Abstract

According to evidence from the Crime Survey for England and Wales (CSEW), there have been significant falls in crime levels in England and Wales since the 1990s. Many hypotheses have been proposed to explain these falls. However, there is scarce research on the role of the number of police officers in bringing about the crime drop in the UK. We fitted multilevel models to analyse the role of the number of police officers in the crime drop in England between 1991 and 2001 using a variety of data sources, including police-recorded crime data, UK Census data, and police workforce data. We found that the role of police officer strength in the crime drop in England was limited to vehicle thefts, thefts from vehicle, and thefts from person. Given the relatively mixed picture, we recommend that police forces should focus on what newly recruited police officers do and where they are deployed, as opposed to becoming too focused on the number of officers. More implications of the findings in relation to the recent Police Uplift Programme are discussed.

Keywords

Police officer strength, police numbers, crime drop, victimisation, multilevel modelling

Introduction

In April 2023, the Government announced they had fulfilled their 2019 manifesto commitment (via the Police Uplift Programme) to recruit 20,000 "more"[1] police officers by March 2023 (Hansard, 2023). The Home Office estimate these new police officers will help prevent 505,050 crimes per year from 2024-25 (National Audit Office, 2022). However, they acknowledge their "…evidence base is weak and highly sensitive to what appear to be optimistic assumptions based on limited evidence" (ibid, p9). The purpose of this study is to examine the relationship between crime levels and police officer numbers in England over time.

Evidence from both victimisation surveys and police recorded crime data (PRCD) in many Western industrialised countries, including England and Wales, indicate that crime rates have fallen markedly (with variation in timing, magnitude, and trajectory) since the 1990s (Aebi and Linde, 2010; Tseloni et al., 2010; Van Dijk et al., 2012; Tonry, 2014; Caneppele and Aebi, 2019; ONS, 2022a). Many hypotheses have been proposed to explain the crime drop phenomenon, which include changes in economic prosperity, offender motivations, substance abuse, the presence of (and access to) better security and opportunity structures, criminal justice policies, and policing (see Farrell et al., 2014 for a comprehensive review).

Existing studies of the role of policing in crime reduction have focused upon two key aspects: the effect of policing styles (e.g., problem-oriented policing) on crime, and the impact of police officer numbers (i.e., police officer strength) on crime (the focus of this article). Findings from previous studies on the impact of police officer numbers on crime levels are mixed (Marvell and Moody, 1996; Sherman et al., 1999; Levitt, 2004; Bradford, 2011; Roeder et al., 2015). This result can partially be attributed to the use of a variety of methodological approaches (see Lim et

al., 2010; Carriaga and Worrall, 2015; Lee et al., 2016) ranging from cross-sectional (e.g., MacDonald, 2002) and time-series designs (e.g., Corman and Mocan, 2000) to panel data modelling (e.g., Evans and Owens, 2007) and multiple time-series design (Kovandzic and Sloan, 2002). Importantly, there is scarce research that examines the role of police officer strength in the crime drop at the police force area (PFA) level in countries other than the United States (US), and for our specific purposes here, in the United Kingdom (UK). Therefore, this study aims to fill this knowledge gap by investigating the effect of police officer numbers on several crime types at the PFA level (and by their area characteristics such as predominantly rural, urban, and urban with significant rural) in England between 1991 and 2001.

The focus of this article is whether the number of police officers in police force areas has an impact on crime rates. The general premise here is that if the number of police officers is increased, crimes *should* decrease for several reasons. For example, more police might increase arrests of offenders (i.e., incapacitation). This is also defined as the apprehension role of police (Becker, 1968; Nagin, 2013). Another reason could be that offenders might consider that the risk of being caught increases as the number of police officers increases, so they refrain from offending. This is defined as the sentinel role of police by Nagin (2013) (see also Chalfin and McCrary, 2018 for an extensive literature review on criminal deterrence).

The analysis presented here investigates the role of police officer strength in the crime drop across police force areas in England between 1991 and 2001. We do so by fitting a series of multilevel (e.g., random or mixed effects – we use them interchangeably across the paper) models. The next section reviews the relevant literature, followed by the methodology section that provides an overview of the data, and a description of the analysis. Thereafter, the results are presented

followed by a discussion of the limitations of the study and avenues for future research. A discussion and conclusion section ends the paper.

Literature review

Most previous studies on the effect of police officer numbers on crime rates are US-based, and most systematic review and meta-analysis studies of the police officer strength-crime relationship are dominated by US-focused studies. We start with the three most recent systematic reviews on this topic: Lim et al., (2010), Carriaga and Worrall (2015), Lee et al (2016), and in addition a rapid evidence review (Bradford, 2011). Evidence from these reviews suggests the relationship between police officer numbers and crime levels is mixed. Lim et al. (2010) conducted a systematic review of 58 studies and claimed that there is more evidence contradicting a crime reduction effect of hiring more police than there is evidence supporting it. Lee et al. (2016) included 62 studies in their review and concluded that "…Changing policing strategy is likely to have a greater impact on crime than adding more police." (p.431). In contrast, Bradford (2011) concluded that there is a negative association between police numbers and property crime (i.e., increased police numbers lead to decreased property crime). Whilst Carriaga and Worrall (2015) reviewed 24 studies that look at the relationship between police officer strength and crime over time and suggested there is, on average, a small but significant crime reduction effect.

Overall, while some of the previous studies included in these reviews have found that the number of police officers reduces crime rates, others have found the opposite (e.g., Greenwood and Wadycki, 1973) and some find no relationship (e.g, Kleck and Barness, 2014). One of the main potential reasons for these mixed results is that these studies use different designs and methods. Some studies are based on a single year, while other studies are based on a longer period of time. Some studies investigate the effect of police officer strength on a single crime type while

other studies examine multiple offence types. The methods employed by these studies also vary. Some studies apply ordinary least square (OLS) analysis, others apply two-stage least squares (2SLS) regression analysis or Granger causality tests. Importantly, most of these studies ignore the simultaneity bias, which happens when two variables on either side of a model equation influence each other at the same time (i.e., number of police officers and crime rates). The present study overcomes the simultaneity bias via estimating random effects models that investigate the effects of police officer numbers on crime both within and between PFAs (see the notes underneath Appendix tables 1.1 and 2 for more detailed methodology).

Since our focus here is on the crime drop in England, the reviews by Carriaga and Worrall (2015) and Bradford (2011) are most relevant. This is because, the former only includes longitudinal studies that investigate multiple years covering the original crime drop period and the latter includes two UK-focused studies. Studies included in Carriaga and Worrall (2015) are US-focused and either at the city (both single or multiple cities), county, jurisdiction, Dutch areas, or state (either single or multiple cities) levels. UK-focused studies included in Bradford (2011) are Machin and Marie (2005) and Draca et al. (2011). Machin and Marie's (2005) study is at the PFA-level and investigates the impact of the Street Crime Initiative on crime rates in 2002, whereas the independent variable is police expenditure, not police officer numbers. Draca et al. (2011) on the other hand investigates the impact of police deployment (hours worked per 1,000 population) on crime rates in London and finds that a 10 percent increase in police activity reduces crime by around 3 to 4 percent (p.2158). Another study conducted since the Bradford (2011) review by Vollaard and Hamed (2012) focuses on the period 2001-2008 (which does not cover the full crime drop period (i.e., 1990s onwards)) and finds that higher number of police numbers reduce property

and violent crime. Overall, there is scarce research on the role of police officer strength in the crime drop at the *PFA level* in the UK covering the 1990s onwards.

Methodology

The data

Police recorded crime data

Police recorded crime data (PRCD) at the PFA level from 1991 to 2001 were used to examine the role of police officer strength in shaping the crime drop in England. This historical PRCD was derived from a series of publicly available Home Office publications (Home Office, 2016).

Police officer strength data

Police officer strength data (i.e., number of police officers, full time equivalents excluding long-term absentees, Police Community Support Officers and Special Constables)[2] by PFA was derived from publicly available Home Office publications which were brought together in a House of Commons Library briefing paper (House of Commons Library, 2022).

Police force area type data

To be able to control for different crime environments faced by police forces (and some ensuing contextual factors contained within different area types), we used 2001 Rural Urban Classification of higher geographies (i.e., PFAs) (Department for Environment, Food and Rural Affairs, 2013).[3] Using this data, police force areas were categorised into three types: predominantly urban, predominantly rural, urban with significant rural.

The UK Census data

This study also used the 1991 UK Census to construct structural control variables at the PFA level to thoroughly examine the role of police officer strength in the crime drop in England. The Census data was obtained from NOMIS (the ONS's official labour market statistics website). We aggregated the Local Authority data at the PFA level using Local Authority District to Community Safety Partnerships to Police Force Areas (December 2016) Lookup in England and Wales.[4] The section titled 'Selection of control variables' outlines what these contextual factors are.

Population estimates data

Mid-year population estimates for PFAs between 1995 and 2000 were derived from the Chartered Institute of Public Finance and Accountancy (CIPFA) police actuals. Because we had access to CIPFA data 1995 onwards only, mid-year population estimates for the period 1989-1994 were calculated using the CIPFA data and Microsoft Excel's 'trend' function. The next section ('Dependent variables') outlines how these data were used to construct dependent variables.

Analysis

Dependent variables

The police-recorded crime types included four broad crime categories (that were combinations of specific crime types) and five specific crime categories, which are listed below:

1. Total property crimes (including total criminal damage, total other theft, total burglary, total offences against vehicles, and total robbery)

2. Total violence against person crimes (including violence against person with injury (homicide, attempted murder, child destruction, causing death by dangerous or careless driving, wounding or other act endangering life, less serious wounding), and violence against person with injury (threat or conspiracy to murder, endangering railway passenger, endangering life at sea, abandoning a child under the age of two years, child abduction, and procuring illegal abortion))
3. Total criminal damage (including arson, criminal damage endangering life, other criminal damage over £20, other criminal damage under £20, threat or possession with intent to commit criminal damage)
4. Total crimes (including total violence against the person, total sexual, total robbery, total burglary, total offences against vehicles, total other theft, total fraud and forgery, total criminal damage, total drug offences, total other miscellaneous offences)
5. Theft from vehicles
6. Vehicle theft
7. Theft from a person
8. Domestic burglary (dwelling) including aggravated burglary in a dwelling
9. Shoplifting

The above crime types were selected for analysis in order following (and thus allowing for comparisons with) previous research on the relationship between police officer strength and crime (see Lim et al., 2010 and Chalfin and McCrary, 2018). To account for differences in geographical size, crime rates per 10,000 population per PFA were used in these analyses. For example, crime rates for 1990 were calculated using mid-year population estimates for 1989; rates for 1991 were calculated using mid-year population estimates for 1990, and so on.

[TABLE 1 HERE]

Independent variable

The primary independent variable included in the present study was number of police officers per 10,000 population. Please see the notes underneath Appendix Table 2 on how this variable was constructed and included in the models.

Selection of control variables

Drawing upon previous research (e.g., Tseloni, 2006) that used victimisation frameworks, such as routine activities theory (Cohen and Felson, 1979) and social disorganisation theory (Sampson and Groves, 1989), to explore factors that have been empirically demonstrated to exert a strong role in shaping crime opportunities, a number of structural control variables at the PFA level were included in the analysis (see Tseloni, 2006 for a detailed justification for selection of these variables). The variables were derived from the 1991 UK Census and are as follows: % Ethnic diversity (i.e., all ethnicity categories except for White), % People aged 16 to 24, % Economically Active (full-time) people, % Economically Inactive students, % Wholly moving households[5], % Owner households, % Private renter households, % Households renting from Housing Association, % Households renting from Local Authority, % Households with no car, % Households with 1.5 over persons per room, % Lone-parent households, and % Professional Socio-economic status. Table 1 presents descriptive statistics for the dependent, independent and control variables.

Analytical approach

The role of police officer strength in the crime drop in England between 1991 and 2001 was investigated in a series of random effects models. There are two main reasons for selecting this study period. Firstly, the last decade of 20th century covers both increases and decreases in

crime. Secondly, there were significant changes to the police's recording of crimes in 2002/03 (ONS, 2022b), meaning the PRCD figures are not directly comparable before and after 2002/03.

The yearly crime rates per 10,000 population (1991-2001) can be thought of as repeated observations within each PFA. The nature of the data set is therefore hierarchical with two levels: the number of crimes per 10,000 population in each year (level 1) which is nested within each of the 38 (excluding City of London and Welsh police forces) PFAs (level 2).[6] Therefore, the relationship between police officer strength and the selected nine police recorded crime types (see the 'Dependent variables' section) was investigated via random effects modelling[7].

A plain language summary of the modelling process is as follows (a more technical description can be found underneath Appendix Table 2). We fitted multilevel models to test the role of police officer strength in the crime drop by looking at police officer strength differences between PFAs and year-on-year police officer strength change within a PFA while controlling for other PFA characteristics discussed above.

Results

The role of police officer strength in the crime drop in England between 1991 and 2001

First, we plot the trends in total crime and police officer strength from 1991 to 2001. In the interest of space, we restrict trend analysis to total crimes. Figure 1a presents trends in total crime and police officer numbers between 1991 and 2001. Figures 1b-d present trends in total crime and police officer numbers by respective area type (e.g., urban, rural, urban with significant rural areas). To facilitate comparisons data has been indexed to 1991.

Analysis of these figures suggest a mixed and somewhat unclear picture[8]. For example, in Figure 1a, total crime increased between 1991 and 1992 while police officer strength decreased.

Similarly, while total crime increased between 1997 and 1999, police officer strength decreased. The opposite occurred between 1996 and 1997. The above fluctuations might suggest that the absence of police increases crime rates. However, there were parallel trajectories of total crime and police officer strength from 1993 to 1996, and from 2000 to 2001, meaning both total crime and police officer strength fell and increased at the same time during these periods, respectively.

According to the National Audit Office (2022, p.38) "it takes at least two years for a new officer to complete their studies and training, and it will take time for these new officers to become fully effective in their roles". Therefore, one can argue that the crime reduction effect of hiring more police officers is likely to have a delayed impact. However, looking at the figures, we can see in Figure 1a, for example, that the number of police officers increased between 1996 and 1997, but total crime increased between 1997 and 1998 and remained stable between 1998 and 1999, slightly decreased between 1999 and 2000, and increased between 2000 and 2001, while police officer strength went down between 1997 and 2000. In other words, when more police officers were hired, there was an increase in total crime in the following years or there was a downward parallel trend between the two (e.g., Figure 1a, 1b and 1c between 1993-1996). Overall, the initial evidence from descriptive trajectories in Figures 1a-1d tells us a mixed story hence we apply statistical modelling next to test this relationship more robustly.

[FIGURES 1a-1d HERE]

The random effects models tested the role of police officer strength in the crime drop in England between 1991 and 2001 while controlling for area type and census area characteristics. Looking at the row 'Between-PFA effect' in Table 2, which presents findings in relation to the effect of police officer strength on various crime types, there is only one statistically significant result (see the 'vehicle theft' column). This result means that police forces with a greater number of police

officers during the period 1991-2001 experienced fewer vehicle thefts. However, looking at the row 'Within-PFA effect', there was no within-PFA effect for the same crime type. On the contrary, all other within-PFA effects are positive and statistically significant (except for thefts from person), meaning police forces that increased their police officer strength are the ones that experienced more crime during the period 1991-2001. The exception means that police forces with a greater number of police officers experienced fewer thefts from person.

We fitted the same models again but this time with a two year lagged police officer strength variable (see Table 3) to take account of any potential delayed crime reduction impact of an increase in police officers. Comparing the results from Table 2 and Table 3, we can say that most of the results remained similar[9].

What do these findings mean? First, the results show that crime specific analysis is crucial as there is no effect of more police on total crime but there is for vehicle thefts, thefts from vehicle, and thefts from person, depending on whether the police officer strength variable is lagged one year or two years. Second, lagging the police officer strength variable differently does not change the results dramatically. Third, it seems that police forces with more crime hired more officers. However, the results do not necessarily mean that hiring more police officers causes more crime (see Figures). It is highly plausible that those police forces with more police officers have recorded or detected more crimes (see Greenwood and Wadycki, 1973; Vollaard and Hamed, 2012). Overall, the role of police officer strength in the crime drop in England between 1991-2001 was limited to vehicle thefts, thefts from vehicle and thefts from person. The results in relation to the control variables show that police force area type, poverty and lack of stability were mostly positively related to crime rates. In other words, urban PFAs and urban PFAs with significant rural

areas experienced more crime than rural PFAs. In addition, in PFAs where there was more poverty and a lack of stability, more crime was experienced (see Tables 2 and 3).

[TABLE 2 HERE]

[TABLE 3 HERE]

Limitations of the study and recommendation for future studies

There are several limitations to the PRCD that need to be noted. First, police recorded crime data only includes incidents reported to, and recorded by, the police. In addition, the data is sensitive to changes in offence classification, legal definitions and recording practices (Tseloni and Tilley, 2016). We used the PRCD because of the small sample sizes for PFAs in the CSEW. Also, the CSEW does not have PFA identifier prior to 1996.

Although we controlled for a number of key factors associated with crime at the PFA level whilst analysing the effect of police officer strength, we acknowledge "the complexity of the natural and built environment, the political, economic, social and cultural contexts and structures of areas and the actions of individuals and corporate bodies within areas" (Bottoms and Wiles, 1992, cited in Trickett et al., 1995: 274). That is, our empirical models were limited to the variables included. Future studies might use data from a variety of sources to overcome this shortcoming, such as information on the built environment, area footfall and movement networks, and offender information from the Ministry of Justice Data First project (Jackson et al., 2022). The police are also only one part of the wider criminal justice system – many other actors have a role to play in reducing crime. Finally, the analysis was limited to 11 (i.e., 1991 to 2001) years and future studies could investigate a longer period.

Discussion and conclusion

Previous research on the role of police officer strength in the crime drop in the UK is limited. The aim of this study, therefore, was to conduct a robust statistical analysis to examine the role of police officer strength in the crime drop in England between 1991 and 2001 using a variety of data sources and employing random effects modelling. The present research has made significant contributions to the literature by filling a substantial gap in the UK-based literature at a time when there is a drive to recruit more police officers in the UK.

The current study has found that there were only three negative and statistically significant relationships between police officer strength and crime, depending on whether the police officer strength variable was lagged one year or two years. The results indicate that police forces with greater number of police officers experienced fewer vehicle thefts, thefts from vehicles, and thefts from person during the period 1991-2001 (see Tables 2 and 3). These findings are in line with Bradford (2011) who concluded that more police officers lead to fewer property crimes. Contrarily, police forces with a larger number of police officers experienced a greater number of crimes (both total, broad categories of crime, and other individual crime types) over the same period. The findings might be a reflection of the Home Office police funding formula that targets greater level of expenditure (and by definition more police officers) to PFAs where the prevalence of crime is likely to be greater (Home Office, 2013). The findings suggest that overall police officer strength played a limited role in the crime drop in England considering that there have been significant falls in various types of crime in England for which we could not find a statistically significant relationship. In fact, the results show the importance of crime specific analysis.

These results might be related to the fact that police forces are tasked with additional responsibilities alongside crime prevention (College of Policing, 2015), and they are rarely

provided with the resources, authority, and the necessary skills to accomplish their expected tasks (Goldstein, 2018). Therefore, police forces might have spent a significant proportion of their time responding to non-crime related issues (e.g., responding to incidents involving persons with mental ill-health, Langton et al., 2021; Langton et al., 2023).

What might be the implications of the findings from the current study given the ongoing police officer recruitment programme in the UK? Our research shows a narrow focus on the number of police officers is not the answer but, in line with a growing body of previous research, it is likely more important what those police officers do and where they are deployed. In addition, there is also a risk that focusing on the number of officers may limit the flexibility forces have in terms of how they use their resources (National Audit Office, 2022). A recent systematic review by Lee et al. (2016) concluded that "Changing policing strategy is likely to have a greater impact on crime than adding more police." (p.431). Considering the strong evidence about the effectiveness of proactive policing styles, such as problem-oriented policing (Hinkle et al., 2020) and hot spots policing (Braga et al., 2019), we suggest training newly recruited police officers in the fundamentals of proactive policing strategies following the evidence based policing framework (Sherman, 2013; Neyroud, 2022; Piza and Welsh, 2022) that might have a lasting crime reduction effect.

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Tables

Table 1: Descriptive statistics of dependent, independent and control variables

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total
						Dependent variables M (SD)						
Total property crime	2.94	2.96	2.96	2.94	2.92	2.91	2.86	2.86	2.85	2.84	2.87	2.90
	(0.11)	(0.10)	(0.10)	(0.11)	(0.11)	(0.12)	(0.11)	(0.12)	(0.11)	(0.11)	(0.12)	(0.12)
Total violence against person	1.53	1.55	1.56	1.58	1.58	1.61	1.63	1.88	1.92	1.94	1.99	1.71
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.14)	(0.14)	(0.15)	(0.15)	(0.15)	(0.15)	(0.22)
Total criminal damage	2.13	2.17	2.17	2.20	2.20	2.22	2.18	2.19	2.21	2.23	2.28	2.20
	(0.15)	(0.15)	(0.14)	(0.14)	(0.13)	(0.13)	(0.12)	(0.11)	(0.10)	(0.09)	(0.10)	(0.13)
All crime	2.97	3.00	3.00	2.98	2.96	2.95	2.91	2.94	2.95	2.94	2.97	2.96
	(0.10)	(0.10)	(0.10)	(0.10)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.10)	(0.11)	(0.11)
Theft from vehicle	2.21	2.24	2.22	2.19	2.18	2.17	2.11	2.09	2.06	2.03	2.05	2.14
	(0.12)	(0.11)	(0.10)	(0.10)	(0.10)	(0.11)	(0.11)	(0.12)	(0.12)	(0.13)	(0.14)	(0.13)
Vehicle theft	1.98	1.99	2.00	1.94	1.91	1.89	1.80	1.76	1.72	1.68	1.65	1.85
	(0.18)	(0.19)	(0.20)	(0.21)	(0.21)	(0.21)	(0.20)	(0.20)	(0.20)	(0.20)	(0.22)	(0.24)
Theft from person	0.61	0.64	0.72	0.76	0.83	0.82	0.82	0.86	0.90	0.97	1.10	0.82
	(0.26)	(0.28)	(0.31)	(0.28)	(0.27)	(0.28)	(0.27)	(0.26)	(0.28)	(0.28)	(0.27)	(0.30)
Domestic burglary	2.00	2.06	2.09	2.06	2.02	1.99	1.92	1.88	1.85	1.81	1.83	1.95
	(0.16)	(0.16)	(0.17)	(0.18)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.18)	(0.19)	(0.20)
Shoplifting	1.75	1.75	1.73	1.71	1.72	1.71	1.70	1.71	1.73	1.74	1.75	1.73
	(0.13)	(0.10)	(0.11)	(0.09)	(0.09)	(0.09)	(0.09)	(0.10)	(0.10)	(0.10)	(0.11)	(0.10)
						Independent variable M(SD)						
Number of police officers per 10,000 residents	22.09	22.02	22.11	21.93	21.72	21.56	21.72	21.61	21.30	20.74	21.46	21.66
	(4.32)	(4.13)	(3.90)	(3.84)	(4.06)	(3.91)	(3.75)	(3.78)	(3.88)	(4.12)	(4.19)	(3.96)
						Control variables %						
Predominantly rural (% of PFAs)	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7
Predominantly urban (% of PFAs)	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6
Significant rural (% of PFAs)	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7
						Control variables M(SD)						
% Ethnic diversity	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64
	(4.15)	(4.15)	(4.15)	(4.15)	(4.15)	(4.15)	(4.15)	(4.15)	(4.15)	(4.15)	(4.15)	(4.15)
% People aged 16 to 24	12.59	12.59	12.59	12.59	12.59	12.59	12.59	12.59	12.59	12.59	12.59	12.59
	(0.54)	(0.54)	(0.54)	(0.54)	(0.54)	(0.54)	(0.54)	(0.54)	(0.54)	(0.54)	(0.54)	(0.54)
% Economically Active (full-time)	37.75	37.75	37.75	37.75	37.75	37.75	37.75	37.75	37.75	37.75	37.75	37.75
	(3.37)	(3.37)	(3.37)	(3.37)	(3.37)	(3.37)	(3.37)	(3.37)	(3.37)	(3.37)	(3.37)	(3.37)

% Economically Inactive students	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66
	(0.41)	(0.41)	(0.41)	(0.41)	(0.41)	(0.41)	(0.41)	(0.41)	(0.41)	(0.41)	(0.41)	(0.41)
% Wholly moving households	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
	(0.86)	(0.86)	(0.86)	(0.86)	(0.86)	(0.86)	(0.86)	(0.86)	(0.86)	(0.86)	(0.86)	(0.86)
% Owner households	69.63	69.63	69.63	69.63	69.63	69.63	69.63	69.63	69.63	69.63	69.63	69.63
	(5.19)	(5.19)	(5.19)	(5.19)	(5.19)	(5.19)	(5.19)	(5.19)	(5.19)	(5.19)	(5.19)	(5.19)
% Private renter households	6.76	6.76	6.76	6.76	6.76	6.76	6.76	6.76	6.76	6.76	6.76	6.76
	(1.66)	(1.66)	(1.66)	(1.66)	(1.66)	(1.66)	(1.66)	(1.66)	(1.66)	(1.66)	(1.66)	(1.66)
% Households renting from Housing Association	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73
	(1.08)	(1.08)	(1.08)	(1.08)	(1.08)	(1.08)	(1.08)	(1.08)	(1.08)	(1.08)	(1.08)	(1.08)
% Households renting from Local Authority	18.74	18.74	18.74	18.74	18.74	18.74	18.74	18.74	18.74	18.74	18.74	18.74
	(5.51)	(5.51)	(5.51)	(5.51)	(5.51)	(5.51)	(5.51)	(5.51)	(5.51)	(5.51)	(5.51)	(5.51)
% Households with no car	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
	(7.61)	(7.61)	(7.61)	(7.61)	(7.61)	(7.61)	(7.61)	(7.61)	(7.61)	(7.61)	(7.61)	(7.61)
% Households with 1.5 over persons per room	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
% Lone-parent households	3.38	3.38	3.38	3.38	3.38	3.38	3.38	3.38	3.38	3.38	3.38	3.38
	(0.87)	(0.87)	(0.87)	(0.87)	(0.87)	(0.87)	(0.87)	(0.87)	(0.87)	(0.87)	(0.87)	(0.87)
% Professional SEC	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67
	(1.10)	(1.10)	(1.10)	(1.10)	(1.10)	(1.10)	(1.10)	(1.10)	(1.10)	(1.10)	(1.10)	(1.10)

Notes: M = Mean, SD = Standard Deviation. Dependent variables are logarithmic transformation of crime rates per 10,000 population.

Table 2: Estimated effects of number of police officers (one year lagged) on crime

Crime types	All crime	Total property crime	Total VAP	Total criminal damage	Theft from vehicle	Theft from shop	Theft from person	Vehicle theft	Domestic burglary
				Fixed part					
cons	2.979 (0.117)***	2.992 (0.125)***	1.374 (0.162)***	2.188 (0.101)***	2.324 (0.144)***	1.614 (0.133)***	0.420 (0.229)	2.099 (0.172)***	2.007 (0.205)***
(Occasion-gm)	-0.004 (0.001)***	-0.014 (0.001)***	0.049 (0.003)***	0.010 (0.002)***	-0.022 (0.002)***	0.000 (0.002)	0.037 (0.004)***	-0.039 (0.002)***	-0.032 (0.002)***
(Occasion-gm)^2	0.001 (0.000)***	0.0001 (0.0002)	0.006 (0.0004)***	0.001 (0.0002)*	-0.001 (0.0003)***	0.002 (0.0003)***	0.002 (0.0005)**	-0.002 (0.0003)***	-0.002 (0.0003)***
Between-PFA effect	-0.003 (0.005)	-0.006 (0.006)	0.014 (0.007)	-0.002 (0.005)	*-0.012 (0.007)*	0.004 (0.006)	0.011 (0.011)	**-0.017 (0.008)***	-0.005 (0.009)
Within-PFA effect	**0.011 (0.002)*****	**0.009 (0.002)*****	**0.009 (0.004)***	**0.006 (0.003)***	**0.007 (0.003)***	**0.010 (0.003)****	***-0.014 (0.006)****	*0.007 (0.004)*	**0.010 (0.003)****
Predominantly urban	0.048 (0.037)	0.064 (0.040)	-0.108 (0.052)*	0.053 (0.032)	0.111 (0.046)*	0.016 (0.042)	0.260 (0.073)***	0.165 (0.054)**	0.101 (0.065)
Significant rural	0.055 (0.026)*	0.060 (0.028)*	0.013 (0.037)	0.043 (0.023)	0.097 (0.033)**	0.024 (0.030)	0.131 (0.052)*	0.187 (0.039)***	0.095 (0.046)*
Poverty (PCA component 1)	0.078 (0.017)***	0.087 (0.019)***	0.049 (0.024)*	0.080 (0.015)***	0.052 (0.022)*	0.034 (0.020)	0.106 (0.034)**	0.182 (0.026)***	0.136 (0.031)***
Lack of stability (PCA component 2)	0.014 (0.012)	0.011 (0.013)	0.007 (0.017)	-0.008 (0.011)	0.034 (0.015)*	-0.013 (0.014)	0.058 (0.024)*	0.038 (0.018)*	0.004 (0.022)

Notes: *p < .05. **p <.01. ***p < .001 (two-tailed tests). Random parts of the models are available in Appendix Table 2

VAP: Violence against person

Between-PFA effect: mean number of police officers per 10,000 residents in a PFA from 1991 to 2001

Within-PFA effect: difference between number of police officers per 10,000 residents in a PFA each year and mean number of police officers per 10,000 residents in a PFA from 1991 to 2001

Table 3: Estimated effects of number of police officers (two years lagged) on crime

Crime types	All crime	Total property crime	Total VAP	Total criminal damage	Theft from vehicle	Theft from shop	Theft from person	Vehicle theft	Domestic burglary
				Fixed Part					
cons	3.007 (0.107)***	3.011 (0.114)***	1.407 (0.151)***	2.187 (0.094)***	2.322 (0.134)***	1.673 (0.122)***	0.598 (0.221)**	2.064 (0.156)***	2.077 (0.191)***
(Occasion-gm)	-0.005 (0.001)***	-0.014 (0.001)***	0.056 (0.003)***	0.009 (0.002)***	-0.024 (0.002)***	0.001 (0.002)	0.036 (0.004)***	-0.042 (0.003)***	-0.036 (0.002)***
(Occasion-gm)^2	0.002 (0.000)***	0.001 (0.000)***	0.007 (0.000)***	0.002 (0.000)***	0.000 (0.000)	0.002 (0.000)***	0.004 (0.001)***	-0.001 (0.000)*	0.000 (0.000)
Between-PFA effect	-0.005 (0.005)	-0.008 (0.005)	0.013 (0.007)	-0.002 (0.004)	**-0.012 (0.006)***	0.001 (0.006)	0.003 (0.010)	**-0.017 (0.007)***	-0.009 (0.009)
Within-PFA effect	**0.009 (0.002)*****	**0.009 (0.002)*****	***0.008 (0.004)***	**0.008 (0.003)****	**0.009 (0.003)****	**0.009 (0.003)****	-0.002 (0.006)	**0.010 (0.004)***	**0.008 (0.003)****
Predominantly urban	0.054 (0.037)	0.070 (0.039)	-0.115 (0.052)*	0.054 (0.032)	0.114 (0.046)*	0.023 (0.042)	0.274 (0.076)***	0.180 (0.054)**	0.122 (0.066)
Significant rural	0.061 (0.026)*	0.066 (0.027)*	0.010 (0.036)	0.045 (0.022)*	0.103 (0.032)**	0.027 (0.029)	0.136 (0.053)*	0.196 (0.037)***	0.101 (0.046)*
Poverty (PCA component 1)	0.083 (0.016)***	0.092 (0.017)***	0.054 (0.023)*	0.078 (0.014)***	0.055 (0.021)**	0.042 (0.019)*	0.124 (0.034)***	0.179 (0.024)***	0.146 (0.029)***
Lack of stability (PCA component 2)	0.016 (0.012)	0.013 (0.013)	0.008 (0.017)	-0.008 (0.010)	0.036 (0.015)*	-0.010 (0.014)	0.073 (0.025)**	0.040 (0.017)*	0.010 (0.021)

Notes: *p < .05. **p <.01. ***p < .001 (two-tailed tests). Random parts of the models are available in Appendix Table 3

VAP: Violence against person

Between-PFA effect: mean number of police officers per 10,000 residents in a PFA from 1991 to 2001

Within-PFA effect: difference between number of police officers per 10,000 residents in a PFA each year and mean number of police officers per 10,000 residents in a PFA from 1991 to 2001

Figures

Figure 1a: Total offences and police officer strength trends

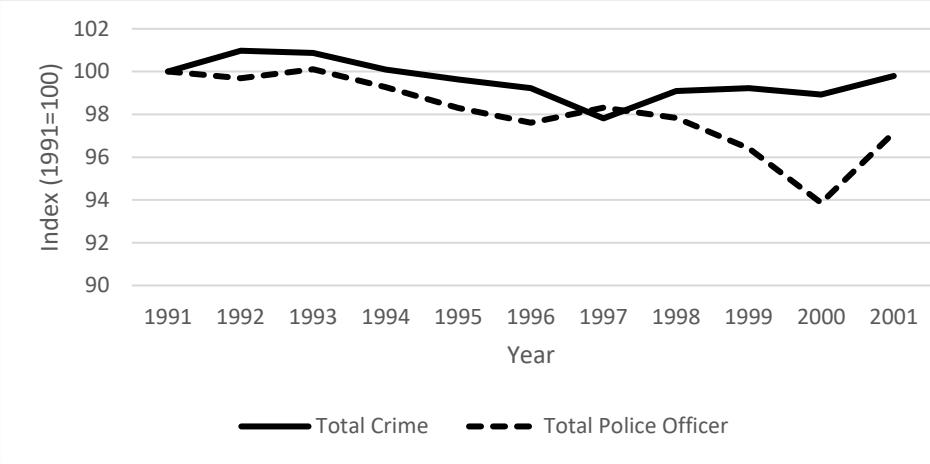


Figure 1b: Total offences and police officer strength trends in predominantly rural areas

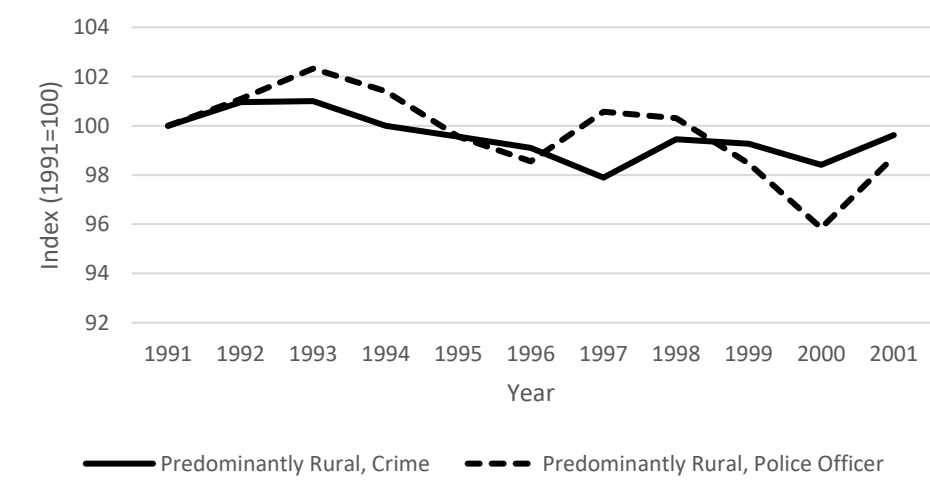


Figure 1c: Total offences and police officer strength trends in predominantly urban areas

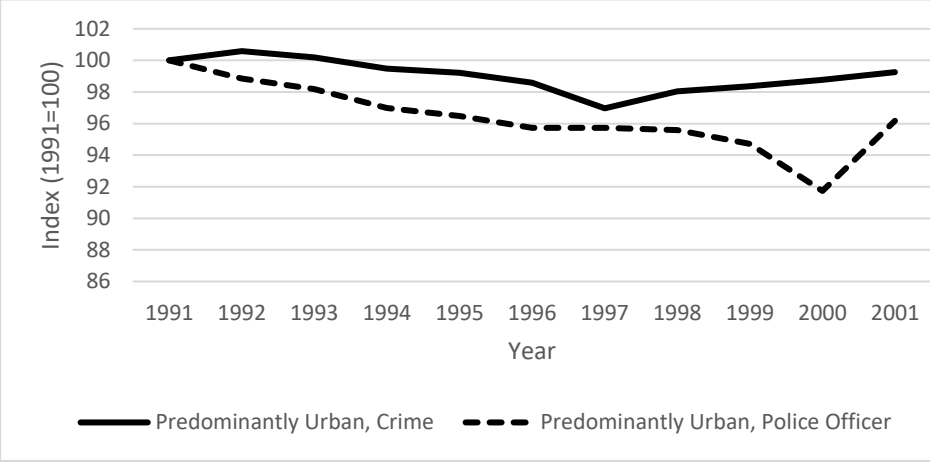
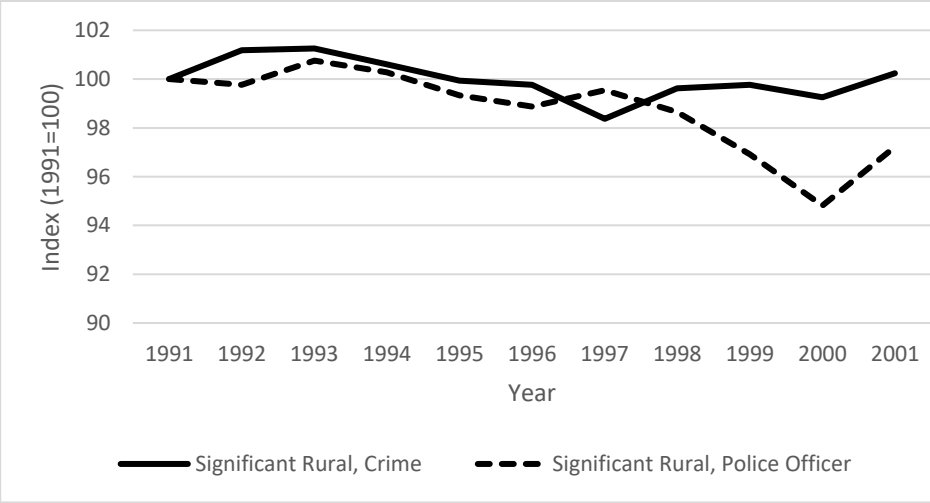


Figure 1d: Total offences and police officer strength trends in urban with significant rural areas



Endnotes

[1] Looking at Figure 2.1 in this Home Office publication (https://www.gov.uk/government/statistics/police-workforce-england-and-wales-31-march-2023/police-workforce-england-and-wales-31-march-2023) "…the recent increase through the Police Uplift Programme is broadly equivalent to the number of officers that were lost between 2010 and 2017". https://fullfact.org/crime/police-officer-uplift-numbers/

[2] The PCSOs and special constables were excluded because the legislation for PCSOs was introduced as part of the Police Reform Act 2002. In relation to special constables, who are members of the public and volunteer to help the police in their duties, they have the same powers as regular officers, but do not have fixed working hours (as they may fit their time around their paid work, for example) and therefore it is inappropriate to collect figures in terms of full-time equivalent. See the user guide to police workforce statistics: https://www.gov.uk/government/publications/user-guide-to-police-workforce-statistics/user-guide-to-police-workforce-statistics#police-officers

[3] The data can be accessed via https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fassets.publishing.service.gov.uk%2Fgovernment%2Fuploads%2Fsystem%2Fuploads%2Fattachment_data%2Ffile%2F239077%2F2001-classification_higher-geogs.xls&wdOrigin=BROWSELINK

[4] The look up can be accessed via https://geoportal.statistics.gov.uk/datasets/ons::local-authority-district-to-community-safety-partnerships-to-police-force-areas-december-2016-lookup-in-england-and-wales-1/explore

[5] A wholly moving household is one where all members of the household have moved from the same address.

[6] The analysis was restricted to PFAs within England because of the non-availability of the area type variable for the four police forces in Wales.

[7] Using SPSS v. 28 (IBM Corp., 2021) for data cleaning and MLwiN v. 3.03 (Rasbash et al., 2019) for statistical analysis.

[8] Looking at Figure 1 in this ONS publication (https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/bulletins/crimeinenglandandwales/yearendingmarch2023), the CSEW data trends show clear reductions in crime rates unlike PRCD over this period. This is because the CSEW is unaffected by changes in levels of reporting to the police or police recording practices (https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/methodologies/userguidetocrimestatisticsforenglandandwales)

[9] All the statistically significant positive within-PFA effects of police officer strength in Table 2 remained positive in Table 3 (see the 'within-PFA effect' row) but the statistically significant negative within-PFA effect of police officer strength on thefts from person in Table 2 (bold and italic) lost its significance in Table 3. In addition to the positive within-PFA effects in Table 3, the non-significant positive within-PFA effect of police officer strength on vehicle thefts in Table 2 (italic) is statistically significant in Table 3. Importantly, the non-significant negative between-effect of police officer strength on thefts from vehicle in Table 2 (italic) is statistically significant in Table 3.