Displacement of Crime or Diffusion of Benefit:

Evidence from the New Deal for Communities Programme

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Chapter 1

Executive Summary

1.1   Background

- Tackling crime and the causes of crime are central policy objectives of the New Deal for Communities (NDC) Programme and the overarching National Strategy for Neighbourhood Renewal of which it is part.

- NDC partnerships have implemented a wide variety of interventions which have crime reduction as the principal outcome. A raft of further interventions have been implemented by NDC partnerships which have the potential to impact upon crime levels despite not having a specific crime-related principal outcome.

- A common concern among policy makers is that area-based crime reduction interventions simply displace criminal offences to proximate localities which are not subject to intervention. The opposite of this situation is where the positive effects of an area-based intervention 'spill over' into surrounding neighbourhoods thus leading to a diffusion of benefit.

- This paper presents the results of a project commissioned as part of the National Evaluation of the NDC Programme to test for evidence of possible displacement or diffusion effects.

1.2   Methodological overview

- The presence of possible geographical displacement of crime/diffusion of benefit is assessed using five concentric buffer rings around each NDC Partnership area[2]. Each buffer ring is of radius 200m giving a total catchment area of 1 kilometre around each NDC. Four types of crime are assessed: violence, burglary, theft and criminal damage. Four time comparison periods are assessed:

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[2]   Islington and Hackney NDC Partnerships are excluded due to sharing a geographic boundary and Plymouth NDC Partnership is excluded due to inability to confidently assign control neighbourhoods.

– 2000-01 to 2001-02

– 2001-02 to 2002-03

– 2002-03 to 2003-04

– 2003-04 to 2004-05

- Changes in crime in the NDC areas and their buffers are assessed relative to each similarly sized neighbourhood[3] in the Partnership's wider local area[4] which had a similar crime rate in 2000-01 and a similar level of multiple deprivation. A Weighted Odds Ratio approach is employed to identify those instances where crime in an NDC partnership has fallen over-and-above what might have been expected in the absence of the Programme. In such instances, a Partnership is said to have seen a 'measurable' reduction in crime.

- Geographical displacement/diffusion can only occur when there is a measurable reduction in crime level in the NDC Partnership. The analyses undertaken focus wholly on those instances where measurable improvements in the NDC crime level are observed. Each NDC Partnership has the potential to register a measurable reduction in crime in each of the four crime types and in each of the four time comparison periods considered. This equates to a total of 624 opportunities across the Programme as a whole for measurable reductions in crime to be observed (note: 39 Partnerships x 4 crime types x 4 time comparison periods = 624 opportunities). The methodology applied in this paper identifies a total of 77 instances of measurable change in a crime level occurring within an NDC Partnership. In other words, a measurable reduction is observed in approximately 12 per cent of the possible opportunities.

1.3 Key findings

- There are many more instances of possible diffusion of benefit than of possible displacement of crime. This finding is consistent across the four different time comparison periods and the four different crime types examined.

- Seventy-seven instances of a measurable reduction in crime were observed within NDC Partnerships across the Programme as a whole. In total, 383 individual buffer rings were therefore eligible to be tested for possible

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3   The similar sized neighbourhoods represent non-NDC 'control' areas against which to compare the progress of the NDC 'treatment' areas. The similar neighbourhoods do not map onto the standard NDC Comparator Areas for two main reasons: (i) some of the standard NDC Comparator Areas lie within the geographical extent across which tests for displacement and diffusion are carried out thereby raising the potential for contamination of results, and (ii) the methodology employed here uses multiple control areas per NDC Partnership rather than a single control area in order to increase the robustness of the results.

4   The term 'wider local area' is used throughout the report and is the NDC's parent local authority minus any MSOAs which have greater than 10 per cent of their population within either an NDC area or surrounding buffer ring. Removing such areas from the wider local authority measure is necessary because these areas can be expected to be affected by the NDC Programme.

displacement or diffusion effects. It is apparent that 23 per cent of these eligible buffer rings experienced possible diffusion of benefit compared to just 2 per cent which experienced possible displacement of crime. The remaining 75 per cent of eligible buffer rings exhibited changes in crime levels which were not suggestive of either possible displacement or diffusion.

- There is remarkable consistency between the four crime types in the propensity for possible displacement/diffusion. Across each of the four crime types, between 21 per cent and 25 per cent of eligible buffer rings indicate possible diffusion while between 0 per cent and 5 per cent indicate possible displacement.

- One or more instances of possible diffusion of benefit were observed around 24 different NDC Partnerships. Certain NDC areas appear to be associated with diffusion of benefit across multiple crime types. The findings from Tower Hamlets and Sandwell NDC areas suggest possible diffusion of benefit to surrounding buffer rings in three of the four crime types. Evidence from a further ten NDC areas suggested possible diffusion to surrounding areas in two of the four crime types and findings from a further 12 areas suggested possible diffusion on a single crime type.

- There is evidence of a distance-decay function associated with instances of possible diffusion of benefit: diffusion is most likely to be observed in the areas immediately surrounding an NDC area and the likelihood of observing diffusion decreases with distance away from the partnership boundary. This finding is consistent across all four crime types and with criminological theory.

- There is a degree of consistency in findings of potential diffusion when looking *across* different buffer rings *within* the same year and *within* the same crime type. In other words, an NDC area is more likely to be associated with diffusion in a number of buffer rings in the same year and for the same crime type than be associated with diffusion in a particular buffer ring over different time periods or between different crime types.

- There is considerable variation in findings across the different time comparison periods indicating a lack of apparent temporal consistency in possible diffusion/displacement effects.

1.4   Acknowledged limitations of the research

- The theory of displacement/diffusion is underpinned by two important *causal* assumptions: first, that a measurable reduction in crime in an intervention area is *caused* by the activity of the intervention; and second, that such a measurable reduction in crime in an intervention area can either *cause* crime to be displacement to proximate non-intervention areas or alternatively *cause* the proximate non-intervention areas to benefit from the activities implemented within the intervention area. However, it is

beyond the scope of this report to definitively attribute any changes in outcomes to the NDC programme operation. In other words, although a measurable reduction in crime (either in an NDC area or in a surrounding buffer ring) represents a change over-and-above what might be expected, it is nevertheless not possible to attribute such a change in a causal sense to the NDC Programme intervention. All conclusions from this report in terms of the NDC Programme's causal impact must therefore be treated with a degree of caution. Consequently, the report refers to 'potential displacement/diffusion' rather than to 'displacement/diffusion'.

- NDC Partnerships have implemented a vast array of interventions which have crime reduction as either a direct or indirect objective. This approach generates considerable difficulties for the evaluation of such interventions. Furthermore, many other area- and person-based interventions to reduce crime are in operation across England which may overlap with the objectives and neighbourhoods targeted through the NDC Programme. Therefore in all instances where measurable reduction in NDC crime rates is observed it is not possible to state definitively that the reduction is caused by NDC Programme's activities. Equally, interventions are likely to be taking place in neighbourhoods used in the analysis as 'control' areas and where this is the case this will tend to underestimate the impact of the NDC Programme.

Chapter 2

Background

2.1 NDC Programme objectives and overlap with other policy initiatives

The NDC Programme is a key element of the Government's National Strategy for Neighbourhood Renewal. The Programme targets 39 neighbourhoods across England with some of the highest levels of multiple deprivation. Key objectives of the Programme are to address the five overarching goals of the National Strategy which are to: reduce worklessness; reduce crime; improve health; improve skills; and improve housing and the physical environment. This report focuses on the crime theme of the NDC Programme's focus. In particular, it tackles an idea of particular concern with any area-based intervention, namely the possibility that activity in the intervention area may have spill-over benefits for surrounding areas. Negative spill-over benefits are usually referred to as problem displacement whereas positive spill-over benefits are usually referred to as diffusion of benefit. This report sets out the extent to which there is evidence of crime displacement and diffusion of benefit across the NDC Programme for four consecutive annual time periods between 2000-2005 and for four key crime categories: violence, burglary, theft and criminal damage.

The NDC Programme is operationalised through a local partnership in each of the 39 target neighbourhoods with local people identifying local problems and implementing locally constructed interventions. The NDC Programme is just one of a raft of various area- and person-based interventions aiming to reduce the incidence of crime through removing the opportunities for offences to take place and tackling the underlying factors that are associated with criminal behaviour. It is important to have an understanding of the overlap and interactions between these various policies when assessing the potential impacts of the NDC Programme.

The introduction of the Crime and Disorder Act 1998 placed a statutory responsibility on the police and local authorities to work together in partnership at the local level to identify local problems and implement local interventions in a coordinated way. These Crime and Disorder Reduction Partnerships (CDRPs), one per local authority in England, often engage with and centrally involve a wide variety of other agencies in order to tackle crime and its causes in a holistic manner.

A variety of policy-specific interventions have been implemented by the Home Office and other interested agencies. These interventions are typically focused around reducing the numbers of high-priority crime types such as burglary, robbery and car crime and increasing the public's perception of personal safety. Examples include the Reducing Burglary Initiative (Home Office), the Street Crime Initiative (Home Office) and the Neighbourhood Wardens Initiative (Communities and Local Government). Each of these interventions is focused on geographical areas with high concentrations of the particular crime problem. Given that NDC Partnership areas are typically located in relatively high crime neighbourhoods, it is important to recognise that a certain degree of overlap is likely in some if not all NDC areas. This potential overlap represents a major difficulty when evaluating the impact of the NDC Programme as results may be 'contaminated' by the alternative intervention. This problem is discussed in more detail in Chapter 4 of this report.

NDC Partnerships have invested considerable resources in a vast array of interventions which may impact either directly or indirectly on crime levels. Between April 1998 and March 2007 over £100 million was invested in specific crime reduction interventions across the 39 Partnerships. However, expenditure on the other key priority themes of education, employment, health and housing and the physical environment may also have an indirect effect on crime levels as such investment may impact upon the complex causes of crime.

The partnership approach to the NDC Programme has generated additional funds contributed from public, private and voluntary sources. In terms of spend on specific crime reduction interventions between April 1998 and March 2007, over £41 million was invested in NDC areas from other public bodies, £2.5 million from private organisations and a further £400,000 from voluntary agencies. In total, therefore, over £145 million was invested in crime-specific initiatives by the NDC Partnerships themselves and various partner organisations. This figure compares with £155 million for Health, £228 million for Employment, £248 million for Community, £251 million for Education, and over £500 million for Housing and the Physical Environment.

2.2 Tackling crime within the NDC Programme: The possibility of displacement and diffusion in an area-based intervention

Crime is often highlighted as one of, if not *the*, major concern of people living in deprived neighbourhoods in England (Burrows and Rhodes, 1998). In recognition of this, the New Deal for Communities (NDC) Programme, and the overarching National Strategy for Neighbourhood Renewal of which it is part, both highlight crime reduction as a central policy objective.

It has been theorised that one potential unintended outcome of implementing an area-based intervention to tackle crime is the geographical

displacement of offences to surrounding areas not covered by the intervention (Cornish and Clarke, 1987; Clarke and Mayhew, 1988; Barr and Pease, 1990; Clarke, 1992; Clarke and Weisburd, 1994; Eck and Weisburd, 1995). The basic premise behind this theory is that interventions which discourage offenders from committing crimes in a particular area (such as door and window locks or extra police or CCTV coverage) simply result in offenders recasting their target areas and focusing on nearby alternative locations not subject to intervention.

The opposite of geographical displacement is diffusion of benefit. In this case, the policy interventions in the target area generate a positive spill-over effect into proximate non-Programme areas resulting in a reduction in crime in these surrounding localities. For instance, it can be theorised that an intervention which successfully tackles the causes of crime as well as reducing the opportunities for crime will essentially reduce the propensity of potential offenders to engage in criminal activity, which could be expected to lead to crime reduction impacts in the wider locality as well as the intervention area.

In evaluating the net benefit of the NDC Programme it is thus crucial to understand whether and, if so to what extent, crime reduction activities in NDC areas may lead to increases or decreases in crime in surrounding areas not subjected to the Programme. This paper evaluates the nature and extent of possible geographical displacement and/or diffusion of crime around NDC areas, using individual level recorded crime data sourced from the 39 regional police forces across England.

It is important to stress that in order for there to be geographical displacement of crime or diffusion of benefit to surrounding areas there must be a 'measurable' reduction in crime within the NDC area itself. In other words, there must first be some evidence that crime has fallen in the Partnership area over-and-above what might be expected based on the experiences of other similar neighbourhoods. Identifying NDC Partnerships where there has been a measurable reduction in crime – and which therefore show the *potential* for displacement/diffusion – is therefore the initial step to any analyses of displacement/diffusion across the NDC Programme. However, as stressed throughout this paper, all analyses presented here are aimed at identifying possible instances of displacement or diffusion; it is not possible to confidently attribute any Programme impact given the complex plethora of interventions operating in NDC Partnership areas and across the wider local area.

2.3   Key research questions

The key policy question addressed in this paper is as follows:

- When NDC Partnerships exhibit measurable reductions in crime, is displacement of crime or diffusion of benefit to proximate non-intervention localities likely?

In order to provide a comprehensive response to this overarching research question this paper tackles a number of component sub-questions:

- Which NDC areas show measurable reductions in crime and display, therefore, the potential for crime displacement and/or diffusion of benefit?

- To what extent are measurable reductions in crime in NDC Partnership areas associated with increases or decreases in crime in surrounding localities?

- How do patterns of potential displacement/diffusion vary by crime type?

- Is there any evidence of a distance-decay function associated with potential displacement/diffusion?

- What is the extent of temporal consistency in observed trends?

To answer these key questions the report presents data between 2000/01 and 2004-05 for each of four key crime types: violence, burglary, theft and criminal damage.

2.4   Structure of the report

The remainder of this report is structured as follows: **Chapter 3** summarises key literature relevant to the central research question; **Chapter 4** gives a short overview of the datasets and methods employed; in **Chapter 5** the nature and extent to which displacement and diffusion may have occurred is analysed; and finally **Chapter 6** presents the main conclusions from this research and highlights policy implications.

Chapter 3

Crime displacement and diffusion of benefit: a summary of theory and evidence

Displacement and diffusion have, in two principal ways, been the subject of considerable attention within the criminological literature. One strand of the literature has focussed theoretically on the processes and mechanisms underpinning these effects. This literature seeks to better understand *why* displacement and diffusion occur in different contexts, the factors which encourage and constrain each of them, and the role which policy can play in affecting them. A second, more empirical, strand to the literature has sought to measure the extent to which displacement and diffusion have taken place around area-based crime interventions using a range of methodological techniques. This chapter provides a very brief overview of the key messages from these two strands of the literature.

3.1 Criminological theory relevant to displacement/diffusion

There are many different theories that attempt to explain how and why crimes occur. One commonly applied theory is the Routine Activities Approach (Cohen and Felson, 1979) which argues that crime has the potential to occur when three factors converge in space and time:

- Motivated offenders

- Suitable targets

- The absence of capable guardians[5]

If all three factors are present at the same time and in the same space then the opportunities for crime are significantly increased, whereas removing any one of the three factors significantly reduces the opportunity for crime to take place. The Routine Activities Approach offers a useful framework to consider the objectives of the NDC Programme as NDC Partnerships are often

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[5] A capable guardian might be a police officer, neighbourhood warden, community resident, local worker, student, shopper etc. whose presence would reduce the likelihood of a motivated offender committing a crime.

attempting to address all three of these factors simultaneously. For example, by tackling the root causes of crime and/or increasing detection and conviction rates (to reduce the number of motivated offenders), by implementing target hardening initiatives such as door and window locks (to reduce the number of suitable targets), and by increasing police presence/CCTV and engendering community cohesion (to increase the presence of capable guardians).

The Routine Activities Approach can be applied to the specific context of displacement/diffusion as explored in this paper. Specifically, if the number of suitable targets is reduced and capable guardians increased by NDC Programme operation then the opportunity for motivated offenders to commit crimes within the Partnership area will be reduced thus leading to a reduction in crime in the NDC area. However, if activity is not also focused on reducing the propensity for motivated offenders to commit crimes then it might be expected that these offenders will recast their target area and commit offences in the surrounding non-Programme neighbourhoods, thus leading to a displacement of crime. A number of studies have considered offenders' 'travel to crime' patterns and found that offenders tend to commit acts of criminality within the boundaries of their local geographical knowledge (e.g. Cohen and Felson (1979); Brantingham and Brantingham (1981); and Wiles and Costello (2000)). Thus if displacement occurs due to Programme operation then it is likely that the offences will be displaced to proximate surrounding areas. However, if the NDC Programme focuses on tackling the root causes of crime which motivate individuals to offend and/or focuses on increasing detection and conviction rates then it might be expected that diffusion of benefit might be observed as proximate geographical areas might also benefit from the reduced offending rates.

3.2   Summary of displacement/diffusion research

Geographical displacement and diffusion of benefit have received much attention in recent decades in (in particular Cornish and Clarke, 1987; Clarke and Mayhew, 1988; Barr and Pease, 1990; Clarke, 1992; Clarke and Weisburd, 1994; Eck and Weisburd, 1995). Within this branch of the literature there has been much attention on defining the concepts and, to a lesser extent, on seeking to theorise the processes by which each takes place and – from a policy perspective – the circumstances and policies which are associated with each outcome.

Cornish and Clarke (1987), for example, suggest that it is useful to consider criminal behaviour in terms of a rational choice framework, which regards such behaviour as the outcome of decisions and choices made by the offender. If an area-based crime reduction intervention successfully reduces the availability of suitable targets and/or increases the risk of detection then the potential offender may not necessarily feel compelled to seek out another crime. As Cornish and Clarke state, with regard to a potential offender, "He may simply desist from any further action…rationalising his loss of income (for example) in various ways: "It was good while it lasted"; "I would have

ended up getting caught" ; and so on" (p.934). Under such a framework it might therefore be expected that the NDC Programme may desist potential offenders from offending altogether (or a least to a lesser extent) rather than simply displace their offending to proximate neighbourhoods.

There have also been a number of evaluations of area-based crime interventions in order to assess whether displacement or diffusion seem to exist in practice, and if so to assess which of the two appears to be more prevalent. Much of this evaluative work has taken place in the USA (see for instance Green, 1995; Sherman and Rogan, 1995; Novak et al., 1999), though recent work by Bowers et al. represent important contributions to evidence in the UK (Bowers and Johnson, 2003; Bowers et al, 2003). Useful syntheses of findings in relation to displacement and diffusion have also been produced (Eck, 1993; Hesseling, 1994; Braga, 2001).

Two points of context for this report stand out in particular from these previous evaluations. First, they in general find more evidence of diffusion of benefit and only limited evidence of displacement of crime. Often these findings are linked back to the theories discussed above but the recognised difficulty in attributing impact in research such as this means conclusions are usually particularly tentative in nature. Second, due to constraints of data availability these evaluations overwhelmingly tend to be localised in nature and to use police beats as the unit of analysis in order to assess evidence of displacement/diffusion. Such data constraints would make the analysis presented in this report problematic to achieve due to the geographically dispersed nature of NDC Partnerships. As discussed in the following chapter, the analyses undertaken for the NDC evaluation and presented in this report are not subject to these data constraints.

Additionally, there has been a focus on 'distance decay' functions within the literature and this is analysed within **Chapter 5** of this report. 'Distance decay' refers to the notion that displacement and diffusion effects will tend to weaken as distance from the intervention area increases, and there is evidence that such distance decay does exist in practice (Phillips, 1980; Rengert and Wasilchick, 1985; van Koppen and de Keijser, 1997), though mediated by factors such as knowledge of different proximate areas in addition to distance (Rengert et al, 1999).

The analyses presented in this report build upon work undertaken by the authors in Phase One of the NDC National Evaluation and which were incorporated into the NDC National Evaluation Interim Report (CRESR, 2005). Results from that earlier study tentatively suggested that diffusion of benefit appeared to be more common than displacement. However, a number of limitations were noted in terms of the data and methodology available for use at the time. This current report addresses those limitations and represents a significantly more sophisticated analysis of the key research questions.

Chapter 4

Data and methods

The analyses undertaken for this report use police recorded crime data to track changes in crime rates over time in NDC Partnership areas and in five concentric buffer rings around each Partnership. To test for possible displacement or diffusion changes in crime rates in the buffer rings are assessed over time in the context of changes in rates in the NDC area. As has been indicated, for either displacement or diffusion to occur there must first be a reduction in crime in the NDC Partnership. If such a reduction is associated with an increase in crime in a surrounding buffer ring then there is evidence of potential displacement. If a reduction in the NDC area is associated with a reduction in a buffer ring then there is evidence of diffusion of benefit.

This chapter briefly summarises the key points relating to the data and methods employed in this paper. For a more detailed discussion please see Appendix A.

4.1　Data

The analyses presented here are based on individual level recorded crime data sourced from each of the 39 regional police forces in England. Thirty-three categories of crime are included in the collated crime database which, for the purposes of these analyses, have been grouped together to form the four broad composite indicators of:

- Violence

- Burglary

- Theft

- Criminal damage

Data have been sourced for five full financial years, from 2000-01 through to 2004-05.

Each record in the crime database contains information on the crime type, date and time of occurrence, date recorded onto the police system, and location of occurrence via a full postcode and/or full grid reference (accurate to the nearest metre).

4.2   Geographies

NDC areas and concentric buffer rings

In order to test for potential displacement and diffusion a common method is to construct one or more non-overlapping buffer rings around the intervention area and to measure crime change in these areas. For the analyses presented in this report, five concentric buffer rings were constructed around each NDC Partnership, each ring being of radius 200m. The farthest extent of the outer-most buffer ring is therefore 1 kilometre from the NDC boundary. For the purpose of illustration, **Figure 1** shows Lambeth NDC and its associated buffer rings as an example. The NDC Partnership area is shaded with blue hatching and each of the five rings surrounding the Partnership is defined by a blue line.

Figure 1 Lambeth NDC Partnership with five concentric buffer rings
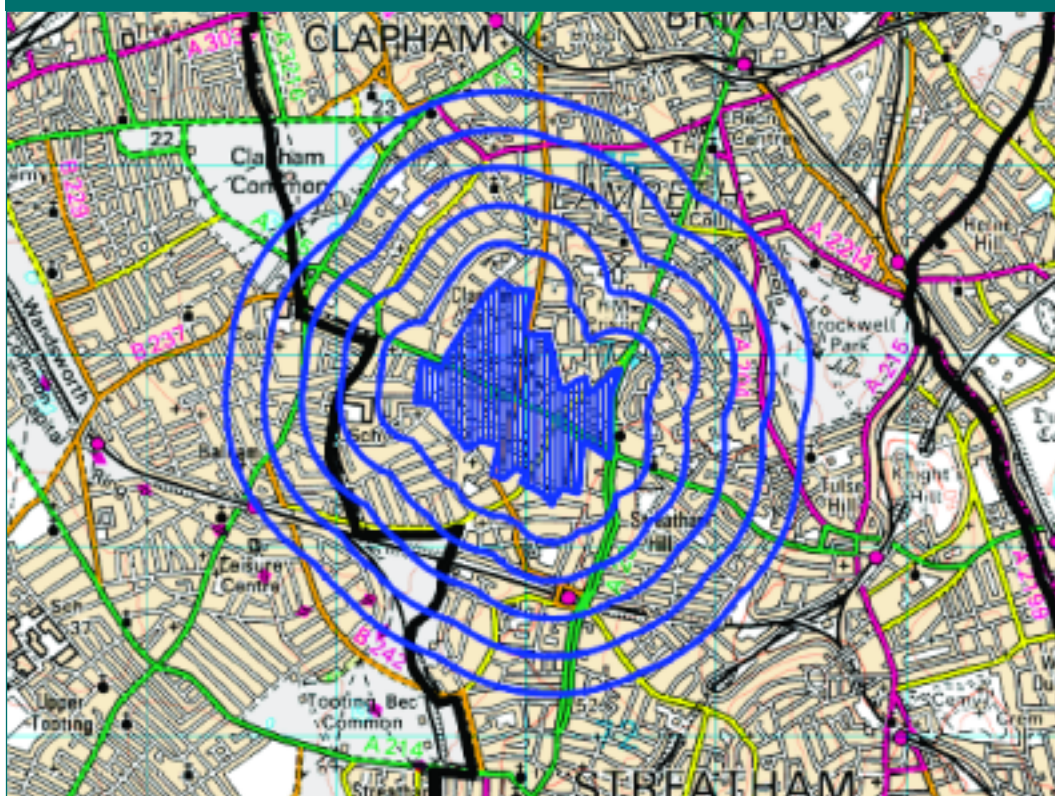
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The 'Wider local area'

As detailed below, changes in crime rates observed in the NDC areas and buffer rings are situated in the context of changes in crime rates in the wider local area. The use of the wider local area is important as it acts as a benchmark against which to assess the extent of change in the target areas. The geographical area chosen for these analyses is the remainder of the parent local authority having excluded the NDC Partnership area and the buffer ring areas. The geographical areas covered by the NDC Partnership(s) and buffer rings are excluded from the area regarded as the wider local area

in order to avoid contamination effects and thus increase the sensitivity of the method to identifying measurable change in crime rates.

Similarly-sized non-NDC 'control' areas and buffer rings

In order to assess whether the changes seen in the NDC and buffer rings represent change beyond that which could normally be expected for areas of their size and type it is necessary to compare these areas with matched 'control' areas. In these analyses, changes in crime rates in NDC areas and buffers are compared to changes observed in similarly sized neighbourhoods which have a similar crime rate in the 2000-01 period and similar levels of multiple deprivation and which fall within the same police force area. The geographical units chosen as similarly-sized neighbourhoods are Middle Layer Super Output Areas (MSOAs). The average resident population in MSOAs in 2001 was 7,300 compared to the average resident population in NDCs in 2001 of 9,800. The similar neighbourhoods do not map directly onto the standard NDC Comparator Areas, used elsewhere in the evaluation, for two main reasons: (i) some of the standard NDC Comparator Areas intersect within the concentric buffer rings across which tests for displacement and diffusion are carried out thereby raising the potential for contamination of results, and (ii) the methodology employed here uses multiple control areas per NDC Partnership rather than a single control area in order to increase the robustness of the results.

4.3   Time comparison periods

For this analysis it was deemed most appropriate to compare a series of sequential one-year time periods rather than compare a single pre-baseline year with a number of subsequent years. As data are available for five consecutive years, from 2000-01 through to 2004-05, this generates four separate time comparison periods:

*   2000-01 to 2001-02

*   2001-02 to 2002-03

*   2002-03 to 2003-04

*   2003-04 to 2004-05.

An alternative method could compare a single pre and post intervention time point, but this method was not followed for three main reasons. First, there is no clear time point at which interventions were implemented through the NDC Programme. Second, even if 2001 was adopted as the assumed baseline then the crime data for the first time comparison period (2000-01 to 2001-02) might be contaminated by Programme effects already in operation at this time. Third, it is useful to revisit the cause-and-effect nature of crime displacement/diffusion theory; that an area-based intervention causes motivated offenders to either re-cast their target offending areas or causes

them to rationally choose to desist from offending. As such, it is likely that if an intervention does successfully reduce crime within its boundaries then offenders' behaviours are likely to be influenced in parallel. In other words, if displacement or diffusion is going to happen it is most likely to occur concurrently with the reduction in crime in the intervention area.

4.4 Methods

Crime counts

The presence of postcode and/or grid reference enables the individual crimes to be aggregated to any given geography. The aggregation method involves an element of geographical 'smoothing' of crimes to account for variations in police geocoding practice. To ensure all data are controlled to a common base, the small area crime counts are constrained to Home Office totals for Crime and Disorder Reduction Partnership (CDRP) areas. Crime counts are created for each NDC area, each buffer ring around each Partnership, each MSOA and each NDC Partnership's wider local area.

Crime rates

Crime rates are constructed by expressing the crime counts in the context of estimated numbers of population or properties 'at-risk' of being the subject of a crime. For the burglary rate a property-based denominator is employed: total residential properties plus total business properties. For the violence, theft and criminal damage indicators a population-based denominator is employed: total resident population plus total workplace population. By extending the denominators to include more than resident population/properties it is possible to go some way towards constructing a more realistic 'at-risk' denominator for each of the crime rates. Crime rates are created for each NDC area, each buffer ring around each Partnership, each MSOA and each wider local area.

Measuring crime reduction in NDC areas

A measure of crime reduction was constructed by, first, assessing changes in crime levels in the NDC area relative to the wider local area and, second, comparing these NDC changes with equivalent data for non-NDC 'control' neighbourhoods (MSOAs) which were similar to the NDC according to population size, crime levels (in the relevant crime type) in 2000-01 and levels of deprivation as measured by the Index of Multiple Deprivation 2004. To achieve these steps, odds ratios were used to compare changes in the each NDC area with changes in each of the control neighbourhoods to assess whether the NDC was improving relative to these similar areas. By always assessing the NDC crime rate and the control area crime rate in relation to their own wider local area crime rate this method essentially uses a Weighted Odds Ratios approach which is an important advance on previous work in this field. This methodology enabled the identification of those NDC areas which exhibited measurable changes in crime rates over-and-above what might

have been expected in the absence of the Programme[6] and thus which might potentially be linked to NDC activity. The analytical techniques adopted here explicitly control for a number of threats to validity including regression to the mean; the selection of control areas based on initial crime rate and level of multiple deprivation mean that areas are compared on a like-for-like basis thus avoiding regression to the mean. A separate such outcome measure was created per NDC Partnership, per crime type and per time comparison period. Four separate year-on-year time comparison periods were examined, from 2000-01 to 2001-02 through to 2003-04 to 2004-05.

Testing for displacement or diffusion

For the analyses of possible displacement and diffusion presented in this report we examine only those instances where an NDC area has exhibited a measurable reduction in crime and therefore has the potential for diffusion/displacement. The method of identifying change in NDC Partnership crime rates detailed above was replicated for each of the five concentric buffer rings around each of the NDC Partnerships which met the criteria of having exhibited a measurable reduction in crime within the Partnership boundary. The change in buffer crime rate was then situated in the context of the change in NDC crime rate to generate a Weighted Displacement Quotient (WDQ) (Bowers and Johnson, 2003). This quotient represents the extent to which changes to crime levels in the buffer ring relate to changes in crime levels in the NDC area. Each buffer WDQ was compared to the WDQ calculated for each of the similar control neighbourhoods and a series of Odds Ratios produced. Areas were identified where the level of possible displacement or diffusion was over-and-above what might be expected in the absence of the Programme. A separate WDQ was constructed per buffer ring, per crime type and per time comparison period. Again, four separate year-on-year time comparison periods were examined, from 2000-01 to 2001-02 through to 2003-04 to 2004-05.

Exclusion of certain NDC Partnerships and buffer rings

As Islington and Hackney NDC Partnerships share a common boundary it has not been possible to construct non-overlapping buffer rings around these areas. It has been necessary therefore to exclude these two NDCs from the analysis of displacement/diffusion. Plymouth NDC Partnership does not match any control neighbourhoods in terms of Index of Multiple Deprivation 2004 score and crime rates in 2000-01. Lacking any possible control area, therefore, Plymouth NDC is also excluded from the analyses. In total, therefore, the displacement/diffusion analyses presented below focus on thirty-six of the thirty-nine NDC Partnerships.

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6   See Appendix A for details of the methodology and criteria by which change in crime rates was assessed as 'measurable'

4.5   Acknowledged limitations of the research

The theory of displacement/diffusion is underpinned by two important *causal* assumptions: first, that a measurable reduction in crime in an intervention area is *caused* by the activity of the intervention; and second, that such a measurable reduction in crime in an intervention area can either *cause* crime to be displacement to proximate non-intervention areas or alternatively *cause* the proximate non-intervention areas to benefit from the activities implemented within the intervention area. However, it is beyond the scope of this report to definitively attribute any changes in outcomes to the NDC programme operation. In other words, although a measurable reduction in crime (either in an NDC area or in a surrounding buffer ring) represents a change over-and-above what might be expected, it is nevertheless not possible to attribute such a change in a causal sense to the NDC Programme intervention. All conclusions from this report in terms of the NDC Programme's causal impact must therefore be treated with a degree of caution. Consequently, the report refers to 'potential displacement/diffusion' rather than to 'displacement/diffusion'.

NDC Partnerships have implemented a vast array of interventions which have crime reduction as either a direct or indirect objective. This approach generates considerable difficulties for the evaluation of such interventions. Furthermore, many other area- and person-based interventions to reduce crime are in operation across England which may overlap with the objectives and neighbourhoods targeted through the NDC Programme. Therefore in all instances where measurable reduction in NDC crime rates is observed it is not possible to state definitively that the reduction is caused by NDC Programme's activities. Equally, interventions are likely to be taking place in neighbourhoods used in the analysis as 'control' areas and where this is the case this will tend to underestimate the impact of the NDC Programme. However, knowledge of the existence of such policies was not available during these analyses.

Chapter 5

Results: Does crime appear to be displaced from NDC areas to surrounding areas or is there a possible diffusion of benefit?

As noted in **Chapter 1** of this report, the analyses undertaken are intended to answer a number of key research questions relating to displacement and diffusion:

• Which NDC areas show measurable reductions in crime and display, therefore, the potential for crime displacement and/or diffusion of benefit?

• To what extent are measurable reductions in crime in NDC Partnership areas associated with increases or decreases in crime in surrounding localities?

• How do patterns of potential displacement/diffusion vary by crime type?

• Is there any evidence of a distance-decay function associated with potential displacement/diffusion?

• What is the extent of temporal consistency in observed trends?

These research questions are addressed below.

5.1 Which NDC areas show measurable reductions in crime and therefore display the potential for crime displacement and/or diffusion of benefit?

As noted in the previous chapter, the analyses of displacement undertaken for this paper focus on change in crime rates from one year to the next rather than on the overall time period. This is because if crime is geographically displaced from an NDC area then it should occur in a different area at the same time. In other words, we assume that any displacement would occur concurrently with the reduction in the NDC area. In order to test for displacement/diffusion under this assumption it is necessary to examine year-on-year changes rather than from the first year of analysis to the last.

The analyses undertaken generate tables of odd ratios from which 'measurable changes' in crime rates in NDC areas by year and by crime type can be assessed[7]. Table 1 below shows the number of NDC Partnerships that saw a measurable reduction in crime over each of the four different time comparison periods and for each of the four crime types.

Table 1 Number of NDC Partnerships exhibiting measurable reduction in crime level per crime type and per year[8]					
	Violence	Burglary	Theft	Criminal Damage	Total across all four crime types
2000-01 to 2001-02	4	6	5	7	22
2001-02 to 2002-03	3	2	4	3	12
2002-03 to 2003-04	4	9	5	6	24
2003-04 to 2004-05	6	7	2	4	19
Total across all four time periods	17	24	16	20	77
Maximum possible opportunities for measurable reduction	144	144	144	144	576

Table 1 shows that when looking, for instance, at violence between 2000-01 and 20001-02 that of the 36 NDC Partnerships under investigation here[9] only four exhibited a measurable reduction in violence levels in this period, and hence it is only these four NDC Partnerships which satisfy the 'inclusion criteria' that displacement/diffusion relating to violence could *potentially* occur in this time period. Each of the 36 NDC areas could experience a measurable reduction in crime in any one or more of the four time periods resulting in a maximum of 144 possible opportunities for a measurable reduction per crime type (i.e. 36 NDCs multiplied by 4 time periods). There are therefore 576 possible opportunities for observing a measurable reduction across all four crime types (i.e. 144 opportunities per crime type multiplied by 4 crime types)

Displacement or diffusion may occur in any one or any combination of concentric buffer rings around each NDC area. When looking at violence, therefore, the analyses undertaken for this section of the report first test

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7   These odds ratios are presented in Appendix B.

8   Table B1 in Appendix B provides a full breakdown of these data and shows the number of NDC Partnerships that saw a measurable reduction in crime over each of the four different time comparison periods and for each of the four crime types.

9   As discussed above Plymouth, Hackney and Islington have of necessity been excluded from analyses of displacement/diffusion

whether displacement or diffusion in relation to violence is apparent in each of the five concentric buffer rings surrounding each of these four NDCs over this particular time comparison period. Equivalent analyses are undertaken for those NDCs meeting the inclusion criterion for each time period and each of the four crime types.

5.2 To what extent are reductions in crime in NDC partnership areas associated with increases or decreases in crime in surrounding areas?

This section analyses whether those buffer rings with the potential for diffusion or displacement did in fact display evidence of either pattern. Seventy-seven instances of a measurable reduction in crime within NDC Partnerships were observed across the Programme as a whole. In total, 383 individual buffer rings were therefore eligible to be tested for possible displacement or diffusion effects. **The main findings from this section are that 23 per cent of these eligible buffer rings showed evidence suggestive of diffusion of benefit compared to just 2 per cent which experienced possible displacement of crime. The remaining 75 per cent of eligible buffer rings exhibited changes in crime levels which were not suggestive of either possible displacement or diffusion. There is remarkable consistency in these percentages across each of the four crime types. Whilst the majority of NDC areas showed evidence suggestive of diffusion it is also the case that the majority of these instances of apparent diffusion occurred in less than ten NDC areas.**

These analyses use the Weighted Displacement Quotient methodology to measure displacement and diffusion[10]. The evidence shows that there are many more instances of possible diffusion of benefit than of displacement of crime from NDC areas to their surrounding areas. This finding is consistent across the different time comparison periods and across the four different crime types examined (see Table 2).

The first (i.e. left-most) column in Table 2 relates to the time comparison period under consideration. The second column replicates the information on the four crime types presented in Table 1 above. The first figure, for instance, represents the four NDC cases which showed a measurable reduction in violence between 2000-01 and 2001-02 discussed above. The third column shows the number of concentric buffer rings corresponding to these NDCs which have the potential to show displacement or diffusion for that crime type in that time comparison period[11]. The fourth column displays the

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10 See Appendix C for a description of the weighted displacement quotient approach used in this analysis.

11 It is worth noting that although in most cases the value in this column equals the value in the second column multiplied by five (as the 36 NDC Partnerships examined in this report are each surrounded by five concentric buffer rings) there are some buffer rings which are not suitable for inclusion due to having crime rates and/or levels of multiple deprivation that prevent a match to any 'like' MSOA being established (see Appendix A for a discussion of matching to 'like' MSOAs).

number of buffer rings which exhibit changes in crime levels of insufficient magnitude to be suggestive of either displacement or diffusion. In the fifth column the values represent the number of buffer rings in which there is evidence of possible crime displacement to buffers while in the final (i.e. right-most) column the figures represent the number of buffer rings in which there is evidence that diffusion of benefit may have occurred. For example, row one shows that 4 NDCs showed a measurable reduction in violence between 2000-01 and 2001-02. Of the 20 buffer rings around these four NDCs, 14 saw no measurable change whilst six also showed a reduction in violence, suggesting possible diffusion of benefit to these six buffer rings.

It is clear from Table 2 that there are many more instances of possible diffusion of benefit than of displacement of crime. This finding is consistent across the different time comparison periods and across the four different crime types examined. In total, 383 individual buffer rings were therefore eligible to be tested for possible displacement or diffusion effects. It is apparent that 23 per cent of these eligible buffer rings experienced possible diffusion of benefit compared to just 2 per cent which experienced possible displacement of crime. The remaining 75 per cent of eligible buffer rings exhibited changes in crime levels which were not suggestive of either possible displacement or diffusion.

While the findings suggest that at a programme wide level there appears to be more evidence to suggest far greater positive diffusion of benefit than displacement, the aggregation of results may hide interesting information about individual areas. For instance, it is not apparent from Table 2 whether it is the same NDCs and/or the same buffer rings that are exhibiting measurable change across multiple years or whether the pattern is in fact more varied with a greater spread of areas being represented. In short, each opportunity for possible displacement or diffusion needs to be considered independently and so the relevant analyses are explored in the following sections.

Table 2 Number of concentric buffer rings exhibiting potential displacement or diffusion per crime type and per time comparison period					
	Number of NDCs meeting inclusion criterion	Number of concentric buffers assessed	Number of buffers with no measurable change	Number of buffers suggesting displacement	Number of buffers suggesting diffusion
Violence					
2000-01 to 2001-02	4	20	14	0	6
2001-02 to 2002-03	3	15	11	0	4
2002-03 to 2003-04	4	20	14	1	5
2003-04 to 2004-05	6	30	27	0	3
Total count	17	85	66	1	18
Percentage		100%	78%	1%	21%
Burglary					
2000-01 to 2001-02	6	30	22	0	8
2001-02 to 2002-03	2	10	4	0	6
2002-03 to 2003-04	9	45	36	0	9
2003-04 to 2004-05	7	35	27	1	7
Total count	24	120	89	1	30
Percentage		100%	74%	1%	25%
Theft					
2000-01 to 2001-02	5	25	23	0	2
2001-02 to 2002-03	4	20	7	4	9
2002-03 to 2003-04	5	25	16	0	9
2003-04 to 2004-05	2	10	10	0	0
Total count	16	80	56	4	20
Percentage		100%	70%	5%	25%

Table 2 Number of concentric buffer rings exhibiting potential displacement or diffusion per crime type and per time comparison period (cont.)					
	Number of NDCs meeting inclusion criterion	Number of concentric buffers assessed	Number of buffers with no measurable change	Number of buffers suggesting displacement	Number of buffers suggesting diffusion
Criminal Damage					
2000-01 to 2001-02	7	33	26	0	7
2001-02 to 2002-03	3	15	11	0	4
2002-03 to 2003-04	6	30	24	0	6
2003-04 to 2004-05	4	20	16	0	4
Total count	20	98	77	0	21
Percentage		100%	79%	0%	21%
All four crime types					
2000-01 to 2001-02	22	108	85	0	23
2001-02 to 2002-03	12	60	33	4	23
2002-03 to 2003-04	24	120	90	1	29
2003-04 to 2004-05	19	95	80	1	14
Total count	77	383	288	6	89
Percentage		100%	75%	2%	23%

5.3 How do patterns of potential displacement/diffusion vary by crime type and between NDC areas?

Table 3 provides a summary of diffusion results by individual NDC Partnership area, while **Table 4** presents equivalent figures for displacement. Looking first at **Table 3**, it is clear in terms of possible diffusion effects that certain NDC areas appear to be associated with diffusion to surrounding areas across multiple crime types. Tower Hamlets and Sandwell in particular stand out as each is associated with evidence of possible diffusion in three of the four crime types, while a further ten areas were associated with evidence of diffusion in two of the four crime types. The remaining twelve areas in the table were each associated with evidence of diffusion on one of the four crime types. This suggests that whilst the majority of NDC areas showed evidence suggesting some diffusion of benefit from the NDC area to surrounding buffer rings, the majority of apparent instances of diffusion occurred in less than ten of the NDC areas.

Table 3 Number of buffer rings with evidence of diffusion of benefit in any of the four time comparison periods, by NDC and crime type					
	Violence	Burglary	Theft	Criminal Damage	Total across all four crime types
Tower Hamlets	2	6	–	2	10
Sandwell	3	–	6	1	10
Bradford	4	–	–	4	8
Sheffield	2	–	–	5	7
Lambeth	–	4	3	–	7
Walsall	–	5	1	–	6
Wolverhampton	–	–	6	–	6
Salford	1	5	–	–	6
Liverpool	–	2	–	3	5
Bristol	4	–	–	1	5
Coventry	–	3	2	–	5
H'smith and Fulham	1	3	–	–	4
Lewisham	–	3	–	–	3
Hartlepool	–	–	3	–	3
Birmingham Aston	2	1	–	–	3
Rochdale	–	–	–	2	2
Doncaster	–	–	–	2	2
Newham	–	1	–	–	1
Newcastle upon Tyne	–	–	–	1	1
Brighton and Hove	–	–	1	–	1
Oldham	1	–	–	–	1
Knowsley	–	–	–	1	1
Brent	–	–	–	1	1
Haringey	–	1	–	–	1

Considering the potential displacement of crime, **Table 4** shows that the Newcastle NDC area showed evidence of potential displacement relating to theft, while the Sheffield NDC area showed evidence of potential

displacement of violence and burglary offences. In both cases, however, any evidence of displacement was relatively limited – particularly in the case of Sheffield NDC – and occurred in only one time period. There was no evidence of possible displacement for any other NDC areas.

Table 4 Number of observed instances of possible displacement in a surrounding buffer ring (in any of the four time comparison periods)				
	Violence	**Burglary**	**Theft**	**Criminal Damage**	**Total across all four crime types**
Newcastle upon Tyne	–	–	4	–	4
Sheffield	1	1	–	–	2

Source:

However, it should be noted that the Sheffield NDC area appears under the violence theme in both **Table 3** and **Table 4** indicating that there need not necessarily be consistency over time and space. It is feasible that an area may see possible displacement in one year followed by diffusion in the next (i.e. temporal inconsistency) and/or see displacement in one buffer ring but diffusion in another (i.e. spatial inconsistency). These spatial and temporal patterns and trends are examined below.

5.4 Is there any evidence of a distance-decay function associated with potential displacement/diffusion?

Given the rarity of instances of apparent displacement of crime this section focuses on those instances of apparent diffusion of benefit and analyses whether there is evidence of a distance-decay function (i.e. whether diffusion or more likely to occur in buffer rings closer to the NDC area than to buffer rings farther away from the NDC area). **The main finding from this section is that there is evidence of a distance-decay function associated with instances of possible diffusion of benefit: diffusion is most likely to be observed in the areas immediately surrounding an NDC area and the likelihood of observing diffusion decreases with distance away from the partnership boundary. This finding is consistent across all four crime types.**

One common aspect of analyses of geographical crime displacement is to assess whether there is any evidence that displacement or diffusion varies according to the distance from the target area and, as in this analysis, this is typically assessed with the construction of multiple non-overlapping concentric buffer rings around the target area(s) of interest. With five such buffers, this analysis benefits from having a relatively large number of buffers and, as such, is well-placed to analyse the extent to which evidence of displacement and diffusion vary by distance from the NDC boundary.

As discussed in **Chapter 3**, the theory of 'distance decay' predicts that effects will be stronger in areas immediately surrounding the target area compared with areas slightly farther from it, and various previous analyses have found evidence that such a 'distance decay' function exists.

Table 5 and **Table 6** show the spatial distribution across buffer rings in cases where there is evidence of possible diffusion or displacement respectively. It is clear from **Table 5** that there does appear to be a distance-decay function associated with instances of possible diffusion. It is also clear that this finding is consistent across all four crime types. Consequently, the results from this element of the analysis suggest that positive diffusion of benefit is most likely to be observed in the areas immediately surrounding an NDC Partnership and that the likelihood of observing diffusion decreases with distance away from the Partnership boundary[12].

Table 5 Spatial distribution of diffusion across buffer rings					
	Violence	**Burglary**	**Theft**	**Criminal Damage**	**Total across all four crime types**
Buffer 1	6	8	7	6	27
Buffer 2	3	10	4	7	24
Buffer 3	3	6	4	2	15
Buffer 4	3	3	3	2	11
Buffer 5	3	3	2	2	10

Table 6 Spatial distribution of displacement across buffer rings					
	Violence	**Burglary**	**Theft**	**Criminal Damage**	**Total across all four crime types**
Buffer 1	1	–	–	–	1
Buffer 2	–	1	1	–	2
Buffer 3	–	–	1	–	1
Buffer 4	–	–	1	–	1
Buffer 5	–	–	1	–	1

Table 6 presents equivalent information for instances of possible displacement. Due to the much smaller number of possible instances of displacement it is difficult to draw any conclusions about any potential

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12 It is possible that the results observed with regard to distance decay may in part be influenced by the disparities in spatial scale between the inner buffers and the outer buffers, as smaller geographical areas (i.e. the inner buffers) are likely to be affected to a greater extent by stochastic change than larger geographical areas (i.e. outer buffers).

distance-decay function associated with such effects. The potential case of violence displacement is observed in Buffer 1 while the potential case of burglary displacement is observed in Buffer 2. In terms of possible theft displacement, the figures suggest that displacement may have occurred once in each of the four outer-most buffer rings of Newcastle NDC. However, to make sense of the findings regarding theft it is important to consider in which NDC Partnership(s) the apparent displacement occurred and during which time comparison periods, as doing so explores the extent to which any individual NDC area experienced consistent evidence of diffusion over time and for a particular crime type. The analyses in the next section address this requirement.

5.5   Do the trends observed change over time?

This section focuses at individual NDC partnership level on the consistency of the findings. **The main findings in this section are that there is a degree of consistency in the findings of potential diffusion when looking *across* different buffer rings *within* the same year and *within* the same crime type. It is much less common, however, for a single NDC to show evidence of possible diffusion of benefit across more than one crime type to the same buffer ring and in the same time comparison period. The findings do not show evidence of consistency of diffusion over the four time comparison periods.**

This analysis examines which NDC Partnerships experienced diffusion/displacement over time for particular crime types. **Table 7** and **Table 8** present data in a manner that allows key messages to be identified at the level of individual NDC areas. **Table 7** and **Table 8** show results disaggregated by the three factors of: (i) crime type; (ii) buffer ring; and (iii) time comparison period. The tables should be interpreted as follows. Each table is divided into four sub-sections, each relating to one of the four crime types. Each row represents a buffer ring whilst columns within each of the four crime type sub-sections correspond to the four time comparison periods. Each cell lists, therefore, those NDCs which show evidence suggestive of diffusion or displacement for that crime type, in that buffer ring and in that time comparison period. For instance, in the top-most sub-section of **Table 7**, relating to violence, five NDCs are listed in the top-left cell: Sandwell, Sheffield, Salford, Oldham and Hammersmith & Fulham. This cell highlights that in the inner-most buffer ring surrounding these five NDC Partnerships there is evidence of potential diffusion of benefit relating to violence in the 2000-01 to 20001-02 time period. Similarly, in terms of burglary, **Table 7** shows that Walsall was the only NDC Partnership to exhibit evidence of potential diffusion of benefit to the outer-most buffer ring (i.e. Buffer 5) in the last time comparison period.

This approach enables the analyses to highlight the relationship between the individual NDC area, buffer ring, crime type and time comparison period in terms of possible experience of diffusion of benefit.

Table 7	Instances of apparent diffusion by crime type and time comparison period by NDC area			
	2000-01 to 2001-02	**2001-02 to 2002-03**	**2002-03 to 2003-04**	**2003-04 to 2004-05**
Violence				
Buffer 1	Sandwell Sheffield Salford Oldham H'smith & Fulham			Tower Hamlets
Buffer 2	Sandwell		Bradford Birmingham Aston	
Buffer 3	Sandwell	Bristol	Birmingham Aston	
Buffer 4		Bristol	Bradford	Tower Hamlets
Buffer 5		Bristol Sheffield	Bradford	
Burglary				
Buffer 1	Newham Salford H'smith & Fulham	Tower Hamlets	Lewisham Lambeth	Walsall Coventry
Buffer 2	Salford H'smith & Fulham	Tower Hamlets	Liverpool Lewisham Lambeth Birmingham Aston	Walsall Haringey Coventry
Buffer 3	Salford H'smith & Fulham	Tower Hamlets	Liverpool Lewisham Lambeth	
Buffer 4	Salford	Tower Hamlets		Walsall
Buffer 5		Tower Hamlets Coventry		Walsall
Theft				
Buffer 1	Coventry	Sandwell Hartlepool	Wolverhampton Lambeth	
Buffer 2	Coventry	Brighton Sandwell	Wolverhampton Lambeth	
Buffer 3		Sandwell Hartlepool	Wolverhampton Lambeth	
Buffer 4		Sandwell Hartlepool	Wolverhampton	
Buffer 5		Sandwell	Wolverhampton	

Table 7	Instances of apparent diffusion by crime type and time comparison period by NDC area (continued)		
	2000-01 to 2001-02	**2001-02 to 2002-03**	**2002-03 to 2003-04**	**2003-04 to 2004-05**

	2000-01 to 2001-02	**2001-02 to 2002-03**	**2002-03 to 2003-04**	**2003-04 to 2004-05**
Criminal Damage				
Buffer 1	Newcastle Knowsley Doncaster	Liverpool Bradford	Tower Hamlets	Liverpool Brent
Buffer 2	Doncaster	Bradford	Tower Hamlets Sheffield	Liverpool Sandwell Bristol
Buffer 3		Bradford	Sheffield	
Buffer 4	Rochdale		Sheffield	
Buffer 5	Rochdale		Sheffield	

It is clear from **Table 7** that there is a degree of consistency in the findings of potential diffusion when looking *across* different buffer rings *within* the same year and *within* the same crime type. In the 2000-01 to 20001-02 time comparison period, for instance, there is evidence of possible diffusion of benefit relating to violence in Buffers 1, 2 and 3 of Sandwell NDC. Equally, there is evidence of possible diffusion of benefit relating to theft in all five buffer rings around Wolverhampton NDC in the 2002-03 to 2003-04 time comparison period. There are several other cases within **Table 7** of NDC areas which show consistency in terms of evidence of possible diffusion of benefit to multiple buffer rings within a single time period and crime type.

It is much less common, however, to find consistency of effects in the same buffer ring between crime types, meaning that there are relatively few cases where a single NDC shows evidence of possible diffusion of benefit across more than one crime type to the same buffer ring and in the same time comparison period. There are, however, some exceptions to this case; Lambeth NDC, for instance, shows evidence of possible diffusion to Buffers 1, 2 and 3 in the 2002-03 to 2003-04 period for both burglary and theft. Additionally, there is little consistency when looking from left to right across each row in the table which shows that the observance of potential diffusion in a certain crime type in a particular buffer in any one year does not mean that diffusion is also likely to be observed in the same buffer in other years. For example, Sandwell NDC area shows evidence of possible diffusion in terms of violence in Buffers 1, 2 and 3 in the 2000-01 to 2001-02 period but not in the following, or indeed any other, time period. Likewise, Tower Hamlets NDC area shows evidence of possible diffusion relating to burglary in all five buffer rings in the 2001-02 to 2002-03 period but not in the following, or indeed any other, time period. There is also little consistency when looking from left to right across the columns in each sub-section of the table, irrespective of the buffer row.

Table 8, below, shows comparable data for NDC buffer rings exhibiting evidence of possible crime displacement over the period. Although there is limited evidence in relation to displacement of crime, two interesting findings do emerge. First, there is some evidence of potential displacement of theft occurring around the Newcastle NDC Partnership in the 2001-02 to 2002-03 time comparison period: potential displacement is observed in four of the five buffer rings in this period, supporting the finding of consistency across buffer rings observed in **Table 7**. Second, it is apparent from consideration of

Table 7 alongside **Table 8** that the Sheffield NDC area appears to have been associated with diffusion of benefit with regard to violence in Buffer 1 in the 2000-01 to 2001-02 period, but then associated with displacement of violence in the same buffer in the 2002-03 to 2003-04 period. These findings therefore qualify those presented earlier in this report in **Table 2** and **Table 3** by demonstrating that displacement and diffusion of a particular crime type can occur in the same buffer ring over different periods of time.

In summary, therefore, it appears from **Table 7** and **Table 8** that there is a certain degree of consistency in findings of potential diffusion and displacement across buffer rings within the same crime type and year. There is however considerable variation in findings across the different time comparison periods which indicates a possible lack of temporal consistency in diffusion/displacement effects.

Table 8 Instances of apparent displacement by crime type and time comparison period				
	2000-01 to 2001-02	**2001-02 to 2002-03**	**2002-03 to 2003-04**	**2003-04 to 2004-05**
Violence				
Buffer 1			Sheffield	
Buffer 2				
Buffer 3				
Buffer 4				
Buffer 5				
Burglary				
Buffer 1				
Buffer 2				Sheffield
Buffer 3				
Buffer 4				
Buffer 5				
Theft				
Buffer 1				
Buffer 2		Newcastle		
Buffer 3		Newcastle		
Buffer 4		Newcastle		
Buffer 5		Newcastle		
Criminal Damage				
Buffer 1				
Buffer 2				
Buffer 3				
Buffer 4				
Buffer 5				

Chapter 6

Conclusions

The focus of this report has been on exploring whether there is any evidence of potential geographical displacement of crime or diffusion of benefit around those NDC Partnerships that experienced a measurable reduction in crime.

The findings suggest that there is only limited evidence of possible displacement of crime surrounding NDC areas whereas there is far greater evidence of possible diffusion of benefit. However, as has been cautioned throughout this report, the findings presented here must be regarded as tentatively suggestive of true patterns only. As outlined in **Section 1.3**, there remain limitations to this study which constrain the conclusions that can be drawn from the results. First, whilst the analyses presented in this report may be *suggestive* of diffusion of benefit and, to a more limited degree, displacement effects it is not possible to attribute any changes to the NDC Programme. Second, a large range of policy interventions both within and beyond NDC areas have taken place since 2000 and these interventions can be expected to also affect levels of crime – either directly or indirectly. The existence of such policies makes it difficult to isolate the independent impact of the NDC Programme.

Given the caveats discussed above, the analyses presented suggest that there are in fact only a limited number of instances in which measurable reductions in crime have been observed in NDC Partnership areas (77 out of a possible 576 possible instances, equating to 13.4%).

The analyses of potential displacement/diffusion presented in this report suggest that measurable reductions in crime in an NDC Partnership are more likely to be accompanied by measurable reductions in crime in surrounding buffer rings than by measurable increases in the buffer rings. This finding has been shown to be consistent across the four different time comparison periods and the four different crime types examined. Diffusion of benefit appears to have occurred in 23 per cent of cases where there was the potential for displacement or diffusion (i.e. where the NDC itself had seen a measurable reduction in crime). Displacement, however, was extremely rare, occurring in possibly only 2 per cent of such cases. This suggests that there is very little evidence that activity in NDC Partnerships simply displaces crime to surrounding non-Programme neighbourhoods, thus offsetting the positive impacts observed in the Partnership area. Rather, there is evidence that

measurable reductions in crime within NDC Partnership boundaries are more likely to be accompanied by reductions in crime in the surrounding non-Programme neighbourhoods, thus suggesting Programme operation may be generating a positive diffusion of benefit to proximate localities.

Moreover, it appears that certain NDC Partnerships appear to be associated with diffusion of benefit across multiple crime types. For instance, Tower Hamlets and Sandwell NDC Partnerships were each associated with possible diffusion of benefit to surrounding buffer rings in three of the four crime types while a further ten areas were associated with possible diffusion to surrounding areas in two of the four crime types. There is however considerable variation in findings across the different time comparison periods, indicating a lack of temporal consistency in apparent diffusion/displacement effects.

Additionally, the evidence suggests that there is a measurable distance-decay function associated with observed instances of diffusion of benefit: diffusion is most likely to be observed in the areas immediately surrounding an NDC Partnership and the likelihood of observing diffusion decreases with distance away from the Partnership boundary. This finding is again generally consistent across all four crime types. This finding is again consistent across all four crime types. This finding concurs with theories of distance-decay relating to displacement/diffusion articulated in previous literature and has important implications for assessing the net impact of Programme operation. Put simply, if the benefits of the NDC Programme are being experienced by individuals living in non-Programme neighbourhoods surrounding the Partnerships then these beneficial effects could be incorporated into an overall assessment of impact or value for money. Perhaps the spectre or displacement might also be recognised for what it is; just one possibility and one that is far from inevitable.

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Appendix A

Calculating 'measurable change' in crime rates

The analyses presented in this report examine how crime levels have changed over time in NDC Partnership areas. Rather than take the simplistic approach of tracking absolute changes in NDC Partnership crime rates over time, these analyses situate the changes observed in NDC areas within the context of trends observed in their wider local area. The purpose of this is to enable the identification of instances where NDC areas experience larger reductions in crime than the surrounding area more generally and thus showing the potential for displacement or diffusion. The level of crime in an NDC area is thus expressed as the ratio of the NDC crime rate to the wider local area crime rate for any given year. This ratio is essentially the 'gap' between the NDC area crime rate and the wider local authority crime rate. Following the objectives of the National Strategy for Neighbourhood Renewal more broadly, the aim of the NDC Programme is to 'narrow' this gap over time. The key outcome measure used in this report to track change over time is thus the change in this ratio over a particular time comparison period.

It is recognised here that an area's starting characteristics may influence the changes observed in that area over time. For example, whilst an NDC Partnership area may 'narrow the gap' with its wider local area on a key crime type, this change may not be specific to the NDC area but rather be a common feature amongst deprived neighbourhoods more generally. In order to assess whether the NDC area is therefore simply following the trend observed amongst other similar neighbourhoods, a further check is implemented to compare changes in NDC areas with changes in other 'like' neighbourhoods. Where the reduction in crime in an NDC area is greater than the reduction in other 'like' neighbourhoods it is possible to say with a degree of confidence that a 'measurable change' in crime levels has occurred in the NDC area. This method is also applied to each of the concentric buffer rings to assess changes over time in crime levels in these geographical units. This Appendix details the methodology used to calculate whether a change in the crime rates of an NDC Partnership or buffer ring can be said to represent 'measurable change'.

Firstly, it is necessary to derive crime counts and rates for the various geographies used in the analysis. The presence of postcode and/or grid reference enables the individual crimes to be aggregated to any given geography. The aggregation method involves an element of geographical 'smoothing' of crimes to account for variations in police geocoding practice.

To ensure all data are controlled to a common base, the small area crime counts are constrained to Home Office totals for Crime and Disorder Reduction Partnership (CDRP) areas. Crime counts are created for each NDC area, each buffer ring around each Partnership, each MSOA and each NDC Partnership's wider local area. Next, crime rates are constructed by expressing the crime counts in the context of estimated numbers of population or properties 'at-risk' of being the subject of a crime. For the burglary rate a property-based denominator is employed: total residential properties plus total business properties. For the violence, theft and criminal damage indicators a population-based denominator is employed: total resident population plus total workplace population. By extending the denominators to include more than resident population/properties it is possible to go some way towards constructing a more realistic 'at-risk' denominator for each of the crime rates. Crime rates are created for each NDC area, each buffer ring around each Partnership, each MSOA and each wider local area.

Using these crime rates, the methodology used to calculate measurable change consists of three stages. This Appendix discusses the calculation in relation to the NDC areas; as noted above, an almost identical methodology was used to detect evidence of displacement/diffusion in each buffer ring using the Weighted Displacement Quotient and this methodology is detailed in **Appendix C**. **Figure A2** below presents a diagrammatical example of the method to which the discussion in this Appendix refers, using the example of change in relative theft rates in Birmingham Kings Norton NDC between 2000-01 to 2001-02.

In Stage 1 of the methodology, an odds ratio is computed to compare changes in crime rates in the NDC area with any 'like' MSOAs within the NDC's police force area. MSOAs are used as these represent the most similar standard geography to NDC (and buffer) areas in terms of population size, and 'like' MSOAs are defined as those which fall within 20 per cent of the NDC's 2004 Index of Multiple Deprivation score *and* within 20 per cent of the NDC Partnership's 2000-01 crime rate for the crime type in question. MSOAs within an NDC or buffer ring are excluded from the list of possible 'like' MSOAs[13].

Stage 1 of the process contains the following four steps. First, in order to control for broader local crime trends, crime rates of each NDC area and of all MSOAs are firstly divided by their 'wider local area' crime rates to make 'relative' crime rates (i.e. the ratio of NDC-to-wider local area crime rates or the ratio of MSOA-to-wide local area crime rates). In this analysis a wider local area represents the remainder of the NDC's parent local authority having excluded MSOAs identified as falling within an NDC Partnership or buffer areas. Figure A1 shows these wider local areas using the Liverpool NDC Partnership as an example. Here, the local authority boundary of Liverpool is shown by the thick black line and the component MSOAs are shown within the local authority boundary. Also shown are the two NDC Partnerships of Liverpool and Knowsley and their associated concentric buffer rings. The area

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13 An MSOA is identified as falling 'within' an NDC or buffer ring when greater than 10 per cent of its population lives within the NDC or buffer area in any year from 2000-2004

regarded as the 'wider local area' for Liverpool NDC Partnership is thus represented by the MSOAs shaded dark green while those shaded light green are excluded from this comparator benchmark definition. It is important to note that MSOAs that intersect with any other NDC or its buffer rings are also excluded from the wider local authority as well as the NDC and buffer rings in question. In the example presented here it is therefore apparent that those MSOAs that fall within the Liverpool local authority boundary but which also fall within the buffer rings around Knowsley NDC Partnership are excluded from Liverpool NDC's wider local area definition.

The relative crime rates are calculated for each of the five years for which data are available (2000-01, 2001-02, 2002-03, 2003-04, and 2004-05). This is shown in the following equation, using 2000-01 as the example year:

NDC relative crime rate 2000-01 = NDC rate 2000-01/Wider local area rate 2000-01

Second, this enables odds to be computed for each NDC Partnership and for each MSOA of the change in these relative crime rates between each of the four time comparison periods analysed in the report (2000-01 to2001-02, 2001-02 to 2002-03, 2002-03 to 2003-04, and 2003-04 to 2004-05). This step is shown in the following equation, using change between the 2000-01 to 2001-02 period as the example time comparison period:

NDC odds 2000-01 to 2001-02 = NDC relative crime rate 2000-01/NDC relative crime rate 2001-02

Figure A1 Mapping the wider local area
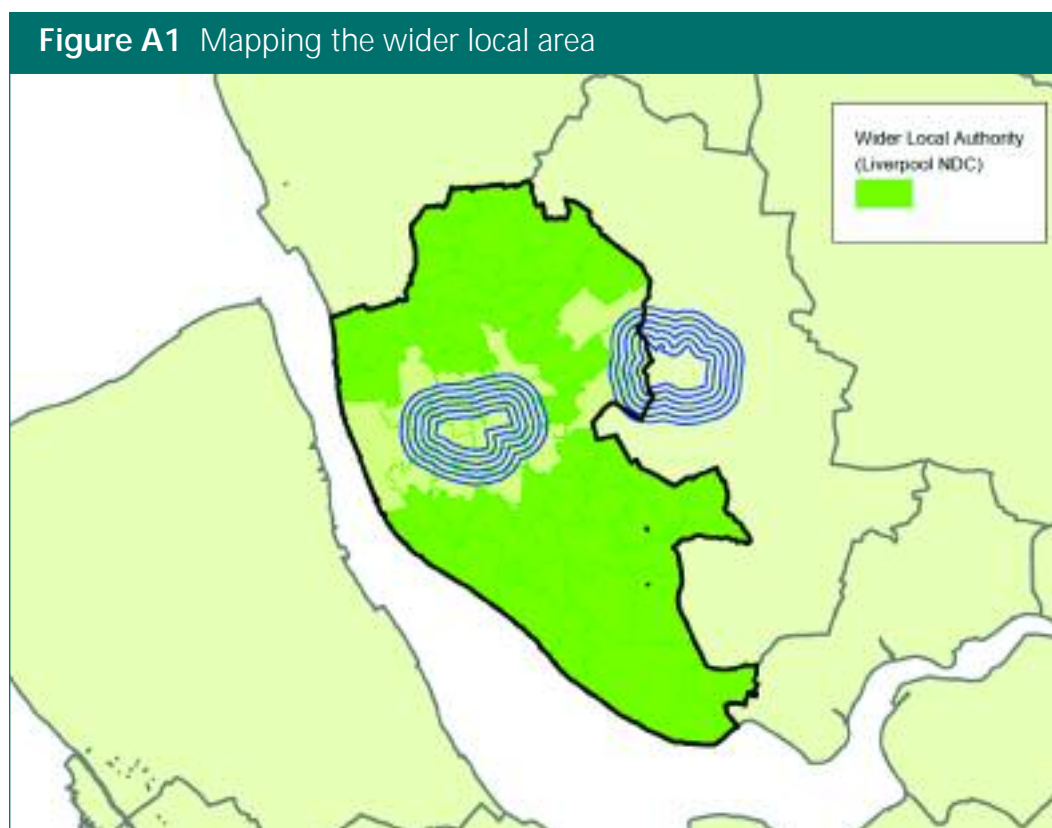
Third, composite odds ratios are calculated between the odds of the NDC area and the odds of each 'like' MSOA for each of the four time comparison periods analysed. Where an odds ratio greater than one represents a larger improvement in the NDC compared with that seen in the MSOA. For example, **Figure A2** shows that in the case of theft between 2000-01to 2001-02 in Birmingham Kings Norton NDC there were a number of MSOAs that were deemed 'like' the NDC area; a total of 40 MSOAs in this example. In this case, therefore, 40 odds ratios will be calculated, each one comparing the NDC with a different one of these MSOAs. These are shown as the blue dots in **F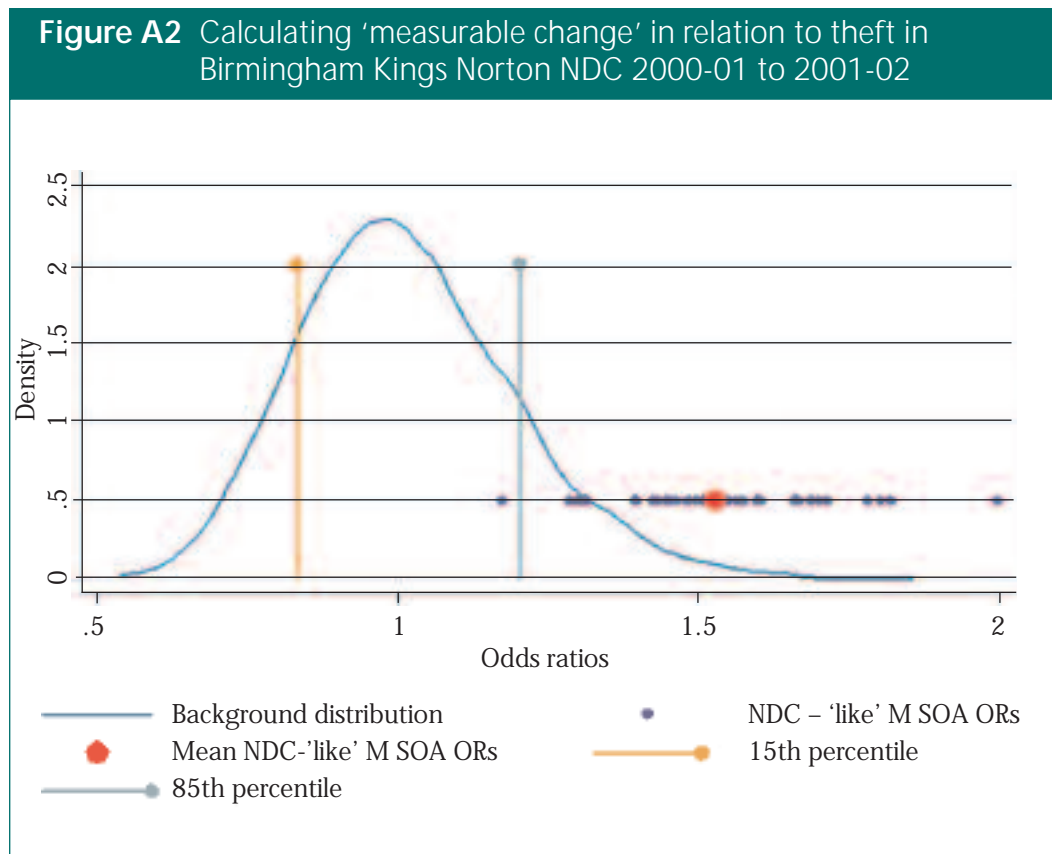igure A2** below. These 40 odds ratios represent change in the NDC's relative crime rate over the time comparison period compared with a different – but always 'like' – MSOA each time. This step is shown in the following equation:

NDC odds ratio$_1$ 2000-01 to 2001-02 = NDC odds 2000-01 to 2001-02/MSOA$_1$ odds 2000-01 to 2001-02

It will be noted that in the equation above the subscript '1' is used. This denoted the fact that there may be more than one MSOA which is 'like' the NDC Partnership (there are 40 such MSOAs in **Figure A2** for example). The subscript '1' denotes that this equation is repeated for each of the 40 MSOAs, each one generating a separate NDC odds ratio.

Fourth, the mean of these 40 odds ratios is computed as a single summary figure for the change in 'relative' crime rates in the NDC compared with its 'like' MSOAs. This is shown as the large red dot in **Figure A2**.

Stage 2 of the process relates these NDC odds ratios to a 'background distribution' of odds ratios relevant to that NDC Partnership. This background distribution follows the same methodology as outlined in Stage 1 except that, in Stage 2, individual MSOAs within the NDC Partnership's police force area are taken in turn and the changes in crime levels in them compared with every other MSOA 'like' itself. In each of the three equations above, therefore, each instance where the NDC appears this will be replaced by an MSOA. Only MSOAs which are within the NDC's police force area and which are not identified as being within an NDC or buffer area can be used within the creation of the background distribution. Comparing each MSOA with every other 'like' MSOA in its police force area creates a large distribution of odds ratios which form the background distribution. The background distribution in **Figure A2**, for instance, contains 7217 odds ratios. This background distribution represents the spread of change seen within these MSOAs and, therefore, can be taken to represent the distribution of odds rations which could normally or reasonably be expected to be seen with geographical areas of this size in this police force area.

Figure A2 Calculating 'measurable change' in relation to theft in Birmingham Kings Norton NDC 2000-01 to 2001-02

Stage 3, finally, calculates whether the level of change seen within the NDC Partnership over this time period represents 'measurable reduction' when compared with the background distribution. Throughout this report, 'measurable reduction' in an NDC area's relative crime rates is taken to be change which places the NDC's mean odds ratio above the 85th percentile of the background distribution. This 85th percentile threshold is shown in **Figure A2** with the grey vertical line. Where an NDC's mean odds ratio is above one and where it lies above the 85th percentile of the background distribution (i.e. at its right tail) the NDC is said to show a measurable improvement in its relative crime rate[14]. In the example of theft in Birmingham Kings Norton NDC shown above in Figure A2, for example, it can be seen that the NDC's odds ratio falls some way to the right of the 85th percentile and would therefore be referred to as indicating a measurable reduction in the theft rate of the NDC for this time period relative to its wider local area.[15]

In taking the 85th percentile as the threshold for 'measurable reduction' this analysis adopts a relatively broad inclusion threshold in terms of which values constitute change which is regarded as 'measurable' when compared with standard equivalent statistical thresholds. There are two reasons in particular

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14   Alternatively, where an NDC Partnership's mean odds ratio is below one and where it lies below the 15th percentile of the background distribution (i.e. at its left tail) the NDC is said to show a measurable worsening in its relative crime rate.

15   It is important to note here that when measuring potential displacement or diffusion to the buffer rings the outcome measure used in the Weighted Displacement Quotient (WDQ). The methodology underpinning the use of the WDQ is detailed in Appendix C.

why the 85th percentile value is considered appropriate as a threshold for measurable change in this analysis. First, one problem common to much evaluation of crime (and other topics) is that whilst we would ideally wish to compare NDC Partnerships and buffer areas with MSOAs *without* crime reduction polices, in reality we know little about whether such policies do exist in MSOAs used either in the calculation of the NDC odds ratios or within the background distribution. In many of these MSOAs crime reduction policies will certainly exist and this may lead to the impact of the NDC being underestimated. Second, although MSOAs are the standard geography closest in population size to the NDC and buffer areas (and whilst this analysis is fortunate in having access to crime data which enables crime to be aggregated to this, and any other, standard geography) it remains the case that NDCs are on average somewhat larger than MSOAs. Given that smaller areas will tend to have greater stochastic variation in their crime rates over time than larger areas, this means that NDCs are somewhat less likely than MSOAs to reach the tails of the distribution. For these two reasons adopting the 85th percentile value as the threshold for 'measurable reduction' is considered appropriate in these analyses, but the reader should be alert to the issue raised.

Appendix B

Changes in crime rates in NDC Partnerships

Table B1 to **Table B4** show odds ratios of relative change in crime rates in NDC Partnership areas for each crime type and in each time comparison period analysed. Odds ratios greater than one represent an improvement in the NDC's crime rate relative to its wider local area. Odds ratios less than one represent a worsening in the NDC's crime rate relative to its wider local area. Figures highlighted in bold show those data (which can be either relative improvements or relative worsening) in which crime changes were 'measurable changes'[16].

Table B1 Changes in relative crime rates in NDC areas, 2000-01 to 2001-02				
	Violence 00–01 to 01–02	Burglary 00–01 to 01–02	Theft 00–01 to 01–02	Criminal Damage 00–01 to 01–02
Birmingham Aston	1.05	0.99	0.94	1.10
Birmingham Kings Norton	0.92	0.91	**1.53**	1.16
Bradford	1.00	1.10	1.11	**1.27**
Brent	1.05	0.99	0.89	1.07
Brighton And Hove	1.07	–	0.99	1.03
Bristol	0.99	–	0.95	**1.35**
Coventry	0.86	1.12	**1.26**	1.08
Derby	1.08	–	**0.80**	0.98
Doncaster	–	1.01	1.03	**1.19**
Hackney	1.10	1.07	1.12	1.10
Hammersmith & Fulham	**1.18**	**1.64**	1.08	0.99
Haringey	0.97	0.96	1.13	0.96
Hartlepool	0.86	0.83	1.04	**1.27**
Islington	**0.80**	1.11	**1.27**	–
Kingston Upon Hull	1.11	1.11	**1.82**	–
Knowsley	1.15	1.16	1.21	**1.47**
Lambeth	1.04	0.92	0.88	0.91
Leicester	1.10	1.05	0.99	**0.72**
Lewisham	**0.81**	**0.76**	**0.70**	**0.82**
Liverpool	1.05	1.16	1.11	1.15
Luton	0.94	0.88	0.99	–
Manchester	1.01	0.95	–	0.94
Middlesbrough	0.85	1.07	**0.75**	1.07
Newcastle	1.02	0.88	0.99	**1.51**
Newham	0.93	**1.32**	0.94	0.95
Norwich	1.09	1.08	1.22	0.96
Nottingham	0.92	1.00	1.07	0.95
Oldham	0.95	0.97	1.00	**0.83**
Plymouth	–	–	**–**	**–**
Rochdale	0.99	1.04	**1.26**	**1.28**
Salford	**1.19**	**1.41**	1.15	1.08
Sandwell	**1.21**	**0.80**	1.15	0.84
Sheffield	**1.22**	**1.47**	–	1.02
Southampton	0.96	**1.33**	0.94	–
Southwark	1.01	**1.58**	**1.29**	–
Sunderland	–	–	**0.55**	**0.74**
Tower Hamlets	0.99	0.86	1.06	0.96
Walsall	1.12	1.17	0.83	**0.81**
Wolverhampton	0.95	0.96	1.09	0.98

Table B2 Changes in relative crime rates in NDC areas, 2001–02 to 2002–03				
	Violence 01–02 to 02–03	Burglary 01–02 to 02–03	Theft 01–02 to 02–03	Criminal Damage 01–02 to 02–03
Birmingham Aston	1.08	0.96	0.98	1.04
Birmingham Kings Norton	0.96	1.19	0.92	1.01
Bradford	1.04	1.13	1.22	**1.30**
Brent	0.95	1.18	1.12	**0.83**
Brighton And Hove	0.91	–	1.01	1.05
Bristol	**1.19**	–	1.25	1.10
Coventry	1.07	**1.34**	1.05	**0.81**
Derby	0.89	–	0.95	1.04
Doncaster	–	**0.76**	1.03	1.14
Hackney	1.05	1.04	**0.77**	0.91
Hammersmith & Fulham	0.87	**0.67**	0.88	0.96
Haringey	1.01	0.92	1.04	1.04
Hartlepool	1.12	1.16	**1.39**	1.03
Islington	1.12	1.18	0.93	–
Kingston Upon Hull	0.99	0.91	**0.78**	–
Knowsley	0.85	1.19	1.02	**0.72**
Lambeth	1.00	1.01	1.05	1.06
Leicester	1.02	0.80	1.11	1.08
Lewisham	1.02	**0.82**	1.09	1.16
Liverpool	1.00	0.90	1.19	**1.29**
Luton	0.94	1.14	1.09	–
Manchester	0.85	1.00	–	0.95
Middlesbrough	1.20	0.82	1.04	1.20
Newcastle	1.13	1.15	**1.35**	0.87
Newham	1.08	0.85	1.19	0.89
Norwich	**0.77**	1.05	**0.67**	0.97
Nottingham	1.18	1.01	0.96	1.09
Oldham	1.13	**0.64**	0.91	1.01
Plymouth	–	–	**–**	**–**
Rochdale	1.08	1.09	1.02	0.86
Salford	0.87	1.00	0.92	1.18
Sandwell	0.86	1.01	**1.23**	**1.24**
Sheffield	**1.38**	**0.79**	–	0.94
Southampton	1.09	0.88	1.07	–
Southwark	0.99	**0.57**	0.96	–
Sunderland	–	–	0.92	0.90
Tower Hamlets	1.00	**1.59**	1.03	0.89
Walsall	**1.21**	1.17	**1.45**	1.13
Wolverhampton	1.08	0.84	**0.80**	1.08

Table B3 Changes in relative crime rates in NDC areas, 2002–03 to 2003–04

	Violence 02–03 to 03–04	Burglary 02–03 to 03–04	Theft 02–03 to 03–04	Criminal Damage 02–03 to 03–04
Birmingham Aston	**1.28**	**1.35**	1.12	1.21
Birmingham Kings Norton	**0.86**	0.98	0.86	**0.81**
Bradford	**1.29**	0.85	0.87	**0.77**
Brent	1.07	0.96	1.16	0.99
Brighton And Hove	0.93	–	**1.36**	0.90
Bristol	0.95	—	1.01	1.07
Coventry	**0.86**	**0.56**	0.95	**0.77**
Derby	0.91	–	1.17	0.94
Doncaster	–	1.05	1.03	1.17
Hackney	0.96	0.87	1.19	1.18
Hammersmith & Fulham	1.01	**1.26**	1.14	0.95
Haringey	0.90	**0.83**	0.99	0.99
Hartlepool	1.11	1.00	1.06	0.93
Islington	1.02	0.96	1.13	–
Kingston Upon Hull	**1.23**	0.94	**0.73**	–
Knowsley	0.95	0.94	1.07	1.09
Lambeth	1.15	**1.34**	**1.24**	1.08
Leicester	0.98	1.05	1.17	**1.30**
Lewisham	0.94	**1.39**	0.94	0.93
Liverpool	1.17	**1.38**	**1.32**	0.89
Luton	1.00	1.12	1.18	–
Manchester	0.97	1.03	–	0.87
Middlesbrough	1.08	1.11	0.91	1.13
Newcastle	1.01	**1.35**	1.02	**1.33**
Newham	1.07	0.87	0.89	**1.29**
Norwich	0.85	0.92	1.05	0.86
Nottingham	1.04	0.90	1.16	**1.25**
Oldham	0.94	**1.29**	1.25	1.11
Plymouth	–	–	**–**	**–**
Rochdale	0.90	0.83	**0.75**	1.08
Salford	1.12	**0.76**	1.10	0.94
Sandwell	0.94	0.94	0.88	0.89
Sheffield	**1.25**	0.90	–	**2.14**
Southampton	1.07	0.84	1.01	–
Southwark	1.08	**1.42**	0.86	–
Sunderland	–	–	0.89	1.13
Tower Hamlets	0.98	0.83	1.03	**1.30**
Walsall	**0.85**	0.91	0.97	1.06
Wolverhampton	1.06	**1.29**	**1.23**	0.92

Table B4 Changes in relative crime rates in NDC areas, 2003–04 to 2004–05				
	Violence 03–04 to 04–05	Burglary 03–04 to 04–05	Theft 03–04 to 04–05	Criminal Damage 03–04 to 04–05
Birmingham Aston	0.88	**0.82**	1.07	0.82
Birmingham Kings Norton	**1.18**	0.92	1.24	0.89
Bradford	0.95	1.14	1.08	1.02
Brent	1.03	1.06	1.05	**1.35**
Brighton And Hove	**1.28**	–	1.23	1.14
Bristol	**0.77**	–	0.95	0.97
Coventry	1.16	**1.30**	1.11	1.00
Derby	1.17	–	1.25	1.01
Doncaster	–	1.03	1.04	1.02
Hackney	1.15	0.94	1.00	**0.81**
Hammersmith & Fulham	1.02	**0.75**	**0.81**	1.01
Haringey	**1.25**	**1.30**	0.93	1.13
Hartlepool	0.88	1.11	**0.74**	**0.78**
Islington	**1.19**	1.07	1.08	–
Kingston Upon Hull	**0.69**	1.10	1.00	–
Knowsley	1.08	0.87	**0.68**	**0.79**
Lambeth	1.01	0.95	0.94	0.91
Leicester	1.03	1.16	0.87	0.90
Lewisham	1.13	1.15	1.18	1.03
Liverpool	1.05	0.90	0.99	**1.37**
Luton	**1.25**	1.07	0.83	–
Manchester	1.06	1.22	–	1.11
Middlesbrough	1.00	1.15	1.04	0.88
Newcastle	0.93	0.85	1.15	**0.83**
Newham	1.11	1.07	0.98	0.95
Norwich	1.07	0.86	0.81	1.01
Nottingham	1.08	**1.56**	1.07	1.14
Oldham	**1.36**	1.15	1.06	1.03
Plymouth	–	–	**–**	**–**
Rochdale	0.91	1.11	**1.53**	1.01
Salford	1.10	0.88	**0.65**	0.91
Sandwell	1.10	1.05	**1.29**	**1.35**
Sheffield	0.91	**1.51**	–	1.20
Southampton	0.98	**1.24**	0.92	–
Southwark	0.96	1.11	1.21	–
Sunderland	–	–	1.10	**1.21**
Tower Hamlets	**1.17**	1.04	1.16	0.94
Walsall	0.91	**1.52**	0.95	0.83
Wolverhampton	1.01	**1.28**	1.06	1.11

Appendix C

Weighted Displacement Quotient

The Weighted Displacement Quotient (WDQ) provides a measure for detecting the apparent existence of displacement/diffusion from NDC Partnerships to buffer rings, and operates essentially by relating crime changes in these two areas to each other. The rationale of the WDQ is as follows. The WDQ places each NDC Partnership and its concentric buffer rings in the context of their wider local area and analyses how the proportions of the wider local area's crime occurring in the NDC Partnership and in the buffer rings change between two time points. By comparing the proportions of crimes which occurred in the NDC Partnership and in each buffer ring in the initial and later time period, the WDQ is able to provide a measure of the extent to which displacement/diffusion seem to have taken place.

For example, if there is a fall in the proportion of the wider local area's crimes which occur in the NDC Partnership between the two time periods (indicative of a relative improvement in the NDC area) *and* there is an increase in the proportion of the wider local area's crimes which occur in the buffer ring then this is taken to be evidence that crime has been displaced from the NDC Partnership into the buffer ring. Inversely, if there is a fall in the proportion of the wider local area's crimes which occur in the NDC Partnership between the two time periods *and* there is also a fall in the proportion of the wider local area's crimes which occur in the buffer ring then this is taken to be evidence that there has been diffusion of benefit from the NDC Partnership into the buffer ring.

More technically, the WDQ methodology used in this report can be expressed using the equations which constitute it, and the WDQ methodology used in this analysis further develops that set out by Bowers and Johnson (2003). Following the description above, the numerator of the WDQ represents change in the buffer area relative to its wider local area between the first period (t_0) and the later time period (t_1):

Buffer change = (Buffer Rate/Wider local area rate) t_1 – (Buffer Rate/Wider local area rate) t_0

The denominator of the WDQ represents change observed in the NDC Partnership relative to its wider local area between the first time period and later time period:

NDC change = (NDC Rate/Wider local area rate) t_1 – (NDC Rate/Wider local area rate) t_0

By combining these two elements, the WDQ of any buffer area can be calculated by:

$$\text{Buffer WDQ} = \frac{(\text{Buffer Rate/Wider local area rate}) \, t_1 - (\text{Buffer Rate/Wider local area rate}) \, t_0}{(\text{NDC Rate/Wider local area rate}) \, t_1 - (\text{NDC Rate/Wider local area rate}) \, t_0}$$

In order to calculate whether the buffer area's WDQ represents a 'measurable change', an equivalent WDQ was calculated for each MSOA in the relevant police force area using this equation, though with the MSOA rate replacing each of the two instances in which the buffer rate appears in the equation. Buffer WDQs were then compared with the WDQ of each 'like' MSOA within the buffer ring's police force area by subtracting each 'like' MSOA's WDQ from the buffer area's WDQ. This can be understood to provide a 'net' buffer WDQ figure, given that it reflects the difference between the WDQ in the buffer area and the WDQ in an MSOA area which is 'like' the buffer ring but which is not proximate to the NDC Partnership. This net WDQ figure is calculated using the following equation:

Net buffer WDQ = Buffer WDQ – 'like' $MSOA_1$ WDQ

It will be noted that the MSOA in this equation is subscripted '1'. This reflects the fact that there may be several MSOAs which are 'like' the buffer, and this equation is repeated separately for each of these MSOAs. These calculations provide a range of net WDQ figures for that buffer ring. These values can then be plotted as equivalent to the blue dots in **Figure A2** in **Appendix A**. This range of net buffer WDQ values will have a mean value which is taken to be the mean net WDQ for that buffer ring, and this mean net WDQ for the buffer ring can be understood as equivalent to the red dot in **Figure A2**.

In order to calculate whether the mean net WDQ for each buffer ring represents 'measurable change' it is compared with a background distribution, as in **Figure A2** in **Appendix A**. Unlike the example presented in **Figure A2**, however, in this case the background distribution relates to net WDQ figures for each MSOA in the buffer ring's police force area (and which are identified as not within an NDC Partnership or buffer ring). This background distribution is calculated using the following equation:

Net $MSOA_1$ WDQ = $MSOA_1$ WDQ – 'like' MSOA WDQ

It will be noted that two of the instances of MSOA in this equation are subscripted '1' and this reflects the fact that this equation takes place for each MSOA ($MSOA_1$ in this example) which is in the buffer ring's police force area and which is identified as not being within an NDC Partnership or buffer ring. All of these net MSOA WDQs together form the background distribution against which the buffer's net WDQ is compared. Where a mean net buffer WDQ lies above the 85th percentile of this background

distribution, and where the NDC Partnership relating to this buffer ring has seen a 'measurable reduction' in this crime type in this time period, there is said to be evidence of diffusion of benefit. Where a mean net buffer WDQ lies below the 15th percentile of this background distribution, and where the NDC Partnership relating to this buffer ring has seen a 'measurable reduction' in this crime type in this time period, there is said to be evidence of crime displacement from the NDC Partnership into this buffer ring.