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Title: **Measuring crime in place: distinguishing between area victimization versus area offences**

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Introduction

We have become accustomed to the regular reporting of crime statistics. In the UK, the Office for National Statistics (ONS) releases quarterly updates on trends in crime as part of its official statistics remit summarising the latest police recorded crime data and Crime Survey for England and Wales (CSEW) estimates. These figures are frequently seized upon by the government of the day and interested commentators to support the latest crime reduction initiative or tough on crime rhetoric, whilst the same figures are used by critics as evidence of failings in the current law and order approach. These data are also widely employed in academic research and policy evaluation. For example, police recorded crime figures are a central component of the police funding formula to determine the budgets allocated to each police force and have also been used as a justification to increase stop and search powers in England and Wales[i], whilst crime survey data is repeatedly leveraged to highlight the existence of a substantial amount of crime that goes unnoticed by the police[ii]. Yet whilst crime data is near ubiquitous in its presence in government, policy, media and academic debates what is less well understood is how difficult it is to measure crime accurately.

Measuring crime

The primary source of information on the extent of crime is police recorded crime data. Each incident that police attend is subsequently classified as criminal or not, with a set of standardised counting rules used to categorise them. Police forces have a statutory duty to then publish this information monthly, with the data collated by ONS for all 43 Police Forces in England and Wales. The data is made available for public use at a high degree of spatial granularity (albeit restricted to comparatively broad offence categories and applying geomasking techniques to prevent spatial disclosure), with more granular offence-codings available at broader spatial scales.

Whilst the accessibility and versatility of police data has allowed its usage in different contexts, it has also been subject to criticism due to the presence of measurement error resulting from the combined influences of victims' under-reporting and inconsistences in

recording practices between and within police jurisdictions. High profile examples of police undercounting have further damaged the veracity of police recorded crime statistics, leading them to lose the official statistics designation in 2014.

Crime survey data, on the other hand, is frequently used to obtain 'unbiased' estimates of crime and to better understand the nature of victimisation. Typically based on victim reports of the incidents that they have experienced in the previous 12 months, crime surveys rely on sampling theory to generate reliable estimates of the overall prevalence of crime. These surveys have repeatedly demonstrated the presence of the so-called 'dark figure' of crime - a substantial gap in the coverage of police records with many events remaining unreported ~~either because of a reluctance to contact the police,~~ and others reported but seemingly absent from official records. Crime surveys also routinely collect information surrounding the nature of each incident, the victim, and their recollections of the offenders. This has enhanced our understanding of the links between deprivation and victimisation, the impacts of domestic and acquaintance violence, and highlighted how some individuals can experience repeated, and sometimes chronic, victimisation. More recently, advances in small area statistics have enabled researchers to explore the spatial dynamics of criminal victimisation at comparatively small scales, demonstrating variations in the magnitude of the dark figure of crime across neighbourhoods with substantially more under-coverage in some small geographic areas than others.

However, survey-based crime data are not error-free. Like any other sample-based survey, crime surveys are affected by selection as well as measurement errors arising from the data collection process. This may include the effects of poor question wording, limitations with the questionnaire design, as well as inadequate training of survey personnel, sampling bias and non-response bias. Crime estimates also suffer from unique errors arising from victims' memory failures, social-desirability bias, and underestimation or exaggeration of incidents, together contributing to systematic bias and low reliability. The sample itself is also frequently criticised, failing to capture the most vulnerable members of society who are also the most likely to be victimised. Lastly, crime surveys are necessarily limited in their focus on crimes where there is an easily identifiable victim who is available to report on the incident, i.e. failing to capture much of fraud and more recent forms of cybercrime, and all of homicides.

Even accepting that crime surveys can typically provide us with a more comprehensive (albeit still error-prone) picture of the extent of the crimes that they cover, there is a further problem with existing survey-based measures that is becoming increasingly

salient as researchers look to leverage crime survey data to estimate crime at more fine-grained spatial resolutions: the possibility of spatial misclassification errors. This, in turn, leads to criminal incidents being attributed to the wrong geographic location. Whilst this is unlikely to be a problem when interest is in understanding the extent of crime at a national or regional level, it may significantly hinder understanding of the spatial distribution of crime in local neighbourhoods. In a recent article[iii] we assessed this issue using a unique dataset that measured incident location in multiple ways.

Understanding crime location

Estimates of crime in geographic areas derived from surveys tend to be based on the places where victims live ('area victimisation rates'), not the places where crimes happen ('area offence rates'). Survey questionnaires rarely probe victims of crime about the specific place where crimes occur, and when they do they simply ask respondents whether it took place in the local area or place of work, or whether it happened in certain types of places (e.g., supermarket, around a pub, car park). Information about the address, coordinates or neighbourhood where each incident happened is not included in surveys. This is an important omission, with research suggesting that at least 1 in 4 victimisation incidents occur outside of victim's neighbourhood of residence[iv], and perhaps as many as 60%[v].

The precise reasons for not attempting to capture offence location are unclear, but it is likely to result from concerns about the accuracy of respondent recall and the additional administrative burdens of coding offence locations. It also reflects the original aim of crime surveys to provide a corrective for national crime estimates from police data, where distinctions between victim residence and offence location are inconsequential. However, as attention has turned to differences in crime risk at the local level, it has complicated efforts to compare and combine the estimates of crime from police and survey data. While survey-based estimates of area victimisation rates may provide valid measures of household crime in residential neighbourhoods, they likely fail to accurately estimate non-residential crimes such as personal theft and robbery.

One obvious way forward is to directly ask victims where the incident took place, rather than relying on home residence as proxy for location. This has recently been trialled in the Barcelona Victimisation Survey, which includes a question probing respondents about the precise location where crime incidents take place. Specifically, respondents were asked to *"Please, write down the street where it happened. We need to know the nearest possible*

street which crosses the place where it happened, or at least a nearby reference point to locate the neighbourhood where it happened. Enter the street and building number, or a nearby place or intersection of streets", enabling survey administrators to code the specific location of the crime event (or at least the general neighbourhood when specific places could not be located). The survey also includes standard items about the victims' neighbourhood of residence and whether crimes are reported to the police, giving us a unique opportunity to compare the magnitude of potential errors arising from estimating offence rates using victim location data.

We assess whether victim-residence or offence-location questions show better measurement properties as a measure of crime across geographic areas. We look separately at violence and property crime, further distinguishing between household and personal property offences. We also examine the effect of restricting the focus to the subset of offences that are reported to the police, providing a more direct comparison with police recorded crime figures. Crime is therefore measured in 4 different ways:

- **Victim residence**: crimes suffered by the residents of a neighbourhood during the last 12 months.
- **Offence location**: crimes that took place in a neighbourhood (suffered by residents and non-residents) during the last 12 months.
- **Victim residence (reported)**: crimes suffered by the residents of a neighbourhood during the last 12 months that were reported to the police.
- **Offence location (reported)**: crimes that took place in a neighbourhood (suffered by residents and non-residents) in the last 12 months that were reported to the police.

We use statistical models to understand the quality of survey-based crime statistics in neighbourhoods by comparing them to measures of crime recorded by the police over the same six-year period.

Findings

All four of the survey-based estimates of crime identifies the highest levels of crime in the city centre and 'old quarter'. This is consistent with the picture from police recorded

crime data and corresponds to the expectations of routine activities theory which predicts that crime will be concentrated in those locations where there is the highest number of people and the greatest opportunities for offending. Importantly, however, the offence location estimates have a higher correlation with police records than victim location estimates, and also exhibit a more similar geographical distribution across the wider suburbs of Barcelona (Figures 1 and 2). In particular, victim residence measures tend to overestimate crime rates in some residential areas outside the city centre. This is likely because many victims live in these residential neighbourhoods but suffer crimes when they travel to more central areas. We observe a closer correspondence between the different survey estimates when household/vehicle property offences are considered. This is most likely to reflect the high proportion of these offences that occur within the victim's residential location (70.9% of property household/vehicle offences happened in the area of residence, compared with 53.9% of violent crimes and 30.7% of personal property offences).

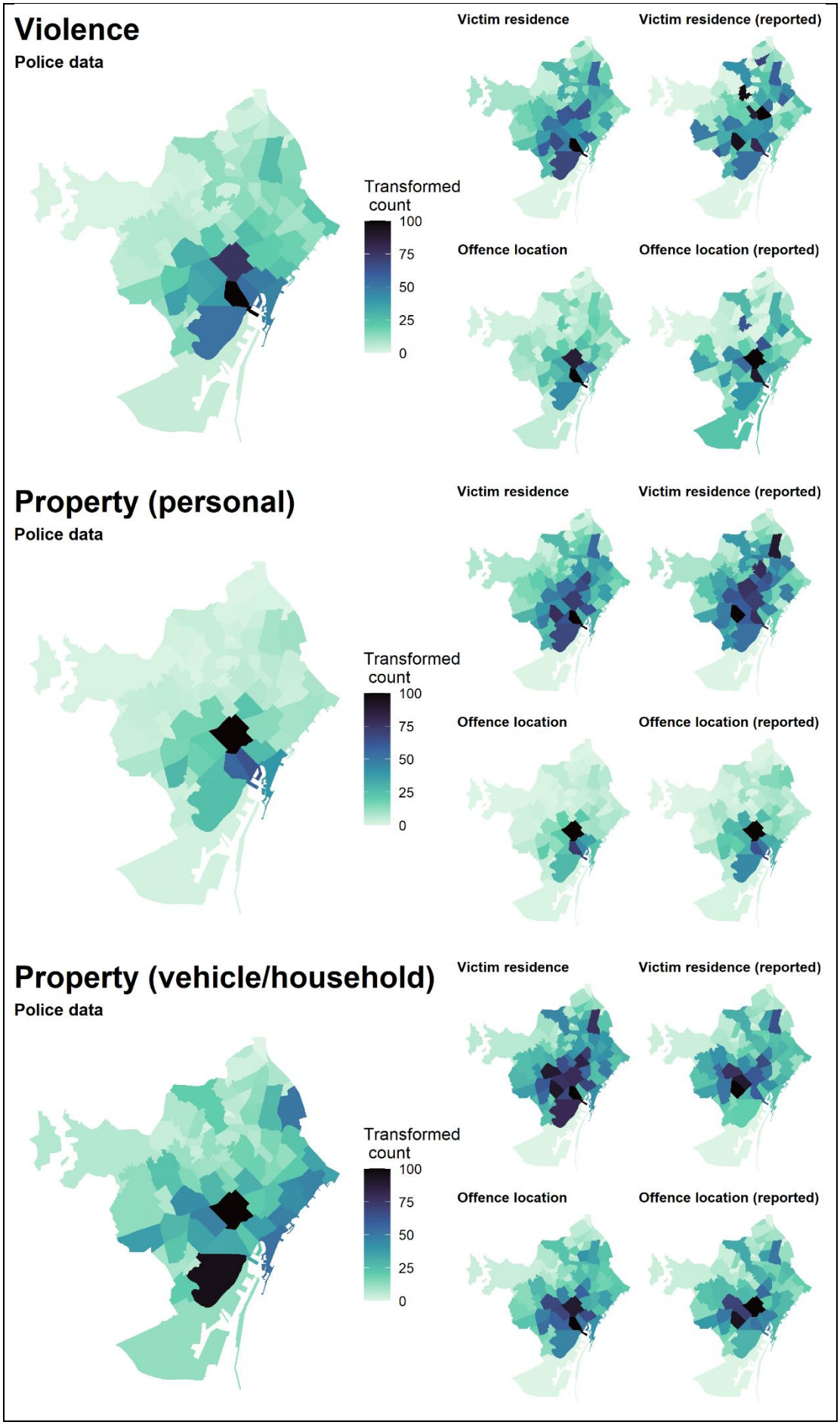
Violence
Police data
Victim residence
Victim residence (reported)
Transformed count
100
75
50
25
0
Offence location
Offence location (reported)
Property (personal)
Police data
Victim residence
Victim residence (reported)
Transformed count
100
75
50
25
0
Offence location
Offence location (reported)
Property (vehicle/household)
Police data
Victim residence
Victim residence (reported)
Transformed count
100
75
50
25
0
Offence location
Offence location (reported)

Fig. 1. Estimates of crimes in neighbourhoods from police and survey data (2015 – 2020)

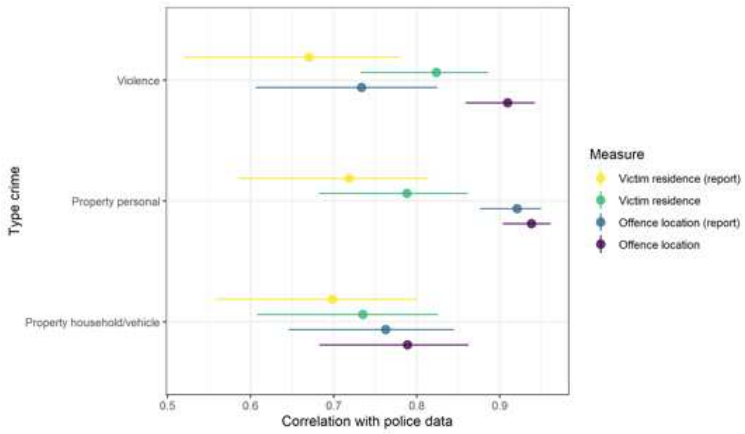

Figure 2. Correlation between police estimates and the four different ways to calculate crimes

The improvements in the correspondence between police recorded crime and survey data that result from asking about offence location do not come at the expense of data quality. Instead we find similar reliability coefficients (i.e., consistency in reporting) across the measures of offence location and victim residence for the three crime types across the six years of data collection (Figure 3). Estimates of violent crimes, however, have lower overall reliability irrespective of the measurement approach.

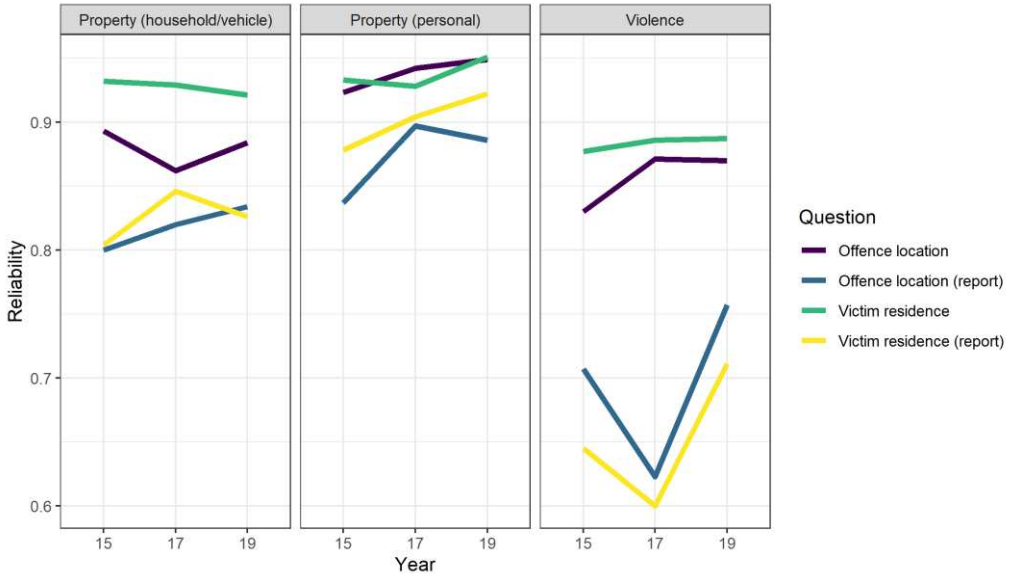

Fig 3. Reliability estimates by topic, type of measure and year

Perhaps surprisingly, 'correcting' the measures of crime by restricting them only to those crimes that were reported to the police actually leads to *lower* correlations with police data and *lower* estimated reliability coefficients. This is true both for the location- and residence-based measures. The precise reason for this is not clear. It may be that we have introduced other types of measurement error by including information on whether or not incidents were reported, such as memory effects and social desirability. Existing research has also identified a range of factors that impact on the willingness of individuals to report crimes to the police, including prior victimisation, offence severity, fear of reprisal, and assessments of a lack of police legitimacy. These may be unevenly distributed across neighbourhoods in Barcelona, contributing to the modest divergence from police recorded crime figures that we observe when we take reporting practice into account. Yet whilst the reported crime estimates exhibit lower reliability, overall validity - the proportion of variance attributed to the crime type (rather than the way of asking the question or random error) - is actually *highest*. This improvement is marginal when personal property offences are considered, but comparatively large for property offences. Validity also tends to be higher amongst offence location measures.

Conclusions

Taken together, these results indicate that there are potential gains to be obtained from using measures of offence location instead of victim residence. Area based crime estimates can be produced that, more closely reflect the spatial distribution of recorded crime data, which in turn can be used to better understand the ecological drivers of crime and provide a more accurate understanding of differential reporting practices across local areas. Importantly, these gains are achievable with apparently minimal impact on the reliability and validity of estimates.

We do not find evidence of bias (e.g., from memory loss and non-recall) when asking victims about the place where crimes happened. Or at least we do not find that these potential issues are more problematic in measures of crime location than victim residence measures. This is observed not only when analysing crimes that tend to happen outside the area of residence (property personal and violence), but also when analysing property household and vehicle crimes that happen in victims' area of residence to a larger extent. As a result, it seems clear that larger national crime surveys, such as the Crime Survey for England and

Wales and the US National Crime Victimization Survey should include measures of offence location in future waves.

Whilst this would undoubtedly result in a small increase in costs associated with the coding of offences to specific locations, the lack of a quality trade off from this approach suggests that the gains for researchers and policy makers to develop new techniques to estimate crime in place are substantial.

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