>
<td>34.27</td>
<td>22.47</td>
<td>6.35</td>
</tr>
</tbody>
</table>
The differences are clearly seen on the following graph (4):

Figure 4: Percentage Victimised once or more in the last 5 years (ESS vs ICVS)

We are using annual recorded crime data and victimisation data that refer to the year preceeding the survey published by ICVS also because this data is weighted and balanced.
5 Empirical Results

Using the cross-country recorded data from Table (1) and victimisation data from Table (2), the following relationship was found to be significant:

\[ CR_i = -0.78 + 0.0000162 GDP_{PC}i - 0.0009155 POLICE_{PC}i + 0.034 GINI_i \]

\[ (0.28) \quad (3.36(e - 06)) \quad (0.000212) \quad (0.008) \]

\[ n = 14 \]

\[ \text{log likelihood} = 11.7 \]

The income, police per capita and Gini Coefficient variables are all significant at the 5% level and the overall fit is satisfactory also. The size of the effects is relatively small but the sample size is very modest. The results estimated with MLE are based on the Tobit Model specified in equation (1). The effect sizes estimated with OLS (2) are smaller but remain significant at 5%.

\[ CR_i = -0.48 + 0.0000129 GDP_{PC}i - 0.0007981 POLICE_{PC}i + 0.027 GINI_i \]

\[ (0.26) \quad (3.30e - 06) \quad (0.002452) \quad (0.0080766) \]

\[ n = 14 \quad R^2 = 0.66 \]

Both estimation procedures are consistent and have the expected signs. An increase in the number of police officers per capita, however, appears to have a negative effect on the Crime Rate (the proportion of offences reported). A positive impact of the Gini Index means that the more unequal is the society the higher the Gini index and the higher the crime rate. And last the GDP per capita where the effect is ambiguous empirically the estimate shows a positive impact.

It is noticeable that the results remained the same when we use another measure of income inequality, namely the ratio of total income received by the 20% of the population with the highest income (top quintile) to that received by the 20% of the population with the lowest income (lowest quintile). Income must be understood as equivalised disposable income. The results applying MLE are:

\[ CR_i = -0.40 + 0.0000157 GDP_{PC}i - 0.0008695 POLICE_{PC}i + 0.1401484 INEQ_i \]

\[ (0.23) \quad (3.65e - 06) \quad (0.0002304) \quad (0.0375833) \]

\[ n = 14 \]

\[ \text{log likelihood} = 10.38 \]
And the results through OLS are:

\[ CR_i = -0.19 + 0.000126GDP\_PC_i - 0.0007658POLICE\_PC_i + 0.11INEQ_i \]

\[ (0.21) \quad (3.59e-06) \quad (.0002627) \quad (0.037) \]

\[ R^2 = 0.6060 \]

\[ n = 14 \]

Again both estimations are consistent with our hypothesis and consistent among themselves all significant at 5% significance level.

The other component of our empirical work involves analysis of data at individual survey respondent level within a single country. Using individual level data from the British Crime Survey we use a logistic regression model to explore the decision by all burglary victims as to whether to report the offence to the police.

The evidence from the BCS shows that indeed reporting is influenced by whether the victim’s loss is insured and the total value of replacement of the property. The results using Logistic Regression are:

\[ RB_i = -0.028 + 0.878INS_i + .002VALUE_i \]

\[ (0.152) \quad (0.230) \quad (0.000) \]

\[ n = 407 \]

\[ Pseudo \ R^2 = 0.288 \]

Slopes are significant but intercept is not. The evidence shown by the sample allows us to say that Reporting Domestic Burglary is explained by the fact that individuals are insured and the value of the property stolen, but the overall significance of the model is poor revealing that there are missing variables that contribute to the decision of whether or not individuals report.

6 Applications and Implications

A measure of the volume of crime is a pre-requisite of efforts to estimate the costs of crime, which in turn are vital for estimating the value of delivering reductions in crime. In some cases the average costs of crime are measured by averaging the gross costs of an offence type over the number of such offences. In other cases costs are estimated for a single offence and then aggregated to derive total costs for the offence type. In either event, lack of
a reliable indicator of the total number of offences (reported plus unreported) can potentially be misleading.

It is, of course, an implication of our findings on the variability of the multiplier that recorded crime rates are not a good basis for deprivation measures: a victimisation rate should be a more reliable guide. We note a further implication, namely that any measure of deprivation that relies on recorded crime rates will obscure changes resulting from changes in crime reporting behaviour. These changes seem to be systematic rather than random and also to be related to income levels. In addition if there is a tendency for the degree of under-reporting of offences to be higher in poorer areas then use of recorded crime rates will tend to bias the estimation of deprivation index numbers.

7 Conclusions

We have demonstrated in this paper that the relationship between recorded crime rates and criminal victimisation rates cannot be characterised adequately as a fixed ratio that is independent of other influences such as income levels. The decision to report crime is a significantly costly one for the victim and, a fortiori, for a witness. The high proportion of offences going unreported is adequate testimony to the fact. In work elsewhere we explore the theoretical basis for modelling the reporting decision in greater depth. For present purposes it is sufficient to note that there are systematic variations on a sufficient scale to make it worth exploring the possible influences.

Although the cross country model is statistically significant the sample size is relatively small so we are loathe to draw inferences about the underlying population parameters. Its purpose is mainly to illustrate the relationship between income, police per-capita and inequality with the crime ratio. Our supporting evidence based on individual level data shows that indeed crime reporting is related to the insurance status of loss and to the total value of the property. Further research is warranted on the differences between reporting and recording across offence types. We believe that in any type of offence victims face a trade-off between the benefits from reporting and the costs of doing so. For offence types where the benefits and costs are not captured well by monetary values there remains scope for further investigation of the relationship between offence seriousness and the reporting outcome.
8 References

References


[18] UNICRI, International Victim Survey 2005
