IS VIOLENT CRIME INCREASING OR DECREASING? A NEW METHODOLOGY TO MEASURE REPEAT ATTACKS MAKING VISIBLE THE SIGNIFICANCE OF GENDER AND DOMESTIC RELATIONS

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The fall in the rate of violent crime has stopped. This is a finding of an investigation using the Crime Survey for England and Wales, 1994–2014, and an improved methodology to include the experiences of high-frequency victims. The cap on the number of crimes included has been removed. We prevent overall volatility from rising by using three-year moving averages and regression techniques that take account of all the data points rather than point to point analysis. The difference between our findings and official statistics is driven by violent crime committed against women and by domestic perpetrators. The timing of the turning point in the trajectory of violent crime corresponds with the economic crisis in 2008/09.

Keywords: crime, violence, domestic violence, gender, Crime Survey for England and Wales, high-frequency victims

Introduction

Is violent crime increasing or decreasing? From the 1960s, crime has increased in Europe and North America; but since the mid-1990s, crime dropped (Blumstein and Wallman 2006; van Dijk *et al.* 2012); indeed, there are claims of a long-run fall in violence in Europe (Elias 1994 [1939]; Pinker 2011; Eisner 2014). Numerous theories have been applied to the crime drop and found wanting (Farrell *et al.* 2014). There are exceptions to the crime drop; some of these have been linked to gender and domestic relations. There are questions as to whether the crime drop has been resilient to the financial and economic crisis starting in 2008 since many of the studies of the crime drop do not include this most recent period. So, taking into account the most recent evidence, and differentiating by gender and domestic relations, the question this paper addresses is whether the rate of violent crime is rising or falling.

The analysis of the gender dimension of violent crime has largely taken place in a specialist field relatively separate from that of mainstream criminology (Walklate 2004). Much criminology that addressed the crime drop has written little about gender (Sharp 2006); analyses of gender-based violence or violence against women have rarely addressed changes over time, though with important exceptions. However, since several of the empirical caveats to the crime drop are gendered, so too might be its theoretical implications. We consider the implications of mainstreaming gender into the analysis of violent crime, rather than treating it as a separate field of domestic violence or violence against women.

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In this context, we investigate the changes in the rate of violent crime captured by the Crime Survey for England and Wales (CSEW) (covering 89 per cent of the UK population) and disaggregate these by the gender of the victim and the relationship between the perpetrator and victim. We use survey data rather than police recorded crime data since so many people do not report their violent victimization to the police. We draw data from the CSEW, a world-leading survey in its quality, long runs of data, large sample size and national representativeness. CSEW data can also be disaggregated by gender and domestic relations.

Investigating changes in the rate of violent crime is methodologically challenging. The repeat nature of domestic violence makes it hard to measure (Ellingworth *et al.* 1995; Farrell and Pease 2007; Farrell and Pease 2010), especially the experiences of those relatively few people who suffer large numbers of repeat offences. Small numbers of individuals who experience high frequencies of victimization are particularly problematic because of the volatility this can introduce when assessing changes over time. The conventional approach has been to ignore or 'cap' the frequency of victimizations of this group in order to avoid this problem. However, this is unsatisfactory because it omits a significant aspect of victimization. Thus, there appears to be a tension in the production of official crime statistics between two goals: accurately assessing the year on year changes in the rate of crime and accurately reporting the extent and distribution of violent crime victimization.

This paper offers rigorous empirical investigation of changes in violent crime. We use data from the CSEW Victim Form module over the period 1994–2014. This is more recent than most of the studies that have addressed the crime drop. We offer a resolution to the methodological challenge of simultaneously analysing the full extent of violent crime reported to the survey to model the underlying trend by using three-year moving averages of all reported crimes to deal with volatility, rejecting the current methodology that arbitrarily caps the number of crimes reported by each respondent that count towards estimated crimes rates at five, thereby improving on the current (2015) Office for National Statistics (ONS) methodology for estimating violent crime (under review ONS 2015d). We present new analysis of changes in the rate of violent crime since 1994. We identify the subsets of the victimized population that are most affected by these changes. By making visible the high frequency of violent crime against some victims, we make visible the gender and domestic relations in changes in violent crime. We provide a comparative analysis of changes in the rate of violent crime against women and men and by perpetrators that are domestic relations rather than acquaintances or strangers. These new analyses challenge the ubiquity of the drop in violent crime, with implications for the theoretical link between economic inequality and crime, the security hypothesis and the integration of gender into mainstream criminology.

Changes in Violent Crime: Substantive, Theoretical and Methodological Issues

Rising and falling crime rates

Is crime rising or falling? There are accounts of both decreases and increases in crime and with different levels of generality. Exceptions to general trends have been identified, concerning particular countries, categories of victims and perpetrators and sources of data.

Crime (both property and violent crime) has appeared to be falling since the mid-1990s. This 'crime drop' was identified in the United States (Blumstein and Wallman 2006), the United Kingdom and elsewhere in North America and Europe (van Dijk *et al.* 2012; Humphreys *et al.* 2014). The crime drop was a surprise to many criminologists, accustomed to a rising crime rate from the 1960s to the early 1990s. Grove *et al.* (2012: 183) noted: 'The crime drop in England and Wales was unexpected and unprecedented'. The ONS (2014a) commented on the CSEW in 2014: 'This latest estimate is the lowest since the survey began in 1981. . . . and is 60% lower than its peak level in 1995'. However, to some historical sociologists, the fall in violent crime was not unexpected, but a reversion back to a long-term trend of falling violence over several centuries in Europe (Eisner 2014). From this perspective, the 1960s–1980s was a historically brief interruption to the decline (Pinker 2011).

There are exceptions to the crime drop in particular countries. Within the EU, while police recorded rates of crime between 2003 and 2012 fell in the majority of Member States, police recorded crime increased in Luxembourg, Slovakia, Italy, Hungary, Sweden, Spain and Belgium, and police recorded violent crime increased in Estonia, Luxembourg, Sweden, Denmark and Finland (Eurostat 2014). Within the United Kingdom, while crime dropped in Scotland and in England and Wales, the rate in Northern Ireland was flat (Eurostat 2014). There are also indications that the crime drop might apply to some social categories of victims and perpetrators rather than others, though these vary by data source. According to the CSEW self-completion module (ONS 2014b), there are no significant changes since 2004 in the prevalence rate of 'intimate violence' (domestic violence, sexual assault and stalking). But according to the published findings of the CSEW Victim Form module (ONS 2013b: Table A1), a fall in domestic violence, from 1,166,000 violent crimes in 1993 to 289,000 in 2010, has ceased, being replaced by a flat or upward trend (398,000 in 2013). Further, the number of police recorded rapes (29,265) and other sexual offences (58,954) in 2014/15 reached the highest level since 2002/03 (ONS 2015a). Though it is hard to disentangle a 'real' increase from an increase in reporting or recording (Home Office, Ministry of Justice and ONS 2013; ONS 2015b), survey data are generally regarded as more reliable because these are less influenced by changes in police administrative practices.

Theoretical issues

The changing rate of violent crime has implications for theories of violence, including: crime increases with inequality; violent crime decreases with the long-term pacification of society; variations in crime are linked to situational factors. Each of these theoretical frameworks can be informed by gender issues but often has not been. Crime theory needs to be able to address two challenges: the timing of changes (Farrell *et al.* 2014) and the exceptions including divergences in gendered rates.

Increased inequality generates higher rates of violent crime. This thesis, drawing on the heritage of Merton (1938) concerning structural strain, developed by writers from Agnew (1992) to Young (1999) and supported by empirical evidence from many studies (Chiricos 1987; Hsieh and Pugh 1993; Pratt and Cullen 2000), is a major framework within which variations in violent crime are theorized. The timing of the drop in crime in Europe and North America during a period of rising inequality appears to challenge this thesis. There has been speculation as to whether the economic crisis, starting in a

financial crisis in 2007 and cascading through the real economy, unemployment and austerity, has affected the rate of crime. Since most of the published studies on changes in the rate of crime use data from before the economic crisis, this remains a question yet to be fully addressed. The gendered pattern of the perpetration of violent crime, in which the more advantaged assault the more disadvantaged (Johnson 1995), also challenges the conventional direction of the thesis. However, gendered inequalities may be intricately linked to gendered violence in ways that might support a revised version of the thesis linking inequality to violence.

The long-term pacification of society means lower rates of violent crime. This thesis, drawing on the heritage of Elias (1994 [1939]), links a long-term decline in the rate of violence to the development of the state and modernity that leads to an increase in self-control, which is associated with less violence. The thesis is rearticulated in revised form by Pinker (2011) and supported with evidence on the development of European society over several centuries (Eisner 2001; 2014). The long-term decline is potentially consistent with a range of criminological theories, including those that focus on the importance of self-control in reducing crime (Gottfredson and Hirschi 1990), those that emphasize the significance of a strong criminal justice system (Durlauf and Nagin 2011), as well as those that focus on justice and economic development (Fajnzylber *et al.* 2002). The thesis is challenged by the increase in violent crime from the 1960s though 1990s, though Pinker argues this is due to reduced self-control due to permissiveness. The thesis neglects the gender dimension of violence, despite the empirical variation in gender-specific rates of perpetration of violence. As Pratt *et al.* (2014: 90) note, unless intimate partner violence can be included, 'self-control theory cannot assume the flavour of generality for which it was originally intended'.

Rates of crime vary with situations and the structuring of routine activities (Cohen and Felson 1979). This thesis links higher rates of crime with the repeated confluence of three elements—a motivated potential offender, a suitable target and the absence of a capable guardian. The thesis can be used to underpin analysis of the repetition of offences, which can be an important component of the total amount of crime and of its changing rate (Farrell *et al.* 1995; Farrell and Pease 2007). Once a person has been victimized, repeat victimization may follow from the situational characteristics of the victim (flags) or from the increased knowledge of the perpetrator of vulnerability (boosts) (Tseloni and Pease 2003; Hope and Trickett 2008). While in the first two frameworks, the explanatory force focuses on perpetrators rather than victims in this third framework the focus equally concerns the security of victims, thereby opening a theoretical route to including the social position of victims within explanations of variations in rates of violent crime. The thesis is challenged to move beyond local variations to account for larger trends in the rate of crime, although Farrell *et al.* (2011) develop this approach into a theory of the crime drop centred on the significance of the increased securitization of cars for other crimes. There is little work explicitly within this tradition that adequately encompasses gender.

Gender is rarely profiled within major criminological frameworks (Sharp 2006), despite the significance of this work (Johnson 1996; Walklate 2004). Gender-based violence is sometimes constructed as a separate field of enquiry, though the notion that gendered violence has a distinctive aetiology (Felson and Lane 2010) is contested. The theoretical framework focused on the implications of economic inequality for violent crime can be gendered in different ways, including linking: variations in gender

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inequality to variations in violence against women (Brush 2011; Khalifeh *et al.* 2013); variations in intra-household inequality to variations in domestic violence (Kalmuss and Straus 1982); and variations in gender-specific unemployment rates to variations in domestic violence (Anderberg *et al.* 2014). Some studies suggest that declines in gender inequality reduce domestic violence (Farmer and Tiefenthaler 2003) by reducing domesticity and increasing women's status and resources (Dugan *et al.* 1999), though others find complex and divergent effects (Pridemore and Frelich 2005; Kangaspunta and Haen Marshall 2012).

The analysis of the gender dimension needs to be more nuanced than a simple claim about a link between gender inequality and gender-based violence against women. It needs to specify the precise forms of inequality, the gendered groups affected, the situations, contexts, practices and mechanisms involved. It needs to distinguish between the gender of the victim and the gender-saturated contexts, such as domestic relations, in which gender-based violence occurs.

The theoretical framework focused on situational factors and routine activities can be gendered. Leaving violent households can reduce domestic violence, although some perpetrators continue to pursue their victim. Whether victims leave after a single incident or only after many generate different patterns of domestic violence (Johnson 1995). Different levels of access to the resources necessary to leave a household and set up another are a source of variance, which depends on wider gender inequalities and specific contextual factors. During adverse economic circumstances, violent relationships may be slower to break up than when there is easier access to the resources to establish a new household (Kneal *et al.* 2014).

It is possible that gender intersects with economic inequality to generate increased situational vulnerability to violent crime, especially domestic violent crime. The financial crisis of 2007/08 led to a crisis in the 'real economy' by 2009: this increased unemployment and decreased income levels. While employment had recuperated to pre-crisis levels by 2012, income levels had not (ONS 2013d). From 2010 there were cuts to government public expenditure, which disproportionately reduced the income to women compared to men as a consequence of changes in taxes and benefits (House of Commons Library 2010). Cuts to public expenditure led to reductions in national and local budgets for some domestic and sexual violence services and for financial support in accessing legal advice (Walby and Towers 2012). Reductions in income for women and households and in specialized services may reduce the ability of women to exit violent households with consequences for the rate of domestic violent crime.

Measurement challenges

There are challenges in the methodology and measurement of violent crime. There are different units of measurement, including 'victims' and 'crimes'. There are different sources of data, including survey and administrative data. There are relatively few people who experience a large number of repeat victimizations, so including them in estimates from survey data without introducing bias is challenging. There is tension between the two goals of official crime statistics: accurately reporting the extent, nature and distribution of crime victimization and accurately assessing changes in the rate of crime.

What is violent crime?

Violent crime is conventionally addressed using the official definition of 'violence against the person' that focuses on assaults with and without injury (Home Office 2015). ONS (2014b: 2) analysis of the CSEW uses this definition of violence against the person (and excludes threats, robbery and homicide). While sexual offences are not included in this official category of 'violence against the person', many domestic violence researchers use a broader definition of violence, which includes sexual crimes. Sexual crimes (rape, attempted rape and sexual assault) are therefore included, following Walby *et al.* (2014).

There is an issue as to whether threats and other non-physical forms of coercion are to be included in the category of violent crime. These acts are not included in ONS counts of 'violence against the person' in its reporting on the CSEW. They are not included here because the mainstream category of 'violent crime' is the focus of this paper and our main point of comparison is ONS published findings from the CSEW.

There is simultaneously in use a definition of 'domestic violence' that includes non-physical forms of abuse. For example, the UK Government defines domestic violence as including both violence and abuse (non-physical actions, including emotional and psychological abuse) and sexual violence, honour violence and female genital mutilation (Home Office 2013). There is incompatibility between the definitions of 'violence' in the mainstream category of 'violence against the person' and the specialized field of 'domestic violence'. Because our focus in this paper concerns mainstream analysis of serious violent crime rather than the specialized field of domestic abuse, we use the definition of violence used in 'violence against the person'. The implications of using the broader definition of violence that includes additional forms of coercion should be explored.

Sources of data

Sources of data on the extent of violent crime include police recorded crime statistics and population sample surveys. There are three reasons for selecting surveys: the under-reporting of violent crime to the police; the unrepresentative nature of the violent crimes reported; and the quality of the process of recording data. The majority of victims of violent crime do not report to the police and, further, this is even less likely when those crimes are committed by persons known to the victim. Hence, they are both a serious undercount and not representative of the crimes committed. Further, in the United Kingdom, the police recorded crime statistics have recently (2014) failed to reach ONS quality standards (UK Statistics Authority 2014). Crime victimization surveys have been developed to provide better estimates of crime victimization than police recorded crimes. This means the CSEW is the best source of data on violent crime (ONS 2015a).

The CSEW interviews one eligible individual from each selected household. Only permanent members of residential households are included. Temporary visitors to households, individuals in institutions such as refuges and those who are homeless are not included in the sampling frame. The CSEW asks questions about crime victimization in two ways: face-to-face via the main questionnaire and the Victim Form module and by self-completion in special modules, including one on intimate violence (domestic violence, sexual assault and stalking). The confidential nature of the self-completion

methodology produces greater disclosure of intimate violence than does the face-to-face section of the survey. Taking prevalence of domestic violent crime (violence against the person and sexual offences), the disclosure rate is estimated to be 3.8 times higher via the self-completion than face-to-face method (Walby *et al.* 2014). However, unlike the original 2001 version of the self-completion survey (Walby and Allen 2004), recent versions only measure the frequency of intimate partner violence across all abusive acts of whatever kind, including emotional and psychological acts. This makes the separation of the violent crime events impossible. In addition, the self-completion module makes no assessment of the number of non-intimate partner perpetrated violent crime such as by non-intimate family member, acquaintance or stranger. Thus, the self-completion module does not provide data from which estimates of the number of violent crimes can be made. Data on both the number of violent crimes and the number of victims are only available from the main questionnaire Victim Form module.

Victims and crimes

There are alternative units of measurement: 'victims' and 'crimes'. This matters since domestic violence is often a repeat crime (Ellingworth *et al.* 1995; Farrell *et al.* 1995). If there were one crime per victim, there would be no difference in the measures. But where the perpetrator is a domestic relation (or acquaintance) there can be multiple crimes per victim (Walby *et al.* 2014), so there is often a difference between the number of victims and the number of crimes for domestic violent crime.

Temporal changes in the number of crimes may involve changes in the number of victims or changes in the number of crimes per victim, or some combination of the two (Hope 1995). In order to understand changes in the rate of violent crime that include multiple crimes against the same person, it is important to measure the number of crimes as well as the number of victims.

The reasons underpinning the choice of the unit of measurement are not only methodological but also conceptual and theoretical. While mainstream criminology (Ellingworth *et al.* 1995; Farrell *et al.* 1995; Hope 1995) follows the police practice of counting the number of crimes, this approach is disputed by some within the domestic violence field who prefer to count the number of victims (Stark 2007). This focus on victims is linked to the concept of 'a course of coercive control', in which the individual incidents are considered less important than the course of conduct as a whole. Some specialized 'Violence against Women' surveys give priority to victims rather than incidents as the unit of measurement (WHO 2013; FRA 2014).

We consider it important to include the number of crimes since this is the category within which violent crime is debated in the mainstream policy and theoretical literature and in order to make visible the repeated nature of domestic violent crime and violent crime against women. Our analysis includes both victims and crimes as units of measurement and compares the outcomes.

High-frequency victims

Measuring the extent of repeat victimization of high-frequency victims of violence is challenging. Not only is repeat victimization (especially by the same perpetrator of the same victim) different from single victimization, some victims suffer many such crimes (Farrell *et al.* 1995; Johnson 1995; 1996). High-frequency victimization is relevant to the

distribution of the risk of experiencing crime, which can be concentrated or dispersed (Hope 1995). If concentrated, it would indicate a more extreme form of victimization, with greater adverse consequences for these victims.

The challenge of measuring the very high numbers of crimes committed against some victims has been previously identified, but not yet satisfactorily met (Ellingworth *et al.* 1995; Farrell *et al.* 1995; Farrell and Pease 2007; 2010). The difficulties in measuring repeat victimization lead to underestimates of not only the extent of violent crime but also of its concentration.

In the United Kingdom, crime frequency in the CSEW Victim Form module is assessed through the completion of up to six Victim Forms, which record the most serious crime incidents that happened to the respondent or household over the last 12 months. These incidents can either be one-off incidents or *series* incidents, which are defined as 'the same thing, done under the same circumstances and probably by the same people' (ONS 2013a: 15). On a series Victim Form, respondents can record any number of crimes in that series between 2 and 96 or 'more than 96/too many to count'.

In the United States, there is a similar process. In the early National Crime Victimization Survey (NCVS), a series form was completed if there were three or more similar incidents in a six-month reference period, being raised to six or more similar incidents in 1992 following research on respondent's ability to remember (Dodge 1987).

Capping versus all reported crimes
Although the frequency of violent crimes is recorded in surveys, published official statistics are not based on this reported data. Instead, official estimates are based on *capped* data. Capping limits the number of crimes included in official estimates of crime. Capping is applied to series events, which record multiple incidents of the same type of crime. Capping reduces the total estimated count of crimes substantially.

Capping of series crimes has been routine in most victimization surveys. In England and Wales, all series incidents have been capped at five since the survey's inception in 1982. The choice of five appears to be arbitrary (Hough and Mayhew 1983). Thus, a reported count of 24 victimizations of the same type—about one every two weeks— would be truncated to five. The US NCVS traditionally removed all series victimization reports (six or more incidents) from national estimates—in effect capping any series at zero crimes. The national survey in Mexico (Encuestas Nacionales Sobre Iseguridad) caps at five incidents (Planty and Langton 2013) while that in Canada caps at three (Nazaretian and Marolla 2013).

The justification of the cap by the Home Office, and since 2010 the ONS, has been that since the numbers of victims that experienced large numbers of crimes is relatively small, including them would increase the year-to-year fluctuations in the estimates of violent crime to an extent that is unreasonable since a priority use of the statistics is to provide an account of changes in the rate of crime over time: '[T]he restriction to the first five incidents in a series has been applied since the CSEW began in order to ensure that estimates are not affected by a very small number of respondents who report an extremely high number of incidents and which are highly variable between survey years' (ONS 2013a: 15).

However, capping the number of crimes has some negative consequences. Farrell and Pease (2007; 2010) report that capping reduces the estimated number of personal

crimes by at least a third. Walby *et al.* (2014) report that when all reported crimes in 2011/12 were counted rather than capped, violent crime increased by 60 per cent and violent crime against women by 70 per cent, noting that capping reduces some types of crimes more than others thereby introducing a skew into the distribution.

Capping in the US NCVS is discussed by Planty and Strom (2007). On the one hand, they note an 'increase in year-to-year estimate instability' if the data were not capped and identified a potential problem of over-reporting when 'respondents rely on cognitive exercises to generate a discrete number of victimizations' (Planty and Strom 2007: 197). On the other hand, they note some major disadvantages produced by capping: the estimates of victimizations are severely underestimated and 'certain groups disproportionately affected by the counting rule may be severely under-recognized as groups prone to victimization'. They concluded that series victimizations should not be excluded, stating 'A viable solution is to count the reported number of series victimizations and then to publish both incident and prevalence rates. . . . It seems more logical to trust what a respondent reports and to err in reporting this information than to dismiss it all and exclude these victimizations. Exclusion creates a larger and more serious error than inclusion' (Planty and Strom 2007: 198).

Following these discussions, Lauritsen *et al.* (2012) proposed a change in NCVS methodology. The Bureau of Justice Statistics now (since 2010) includes incidents recorded on series Victim Forms up to a maximum of ten in a six-month period (the median response rate over all respondents for all crime types). Ten was chosen as the consistency of responses began to decline for larger caps and the magnitude of discrepancies began to increase (Lauritsen *et al.* 2012: 14). Planty and Langton (2013) note that series incidents are not periodic anomalous outliers occurring occasionally but, rather, are consistently reported each year and under similar conditions. The routine capture of these victims by the NCVS procedures is evidence of a real phenomenon and not a measurement error.

'Too many to count'

A further issue concerns the CSEW response category '97' labelled 'more than 96/too many to count', which are also capped at five incidents. While 96 victimizations in a year might appear an unrealistically large response, it is actually equivalent to being victimized about twice a week over a 12-month period, which is not uncommonly found in the domestic violence literature. While some respondents may be unwilling or unable to remember the frequency of attack, other respondents do report their experience of very high levels of violence (more than 96 incidents).

One solution could be to take the mean or median number of crimes in the series Victim Forms for each form of violent crime for each year. However, this is likely to severely underestimate the number of crimes that 97-coded Victim Forms should contribute to the estimate of violent crime. Between 1994 and 2013/14 this would have meant a CSEW count between 4 and 12. The second method is to use a count of '60' for all 97-coded Victim Forms. This method was used in the ONS-endorsed Home Office study (Walby and Allen 2004) on domestic violence using the CSEW. The count of 60 was derived from a review of the secondary literature, including on women in refuges. This count of 60 for '97' has been supported in later studies using the CSEW (Farrell and Pease 2010; 2007). This second method provides a more robust solution, so we use a count of 60 for Victim Forms coded '97'.

Discerning trends in volatile data

Volatility in annual estimates can adversely affect the reliability of estimates of change over time. This is a general issue for victimization surveys (UNODC and UNECE 2009). There is a trade-off between volatility and accuracy. Planty and Langton (2013: 3) are clear that these large series incidents are 'not considered to be errors, but true estimates of victimization with substantive importance'. Thus, increasing or eliminating the cap will increase volatility but also increase accuracy. Capping, in contrast, produces bias in the total estimated number of crimes and the distribution between different crime types. Accurate measurement is important. ONS (2013c: 8) includes accuracy of measurement as one of its five quality indicators, defining accuracy as 'the closeness between an unknown true result and its estimated value'. These ONS guidelines define processing error (B.4.1) as 'systematic error introduced by processing systems' and suggest that outputs should describe the main sources of such error and provide an estimate of the processing error.

It is possible to reduce volatility while counting all reported incidents and thus including the experiences of high-frequency victims. Such methods to 'smooth' data have long been used. The simplest of these is the moving average. This is used by ONS and Eurostat for calculating (and reducing volatility in) unemployment rates—using a three-month average over three consecutive months (Bishop 2004). The disadvantage of losing estimates from the start and end of the series is balanced by the ability to more clearly estimate long-term trends with reduced volatility.

We propose a three-year moving average methodology to reduce volatility to the level of current ONS capping methodology, while increasing accuracy by removing the cap.

Trend detection is a challenge for survey data, where an observed increase may or may not be statistically significant (potentially being within the sampling variability of the data). There are two approaches to this issue: compare two adjacent years or adopt a methodology that examines a longer trend.

The ONS (CSEW published annual statistics) takes the first approach. They offer statistics that compare estimates for adjacent years (year on year) or for differences in pairs of years using selected start and finish years. This methodology means that the choice of comparison years (start and finish years) can make considerable difference to the conclusion about the direction and rate of change.

A second approach is to model the data. This examines long-term trends in the data series through the fitting of a non-linear statistical model, thereby reducing the effects of the arbitrary selection of particular years to be compared (see Appendix).

Conclusions for our methodology

For the source of data, the use of surveys not police records is now consensus. We use the CSEW as a world-leading survey and use data derived from the Victim Form module. For the unit of measurement, we use measures of crimes as well as victims and compare the outcomes to show the implications of each.

Discerning trends in volatile data: to address the methodological challenge of small numbers of high-frequency victims, we increase accuracy while not increasing volatility by using all reported crimes as three-year moving averages rather than by capping. Further, statistical modelling removes the arbitrary selection of year pair comparisons for trend analysis.

Research Questions

The main research question concerning changes in the rate of violent crime is disaggregated into three questions. First, is violent crime captured by the CSEW increasing or decreasing between 1994 and 2014? Second, are there different changes in the rate of violent crime depending on whether the victims are women or men, or depending on the relationship between victim and perpetrator (whether this is a domestic relation, acquaintance or stranger)? Third, is the rate of change (both overall and disaggregated by gender of victim and by relationship) different when the unit of measurement of violent crime is based on victims or crimes? In order to answer these questions, it is necessary to address the methodological challenge of accurate measurement of small numbers of high-frequency victims navigating the tension between achieving accuracy in the measurement of the extent and distribution of violent crimes and an achieving acceptable volatility over time.

We describe our solutions to the methodological challenges before moving to the substantive questions.

Methods and Findings for a New Methodology

We detail the methods used to: estimate the number of violent crimes; control volatility, so it is of the same order as that produced by the current ONS method (capping); and assess changes in violent crime (details in Technical Paper, doi: 10.17635/lancaster/researchdata/53).

Data source

The data are the number of violent crimes and victims of violent crime captured in the CSEW from 1994 to 2013/14, drawn from the main questionnaire Victim Forms. This population survey is a representative sample of adults (16 years and over) who are permanent residents of a household in England and Wales.

Definitions

Violent crime is here defined as 'violence against the person' plus 'sexual offences' (see section 'What is violent crime?'). We follow ONS (2014b) in using the category of 'violence against the person' excluding threats and robbery, and Walby *et al.* (2014) in including sexual violence.

The relationship between victim and offender is disaggregated into domestic, acquaintances and strangers, following the ONS CSEW classification. Domestic perpetrators are current and ex-intimate partners and also family and other household members. Acquaintances are: workmate or colleague; client or member of the public met through work; friend or acquaintance; neighbour; local child, child in the neighbourhood, young people in the local area; tradesman, builder, contractor; ex-husband, wife or partner of someone in the household; or other person known at least by sight. Strangers are those who are unknown, even by sight.

In order to make comparisons over time, we use rates (of victims and of crimes) per 1,000 of the appropriate population. This enables us to take into account the changes in the size of the UK population.

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Estimation of total counts of crimes in the population

For each respondent, we take the aggregate over all Victim Forms of the counts for the specific form of violent crime reported, use a count of 60 for the 'too many to count' category (see section 'What is violent crime?') and follow the ONS convention of using a count of two for series Victim Forms that 'do not know' or 'refuse' to say the number of incidents (coded '98' in the data set). We multiply the weighted population for each individual by the number of incidents they report to the survey. This is then summed over all respondents. The estimates are then adjusted to meet the ONS mid-year population estimates (ONS 2013a: 67–9).

We repeat this procedure to obtain estimates for capped crimes and for victims. In estimating capped crimes, we follow the ONS procedure of capping each Victim Form, rather than each respondent, at a maximum of five. Counting victims effectively caps the aggregated Victim Forms for each respondent at a maximum of one. We include incidents that happened to respondents outside of England and Wales, rather than restricting valid offences to only those that have occurred within the country boundaries. The ONS also has a complicated 'valid' and 'invalid' time period for each sweep of the CSEW because of its continuous, rolling interview process. As we are using data from sweeps that include two different sampling processes in terms of the 'valid' reporting periods, so we have included all offences recorded by each sweep of the CSEW. We are not producing estimates of individual years but rather comparing the trend over a long time period, thus we have opted to use a consistent methodology of counting all reported offences for each sweep.

This gives estimates of crime based on data captured by the CSEW for three units of measurement (all reported crimes, capped crimes and victims) across 12 crime types (all violent crime; domestic violent crime; acquaintance violent crime; and stranger violent crime—with each of these four crime types also being disaggregated by victim gender (female and male)).

Impact of capping on high-frequency victims

We investigate how many Victim Forms are subject to capping to understand if this practice is rare or common. We find around 5 per cent of Victim Forms report counts greater than 5 in each sample year (see Table 1). This means that high-frequency responses are relatively common. It is thus hard to justify the ONS argument that such responses are rare.

We also look at the frequency of '97' ('more than 96/too many to count') responses. Table 1 shows that the number of '97' responses is relatively small.

Statistical methods for measuring volatility

Using our new estimates, we investigate the different levels of volatility produced by existing and our proposed new methodologies. The new estimates are produced using all reported crimes averaged on a rolling basis over three years. Estimates for three-year moving averages are obtained by averaging the estimate for the target year with the estimate for the year before and the year after. (The estimates for each form of

TABLE 1   *Percentage of 'high-frequency' Victim Forms and Victim Forms coded 97: all violent crime against both women and men*

Year of survey	% of Victim Forms with over five violent crimes	% of Victim Forms coded 97	Total number of violent crime Victim Forms	Sample size
1994	5.9	0.4	831	16,550
1996	5.9	0.0	1,011	18,955
1998	4.0	0.1	692	14,947
2000	3.5	0.1	823	19,411
2001/02	4.7	0.7	953	32,824
2002/03	5.8	0.3	968	36,479
2003/04	4.6	0.5	992	37,931
2004/05	6.1	0.3	999	45,120
2005/06	6.2	1.0	1,044	47,796
2006/07	5.9	0.7	1,169	47,203
2007/08	5.0	0.7	1,429	46,983
2008/09	4.3	0.7	1,361	46,286
2009/10	5.1	0.5	1,175	44,638
2010/11	5.4	0.5	1,372	46,754
2011/12	5.8	0.6	1,253	46,031
2012/13	6.6	1.2	887	34,880
2013/14	5.3	0.8	586	35,371

All violent crime: violence against the person and/or sexual assault by a domestic relation, acquaintance or stranger.
Source: CSEW 1994 to 2013/14.

violent crime by each sweep and for all three estimation methods (all reported crimes, capped and victims) are given in the Technical Paper (doi: 10.17635/lancaster/researchdata/53): all estimates are disaggregated by gender of victim and relationship between victim and perpetrator).

To compare the volatility produced using each method, we need a method of measuring volatility. This involves separating the signal or trend in the data series from the noise. The usual method of measuring volatility is to take the variance or standard deviation of the data series around the trend line. However, this method assumes that the variance is unaffected by the size of the mean. With count data, it is common for the variance of a data series to increase with the mean, so this assumption is unrealistic.

Thus, instead we fit an overdispersed quasi-Poisson model with the time trend modelled by a smooth cubic spline curve with three degrees of freedom (details of the volatility modelling are in the Appendix).

Addressing the tension between the accurate measurement of extent and distribution and accurate measurement of change over time

We produce volatility estimates generated using year by year data for victims, capped crimes and all reported crime and a three-year moving average for all reported crimes. The volatility generated by all reported crimes year by year and all reported crimes using three-year moving averages are then compared to the volatility generated using the official method (capped crimes generated using year by year data) and to the method widely used in the 'violence against women' field (number of victims generated

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using year by year data). Table 2 shows the volatility estimates for these four different estimation methods for our 12 forms of violent crime.

When using all reported crimes to generate year by year estimates (column 3), volatility increases substantially (and unacceptably) compared to the official method (column 2). The increase is around four times, and as much as nine times for domestic violence. However, the volatility is reduced to the same level as that produced by the official estimation method when estimates of violent crime are generated using all reported crime and three-year averages (column 4). The volatility generated by this method compared to the official method is lower for all forms of violent crime except two. Even in these cases (domestic violent crime and domestic violent crime against women) that have a slightly higher volatility, it is still of the same order as that generated by the official method.

Thus, estimates generated from all reported crimes averaged over three years are more accurate than those produced by capping while ensuring that volatility is of the same order as the current method in official use (year by year estimates of crimes capped at five).

The approach of three-year averaging is the best way to address the tension between accurate measurement of violent crime and volatility over time.

Statistical models for examining trends in violent crime

To examine trends in violence crime, we adopt a regression approach so that all data points over the period contribute to the estimation. This is in contrast to the preferred ONS method that is to examine changes between two specific years.

There are a number of issues that determined our modelling strategy. The first is whether to examine changes in the *number* of crimes or victims or to examine *rates* of

TABLE 2   *Volatility for different estimation methods*

	Year by year			Three-year average
	Victims	Capped crimes (official ONS method)	All reported crimes	All reported crimes
All violent crime	9,601.2	21,648.5	81,353.9	10,731.9
Violent crime against women	5,792.8	18,504.4	122,408.6	15,860.0
Violent crime against men	7,956.9	16,986.9	63,362.8	5,363.6
All domestic violent crime	3,077.0	8,267.2	80,854.1	9,890.1
All acquaintance violent crime	6,800.8	15,162.2	37,133.1	4,725.4
All stranger violent crime	6,255.1	13,306.1	33,630.6	3,737.5
Domestic violent crime against women	1,836.6	11,746.9	106,297.7	13,088.4
Domestic violent crime against men	3,893.1	5,421.2	10,470.6	2,198.3
Acquaintance violent crime against women	6,994.2	12,510.8	68,856.0	7,813.8
Acquaintance violent crime against men	4,201.5	12,541.3	49,199.7	5,354.9
Stranger violent crime against women	3,212.8	8,107.3	28,853.1	4,659.4
Stranger violent crime against men	5,112.4	9,969.6	23,399.8	2,185.1

Volatility is measured by the dispersion parameter κ from a quasi-Poisson model.
Source: CSEW 1994 to 2013/14.

violence. While there may be interest in whether absolute numbers of crimes or victims are changing, the use of rates allows statements on the populations at risk. Since there has been a substantial increase in the population of England and Wales over the period of study (12 per cent, from 40.5 million in 1994 to 45.3 million in 2013/14 (ONS 2013a: 69; ONS 2015c)), we have chosen to use rates. The rate is per 1,000 of the appropriate female, male or total adult population. Modelling rates makes our analysis more conservative than examining numbers, as a constant rate over the period implies an increase in violent crime of 12 per cent in line with the population.

The second issue is the choice of model. We have modelled the data using a quasi-Poisson log-linear model (which allows for overdispersion) and using the sample size as an offset (see Appendix).

The third issue is how to allow for changes in the survey sample size over time. This has varied from 16,550 in 1994 to around 46,000 between 2004/05 and 2011/12 then dropping to around 35,000 in 2012/13 and 2013/14 (Table 2 in Technical Paper (doi: 10.17635/lancaster/researchdata/53)). We deal with this by modelling *estimated* sample counts that use the individual population weights but are rescaled back to the size of each survey sweep sample, and including the log of the sample size as an offset in the log-linear model. This allows the observed counts to be of the same size as the sample but representative of the population.

When estimating change over time, we follow the segmented regression method described by Muggeo (2008a), which fits two regression lines that meet at a breakpoint. Both the breakpoint and the two regression lines are estimated from the data. With the segmented regression model, the slopes of the two regression lines can be tested to see if they are significantly different from zero: this tells us whether the violence is increasing or decreasing at a significant rate. Where the slope is not significantly different from zero, the rate of violence is static.

Full details of the model specification are in the Appendix.

Are there changes in the trends of each form of violent crime?

Table 3 shows the results of the Davies test to ascertain whether or not there is a statistically significant change in the trajectory of the various forms of violent crime between 1994 and 2013/14 (see Table 3).

For those forms of violent crime where the Davies test shows no significant change, a single slope parameter estimate is given. This shows the direction of slope of the trend and its significance. Slopes that are significantly different from zero indicate either a significant decrease or a significant increase in that form of violent crime, depending on the direction of the slope. For example, for 'all violent crime' using estimates based on capped crime counts, there is no evidence of a breakpoint, and the estimated slope of the line is −0.0523, which is significantly different from zero ($p < 0.001$). Exponentiating this gives the yearly rate of change; $\exp(−0.0523) = 0.949$, suggesting that (using the ONS capping methodology) all violent crime declines by an estimated 5.1 per cent a year.

For those forms of violent crime where a significant change is detected, a segmented regression model is applied to the data. The breakpoint estimates and the slopes of the two components of the segmented line—before and after the breakpoint—are given in Table 4.

TABLE 3 *Significant changepoints in violent crime trajectories*

	All reported crimes		Capped crimes		Victims	
	Significant change detected?	Significance of detected change	Significant change detected?	Significance of detected change	Significant change detected?	Significance of detected change
All violent crime	Yes	***	No	NS	No	NS
Violent crime against women	Yes	***	Yes	*	Yes	**
Violent crime against men	Yes	***	Yes	*	No	NS
Domestic violent crime	Yes	***	Yes	***	Yes	***
Acquaintance violent crime	Yes	***	Yes	*	No	NS
Stranger violent crime	No	NS	No	NS	Yes	**
Domestic violent crime against women	Yes	***	Yes	*	Yes	***
Domestic violent crime against men	Yes	***	Yes	*	No	NS
Acquaintance violent crime against women	Yes	***	No	NS	No	NS
Acquaintance violent crime against men	Yes	***	No	NS	No	NS
Stranger violent crime against women	No	NS	No	NS	No	NS
Stranger violent crime against men	No	NS	No	NS	Yes	**

NS, non-significant.

***$p \leq 0.001$; **$p \leq 0.010$; *$p \leq 0.050$.

Source: CSEW 1994 to 2013/14.

When the trend for 'all violent crime' is based on all reported crimes and three-year averages, there is evidence of a breakpoint. This is estimated to be 2008.7, i.e. in the autumn of 2008. The two slopes are estimated to be −0.0600 ($p < 0.001$) and +0.0467 ($p < 0.05$). Exponentiating the slopes gives the yearly rate of change before and after the changepoint: thus exp(−0.0600) = 0.942, and exp(0.0467) = 1.048, giving a 5.8 per cent yearly decline before the changepoint and a 4.7 per cent yearly increase after the changepoint.

Thus, our preferred methodology of using all crimes reported to the survey over a three-year average, when compared to the ONS methodology results in a different trajectory of violent crime.

Using our preferred methodology, we find that 9 of the 12 forms of violent crime show a significant change of slope. Using the current ONS methodology, only six show this. Moreover, with our methodology, five of the nine regression slopes after the changepoint are positive and significantly different from zero: suggesting rates of violent crime are now increasing. These are: all violent crime, violent crime against women, domestic violent crime, domestic violent crime against women and acquaintance violent crime against women. Two of the remaining four change from a declining slope to an increasing slope, but not one that is significantly different from zero. This shows that the decline in these forms of violence has ceased and may now be beginning to rise.

TABLE 4 *Trends in violent crime by methodology, relationship and gender: segmented regression results*

Forms of violence	All reported violent crime			Capped violent crime			Victims of violent crime		
	Date of significant changepoint	Slope 1 parameter estimate & sig.	Slope 2 parameter estimate & sig.	Date of significant changepoint	Slope 1 parameter estimate & sig.	Slope 2 parameter estimate & sig.	Date of significant changepoint	Slope 1 parameter estimate & sig.	Slope 2 parameter estimate & sig.
All violent crime	2008.7	−0.0600***	0.0467*	–	−0.0523***	–	–	−0.0433***	–
All violent crime against women	2009.3	−0.0647***	0.1297**	2003.7	−0.0886***	−0.0343*	2003.8	−0.0726***	−0.0286**
All violent crime against men	2004.6	−0.0668***	−0.0271***	1996.0	0.1035NS	−0.0554***	–	−0.0400***	–
Domestic violent crime	2008.9	−0.1040***	0.1279*	2008.5	−0.1042***	0.0220NS	2008.7	−0.0859***	0.0071NS
Acquaintance violent crime	2007.9	−0.0655***	0.0294NS	1996.0	0.1035NS	−0.0554***	–	−0.0534***	–
Stranger violent crime	–	−0.0240***	–	–	−0.0295***	–	2010.8	−0.0168**	−0.1094NS
Domestic violent crime against women	2009.4	−0.0952***	0.1650**	2005.2	−0.1159***	−0.0381NS	2004.0	−0.1043***	−0.0408**
Domestic violent crime against men	2006.8	−0.1490***	0.0461NS	2007.8	−0.1138***	0.0145NS	–	−0.0681***	–
Acquaintance violent crime against women	2008.5	−0.0562***	0.0796*	–	−0.0531***	–	–	−0.0474***	–
Acquaintance violent crime against men	2002.3	−0.1072***	−0.0332***	–	−0.0621***	–	–	−0.0562***	–
Stranger violent crime against women	–	−0.0084NS	–	–	−0.0201*	–	–	−0.0234***	–
Stranger violent crime against men	–	−0.0292***	–	–	−0.0315***	–	2010.7	−0.0148*	−0.1289**

NS, non-significant (NS means the slope is not significantly different from zero, thus the estimated slope shows no significant increase or decrease in the number of crimes/victims). Segmented regression results: Slope 1: before the significant changepoint; Slope 2: after the significant changepoint.
***p ≤ 0.001; **p ≤ 0.010; *p ≤ 0.050.
Source: CSEW 1994 to 2013/14: based on year by year estimates.

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The steepest slope observed after the changepoint is for domestic violent crime against women. The estimate of 0.1650, once exponentiated, gives a value of 1.179 suggesting that the rate of domestic violent crime against women is increasing by 17.9% every year after 2009.

The location of the estimated changepoint is significant. Most estimated changepoints lie between 2008 and 2009.

Discussion of Substantive Findings

There are four new substantive findings when analysis is based on the new methodology of including all reported violent crimes rather than on capped crimes or the number of victims. First violent crime against women has been increasing since 2009; second most violent crime against men is still falling; third domestic violent crime has a different trajectory from other forms of violent crime and has been rising since 2009; and fourth overall, violent crime has been rising since 2009, not falling.

Implications of revising the methodology to measure violent crime

Using our preferred method of including all reported crimes over three-year moving averages, there is an increase (rather than decrease) in violent crime and especially in the amount of violent crime against women and by domestic perpetrators. Our preferred method allows the high-frequency victims to become visible. This has consequences for the analysis of the distribution of violent crime. When all violent crime reported to the CSEW is included, there is an increase in violent crime. This increase is found especially in repeated crimes against the same victims. It is found especially in violent crime committed by domestic perpetrators and violent crime against women.

If the current ONS capping method is used, the rate of violent crime overall appears to still be falling, as is violent crime against women. Violent crime by domestic perpetrators appears to have ceased falling but does not show a significant increase after the changepoint (2008.5).

If victims are the unit of measurement, the same pattern is found as for the capped analysis, with the appearance of a continuing fall in the rate of violent crime and violent crime against women, but a cessation in the falling rate of domestic violent crime.

Basing estimates on all reported crimes allows the extent and significance of high-frequency victims to be seen.

Survey methodologies that prioritize the measurement of prevalence (CSEW self-complete questionnaire; WHO 2013; FRA 2014) are challenged by our findings since they make invisible any increase in domestic violence that is concentrated on high-frequency victims. When victims are the unit of measurement, the number of repeat victimizations is treated methodologically and theoretically as irrelevant: this approach misses the important changes in violent crime driven by high-frequency victims.

Different units of measurement also find different trends in acquaintance and stranger violent crime. Capped crimes and victims of acquaintance violence are still falling, whereas all reported crimes stop falling in 2007/08. Crimes (all and capped) of stranger violence are continuing to fall, whereas the prevalence rate falls to 2010/11; after which the fall in the number of victims stops.

Violent crime against women

The trend in violent crime against women is sensitive to the unit of measurement, as illustrated in Figure 1. The trend is different depending on the unit of measurement, showing that female victims of violent crime experiencing one or a small number of
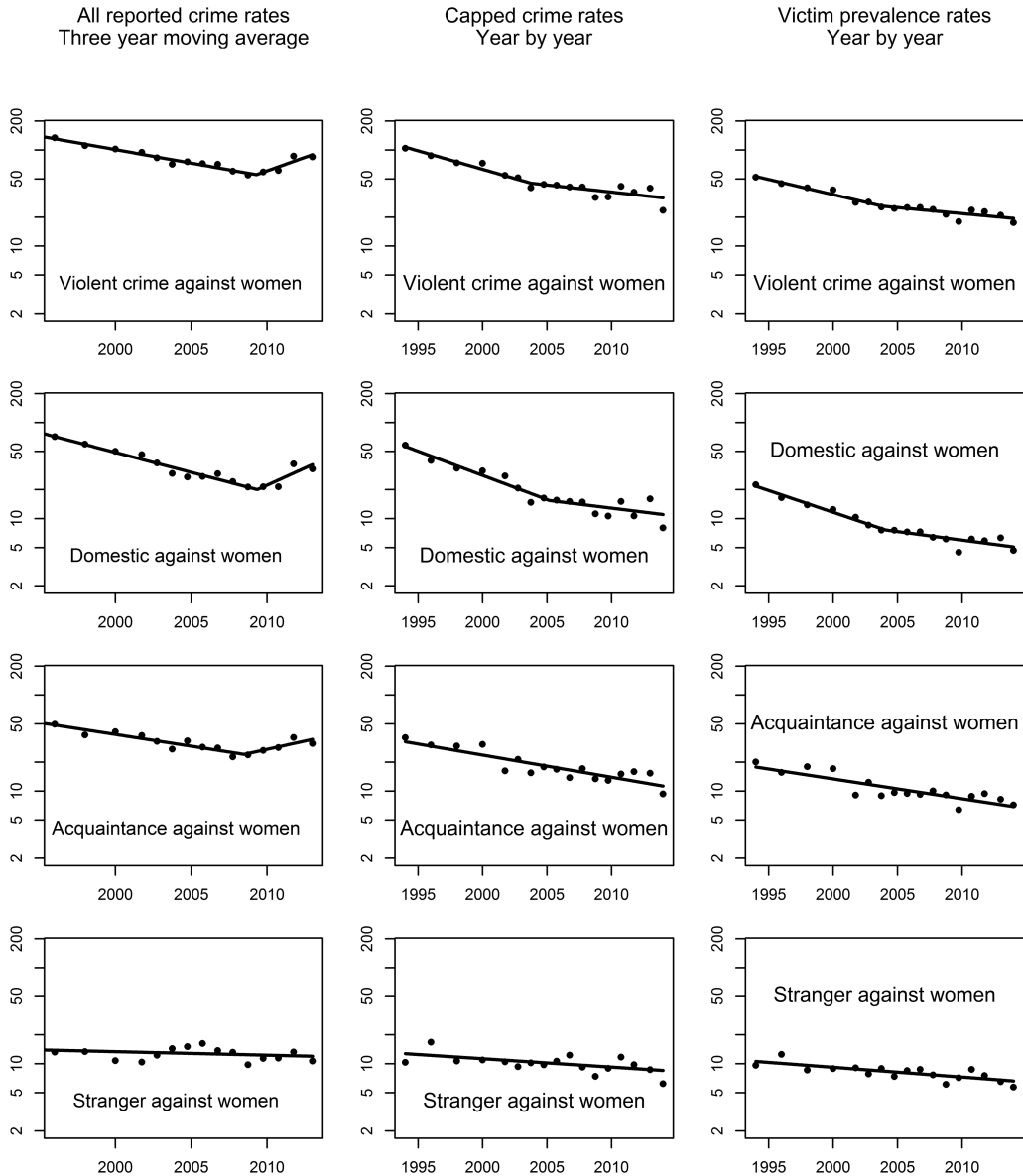

Fig. 1 Violence against women. Reported crime rates per 1,000 population on log scale graphed against year with fitted segmented regression line. Three methods are used to measure violent crime—all reported crime, capped crime and victim prevalence.
Source: CSEW 1994 to 2013/14.

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victimizations are continuing to fall, while the number of female victims of violent crime experiencing high-frequency repeat victimizations has stopped falling: the number of victimizations these women are experiencing now appears to be increasing.

When all reported crimes of violence against women is the unit of measurement, the fall stops in 2009 and rises significantly after this date; however, the capped crimes and victims units of measurement do not detect the increasing number of violent crimes committed against women after 2009.

All domestic violent crimes against women fall between 1994 and 2009; then the fall stops and domestic violent crime starts to increase. The capped crimes unit of measurement only detects the stop in the fall. The victims unit of measurement does not detect any stop in the fall of domestic violent crime against women, finding instead a continuing fall in the number of victims. This suggests that while the number of female victims is still falling, the fall in those victims with repeat victimizations has stopped and in particular the number of crimes high-frequency repeat victims are experiencing may be increasing.

The trend in acquaintance violent crime against women also varies considerably depending on the unit of measurement. When all reported crimes are the unit of measurement, acquaintance violence against women falls between 1994 and 2008: after 2008 the number of crimes increases. By contrast, when capped crimes or victims are used as the unit of measurement, neither the cessation in the fall of acquaintance violence nor the recent increase in crimes is detected. The trend in both capped crimes and victims indicates a fall in acquaintance violence between 1994 and 2013/14. This difference in trends found by the different units of measurement adds further weight to the hypothesis above that while the number of female victims experiencing low frequency victimization may still be falling, the number of women experiencing high-frequency repeat victimization has stopped falling and the number of crimes these women are experiencing may now be increasing.

The trend in stranger violent crime against women also shows a difference by unit of measurement. Both capped crimes and victims show a fall in stranger violence against women between 1994 and 2013/14. By contrast, when all reported crimes are used, there is no change found in the rate of stranger violent crime against women over the period. This also suggests that it is high-frequency repeat female victims that as a group are experiencing an alternative trend in violent crime compared to female victims experiencing low frequency victimization.

When all forms of violent crime against women are aggregated, evidence of the same trend is found. All reported crimes fall to 2009: after this date the fall stops and the rate of violent crime against women increases. By contrast, when the number of capped violent crimes and the number of female victims are the units of measurement, violent crime against women is still falling.

The reporting of increasing numbers of incidents against some victims but much smaller increases in the number of victims suggests that this change in reported rate is not due to changes in the willingness of respondents willing to report violent crime to surveys but rather reflects changes in the 'real' rate of violence.

Violent crime against men

The rate of violent crime against men is falling, as illustrated by the graphs in Figure 2. The unit of measurement does not make a substantial difference to the trends in violent crime
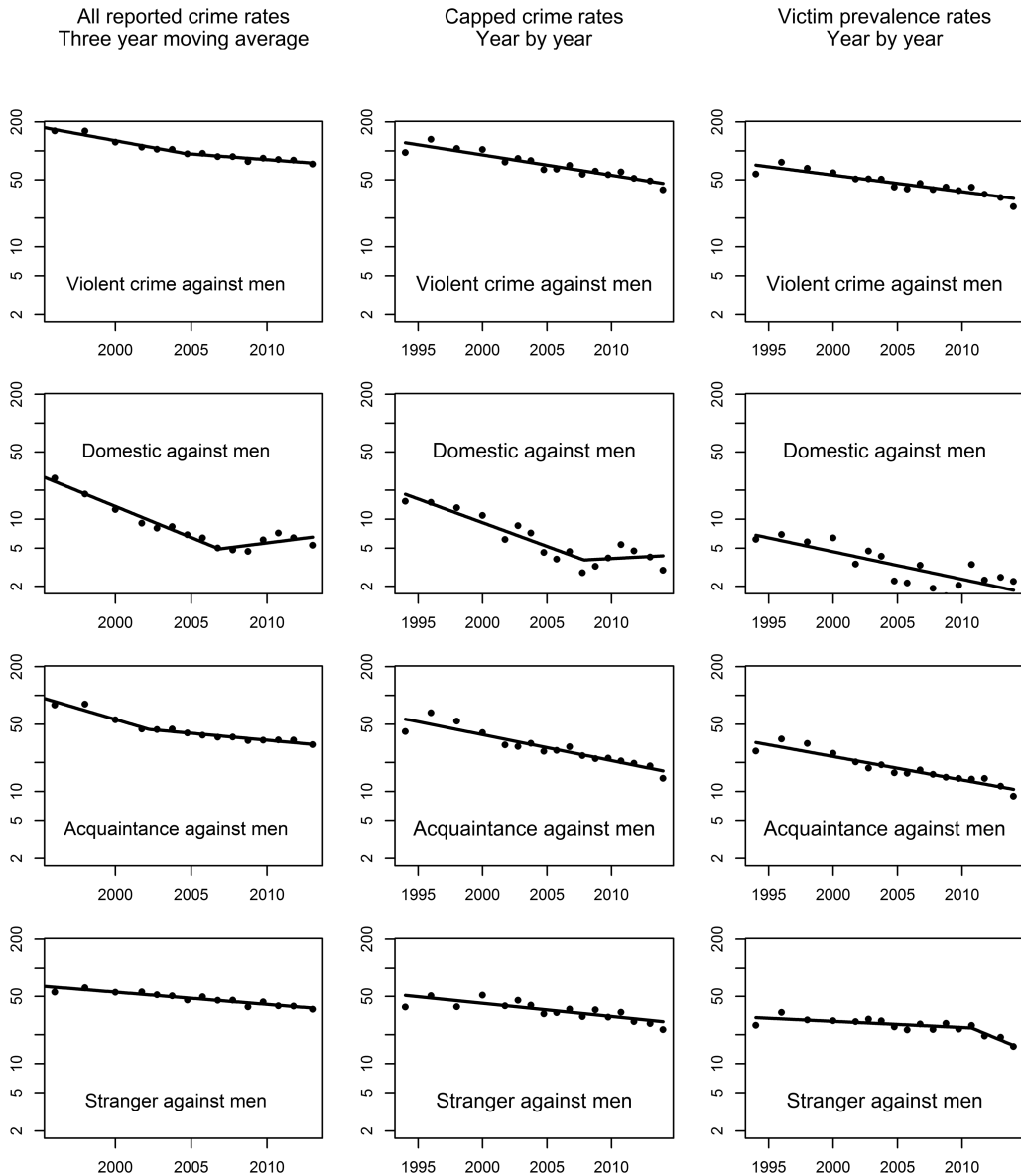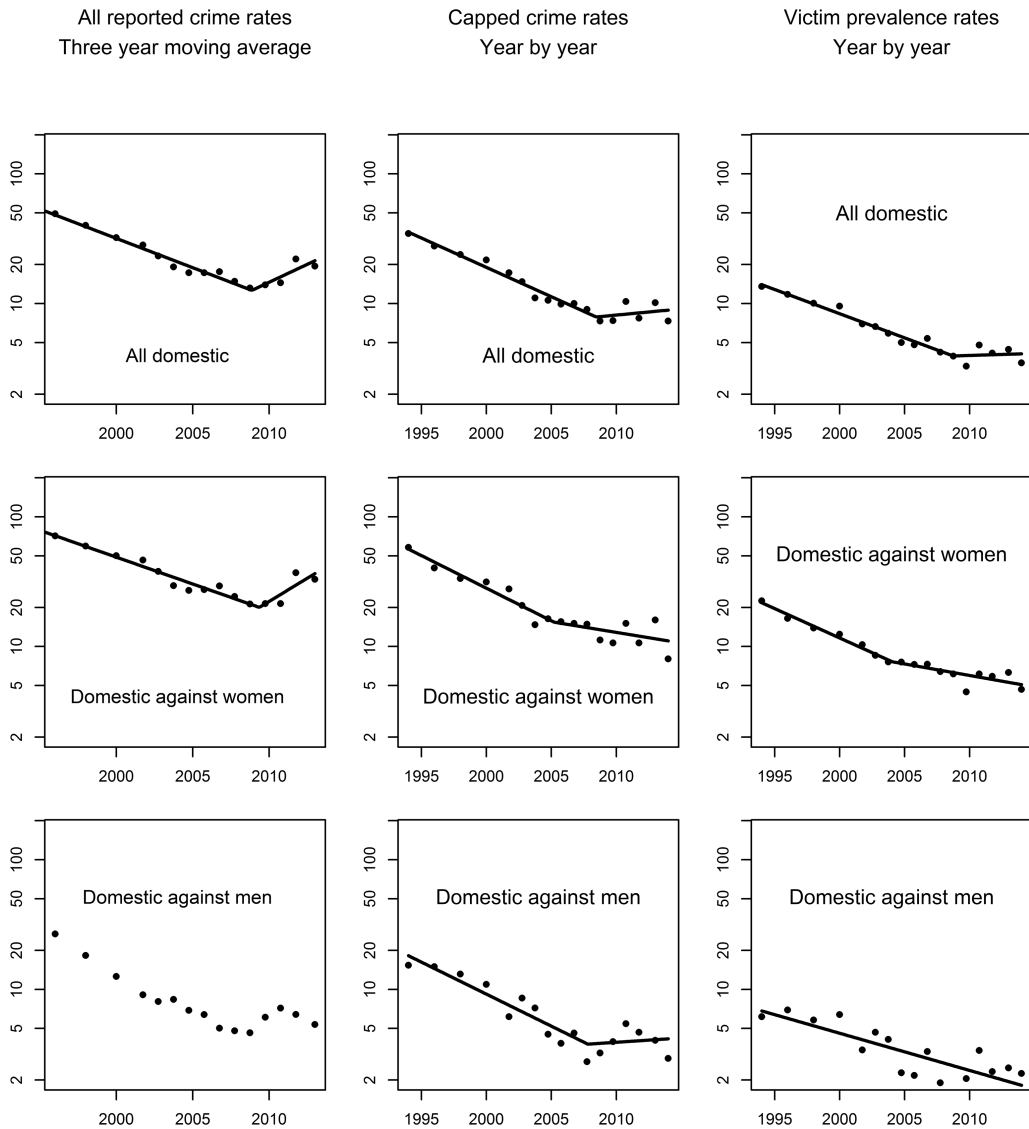
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FIG. 2 Violence against men. Reported crime rates per 1,000 population on log scale graphed against year with fitted segmented regression line. Three methods are used to measure violent crime—all reported crime, capped crime and victim prevalence.
Source: CSEW 1994 to 2013/14.

against men. All violent crime against men, acquaintance violent crime and stranger violent crime against men are all falling no matter which unit of measurement is used. The only exception to the falling trend is domestic violent crime against men. The rate of domestic violent crime against men falls from 1994 to 2006/07 for both all reported and capped crimes: after this date the fall stops and no significant difference in the rate is detected.

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Domestic violent crime

The trajectory of domestic violent crime is different to that of other forms of violent crime. For all three units of measurement, the fall in domestic violent crime, which had been occurring since 1994, stops in 2008/09, as illustrated in Figure 3.

When the unit of measurement is all reported crimes, not only does the fall in the number of crimes stop in 2008/09, after this date the rate of domestic violent crime

FIG. 3 Domestic violence. Reported crime rates per 1,000 population on log scale graphed against year with fitted segmented regression line. Three methods are used to measure violent crime—all reported crime, capped crime and victim prevalence.
Source: CSEW 1994 to 2013/14.

significantly increases. This trend is also found for domestic violent crimes against women. Although the rate of domestic violence against men also stops falling in 2008/09, it does not significantly increase after this date.

The trend in domestic violent crime shows a clear stop in the fall, which had been occurring since 1994, in 2008/09. This stop is detected no matter which unit of measurement is used. No other form of violent crimes shows a change in the trend as consistently as domestic violent crime across all units of measurement.

All violent crime

When the unit of measurement is all reported crimes, the fall in violent crime ceases in 2008/09; the rate of violent crime increases significantly after this point (see Figure 4). However, when the unit of measurement is capped crimes or the number of victims, all violent crimes continues to decline across the whole period.

Disaggregation by gender and relationship

To summarize, gender matters: but this is only visible when all violent crimes reported to the survey are included in the analysis. In order to make visible the trends in violent crime against women in contrast to those in violent crime against men, it is necessary to derive the estimates for analysis from all reported crimes reported to the CSEW.

Violent crime against men is not increasing. By contrast, violent crime against women stops falling in 2008/09: many forms of violent crime against women have been increasing since 2008/09.

The categories of 'gender of victim' and 'relationship of victim and perpetrator' show separate effects and they overlap. The largest increase in crimes is at the point of overlap: women victims of domestic relations. The making visible of high-frequency victims produces a different profile of violent crime. It raises the importance of violence against women, perpetrated by domestic relations compared to unknown (male) perpetrators against other men. Further, violent crime is increasingly against women, increasingly perpetrated by domestic relations and decreasingly against men. By mainstreaming gender and relations into the analysis of violent crime, we make visible these comparisons. Isolated analysis of violence against women, separated from violence against men, makes invisible the changes in the gender profile of crime.

Timing of the changes in the rate of violent crime

The changepoints in the rate of violent crime against women and by domestic perpetrators are both in the period 2008/09. Before that year the rate was falling; afterwards it is rising.

The turning point in the rate of these violent crimes is consistent with an explanation focused on the reduced economic independence of women and the impact of the cuts to services on which women disproportionately depend. However, caution is necessary in asserting this explanation since this paper has not provided evidence on the
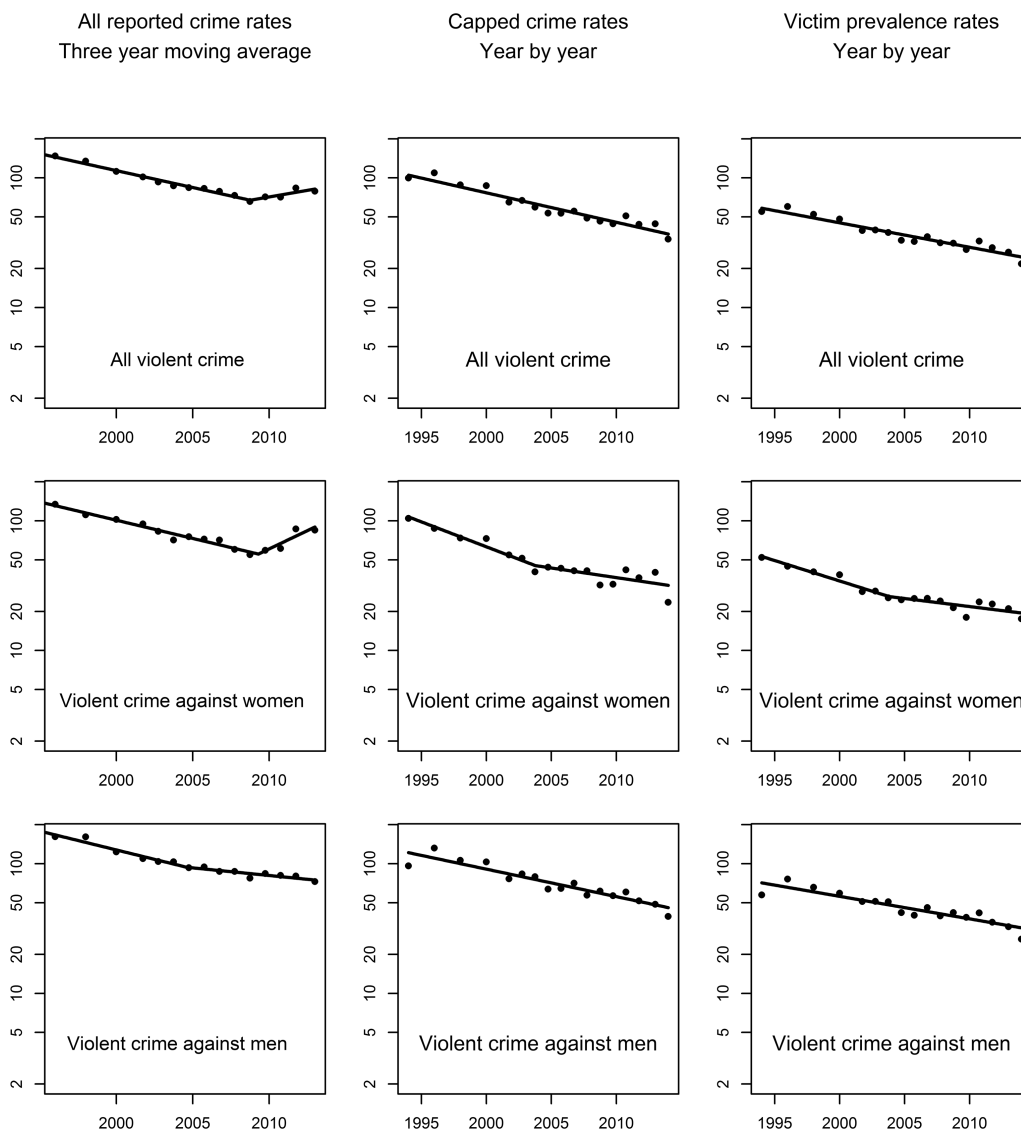
All reported crime rates
Three year moving average

Capped crime rates
Year by year

Victim prevalence rates
Year by year

Fɪɢ. 4 All reported violence. Violent crime rates per 1,000 population on log scale graphed against year with fitted segmented regression line. Three methods are used to measure violent crime—all reported crime, capped crime and victim prevalence.
Source: CSEW 1994 to 2013/14.

changes in the microeconomic relations within households experiencing violence nor for individual women experiencing violent crime. This requires further investigation.

Further, the findings indicate that the theorization of violence against women needs to extend beyond domestic violence and the household in order to also account for the rising trend in acquaintance violent crime and all violent crime against women.

Conclusion

Unit of measurement

High-frequency victims are significant in the changing rate of violent crime and are an important component of the changes in violence over time; this is lost if victims and/or capped data are used as the unit of measurement. Domestic violence (which is disproportionately against women and a gender-saturated category) is often a crime that is repeated by the same perpetrator against the same victim.

Challenging and replacing the methodology of capping: the 'cap' is gendered; disproportionately reducing the amount of violent crime against women that is included in the official statistics. Removing the cap increases the estimate of the amount of violent crime against women and the amount of violent crime that is domestic. Removing the cap makes visible the increase in domestic violence and violence against women that is otherwise hidden by the cap. In particular, the findings demonstrate the significance of the increase in violent crime against those who are repeatedly victimized.

We offer a new methodological resolution to the dilemma of measuring small numbers of high-frequency victims that does not generate excessive volatility. This is to use three-year moving averages and statistical modelling. Three-year moving averages effectively trebles the sample size. Statistical modelling of trends allows for the inclusion of many more data points than comparing the start and finish years. This is relevant to the estimation of official statistics on crime in general as well as on violence against women. Removing the arbitrary cap that excludes some violent crimes committed against the most highly victimized increases the estimate of the amount of violent crime and increases the proportion of violent crime committed against women and by domestic perpetrators. The findings challenge the use of the cap in the presentation and publication of official statistics on violent crime, finding it incompatible with ONS standards of quality for official statistics. This challenge to remove the cap and to revise the methodology extends to surveys in the United States, Canada, Mexico and any other country that uses this practice.

Gender specificity of violent crime

The findings challenge the gender neutrality of crime statistics by demonstrating the relevance of gender for violent crime, it demonstrates the need for ONS, other National Statistical Offices around the world and the UNODC's International Crime Classification for Statistical Purposes (ICCS) to gender disaggregate official statistics, including crime statistics, on a routine basis.

Serious violent crime policy: by demonstrating the increase in violent crime against women, at the same time as a fall in violent crime against men, our findings challenge the presumption that violent crime is predominately a problem of violence against men. It thus adds impetus to the changes in public policy to address violence against women, in the domestic and public spheres. The findings challenge the focus of serious violent crime policy on violence between men. Violent crime is increasing against women and by domestic perpetrators. Policy to target reductions in serious violent crime should include action concerning violence against women and domestic perpetrators, including those that are already multiply victimized.

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Gender mainstreaming

By demonstrating the significance of gender for changes in violent crime, and their timing, it challenges criminological and social analysis to pay increased attention to gender relations, which are needed in order to explain these changes in violent crime. This means including gender relations within mainstream criminological and social theories. It does not mean confining the analysis of gender-based violence to a specialist field. It is necessary to be able to compare the gender-specific rates of violent crime, which is not possible if studies are made of women only.

All violent crime is increasing

This is only visible when high-frequency victims are included in the measurement of violent crime.

Re-theorizing violence

The findings have implications for the internal construction of each of the three theoretical frameworks identified in the section 'Theoretical issues', as well as for the comparison of their explanatory efficacy. The thesis of long-term decline in violence associated with the pacification of society linked to increased self-control is challenged by the increase in violent crime against women. It is hard to explain this increase, especially its gender specificity, as due to a temporary increase in permissiveness. The timing of the increase in violence against high-frequency victims, in violence against women and in violence by domestic perpetrators is consistent with the thesis that the increase is due to the economic crisis that reduced income levels and increased inequalities and thereby reduced the propensity of victims to escape violence, including exiting violent relationships or enabling conflicted households to split up. The analysis of the links between economic inequalities and violent crime needs to address the gendering of both economic inequalities and of violent crime. The financial, economic and ensuing fiscal crisis has been gendered in that the reductions in the resources have disproportionately affected women. This paper has not addressed the specificities of these resources, such as the relative importance of reduced income from wages and benefits, reduced access to specialist domestic violence services and reduced access to funds to pay for civil legal justice. This is a question to be addressed elsewhere. Addressing it would enable an evaluation to be made of the utility of applying a gendered version of routine activity theory to the analysis of violent crime.

The findings challenge the thesis that there is still a drop in the rate of violent crime. The fall in the rate of violent crime has ceased and violent crime against women and by domestic perpetrators is increasing. Criminological and social theory should desist from the assumption that the most important aspect of violent crime is male on male violence. Gender matters. Gender saturated contexts of domestic relations matter. The analysis of violence against women and domestic violence should not be confined to a separate field but is core to the theory of violence.

The analysis here has concentrated on data for England and Wales. There is a need for these methodological innovations to be applied to global violent crime data in order to understand whether trends in different countries are following the same or

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alternative patterns. This would contribute significantly to the further development of the theorization of violence in the global context.

Funding

Acknowledgements

Appendix

This appendix describes the statistical methodology used in this paper on (1) measuring volatility and (2) modelling trends over time. There is an additional Technical Paper on the specifications of the CSEW data that we use in our analysis available at http://dx.doi.org/10.17635/lancaster/researchdata/53.

Modelling volatility

We have four sets of estimates for the 12 forms of violent crime all the sweeps of the CSEW from 1994 to 2013/14. The estimates are available in Tables 1a to 1d in our Technical Paper. The four sets of estimates are:

(1) All reported crimes year by year data
(2) All reported crimes three-year moving average data
(3) Capped crimes year by year data
(4) Victims year by year data

When assessing methods of volatility reduction, we need a method of measuring volatility. This involves separating the signal or trend in the data series from the noise. The usual method of measuring volatility is to take the variance or standard deviation of the data series around the trend line. However, this method assumes that the variance is unaffected by the size of the mean. With count data, it is common for the variance of a data series to increase with the mean, so this assumption is unrealistic.

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We therefore adopt the following procedure for each form of violent crime and for each unit of measurement: fitting an overdispersed quasi-Poisson model, with the time trend modelled by a smooth cubic spline curve with three degrees of freedom. Three degrees of freedom is sufficient to allow the trend curve to have some degree of non-linearity, while still allowing sufficient degrees of freedom to assess volatility. The 'noise' or volatility of the data series is then measured by examining the deviations of the data around this smooth curve. As the variability of count data increases with the mean, we do not use the residual sum of squares but instead use the overdispersion parameter estimate. This is estimated, as is usual, by the chi-squared statistic X^2 divided by the residual degrees of freedom (Hinde and Demetrio 1998). The resulting volatility estimates are presented in Table 2 for the various methods of measurement.

Modelling trends over time in violent crime

To assess trends, we model the whole data series, such that each point in the data series contributes to the trend analysis. The data we are modelling are rates per 1,000 of the relevant population.

Common models for rates are an ordinary least squares model, and a Poisson log-linear model, or overdispersed variants of this model. Osgood (2000) highlights the advantages of a log-linear modelling approach that allow for the variance increasing with the mean; we follow this route. Count data are also commonly overdispersed; we have allowed for this by assuming a quasi-Poisson rather than a Poisson model. This allows for the estimation of a dispersion parameter κ that measures the degree of overdispersion. Rates are modelled in the usual way by including log of the sample size as an offset in the model (Hilbe 2014).

When estimating change over time, we have choices for the shape of the trend curve. We could fit a quadratic or cubic function or use various forms of smooth regression models. However, such models do not readily allow a determination of changes in slopes, or whether a data series appears to be changing direction at a specific point in time: the detection of changepoints is important (Kenny and Knowles 1997). We have therefore adopted the approach of segmented or changepoint regression modelling (Muggeo 2008a) and assume that the data series can be represented as two straight lines with a change at an unknown time breakpoint. Segmented regression models have been used here as they are more specific than general changepoint models and require continuity of the two regression lines at the breakpoint.

Formally, the log-linear segmented model can be written as:

$$\mu_i = E(C_i) \quad \mathrm{Var}(\mu_i) = \kappa \mu_i \text{ and}$$
$$\log(\mu_i) = \log(N_i) + \beta_0 + \beta_1 \mathrm{year}_i + \beta_2(t_i)$$

where

$$t_i = \begin{cases} \mathrm{year}_i - \psi & \text{if } \mathrm{year}_i > \psi \\ 0 & \text{otherwise} \end{cases}$$

where C_i are the rescaled counts, and N_i is the observed sample size for time point i. Both the breakpoint ψ and the regression parameters $\boldsymbol{\beta}$ of the two lines are estimated from the data. We follow the method outlined by Muggeo (2008a). First the presence of a breakpoint is

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tested using the Davies test that tests the hypothesis that there is no breakpoint and only one regression line. If the Davies test suggests rejection of this hypothesis, a *segmented* log-linear regression model is fitted and the breakpoint estimated. Of specific interest are the estimated time point at which the breakpoint occurs and the slope of the two regression lines, estimated by β_1 and $\beta_1 + \beta_2$. Thus, an additional advantage of the segmented model is that the slopes of the two regression lines can be tested to see if they are significantly different from zero.

All models and tests are fitted using the *segmented* package in the statistical software R (Muggeo 2008b).

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