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Whitworth, A. (2013) 'Local inequality and crime: Exploring how variation in the scale of inequality measures affects relationships between inequality and crime', *Urban Studies*, 50(4), pp725-741

Local inequality and crime: Exploring how variation in the scale of inequality measures affects relationships between inequality and crime

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Abstract

There is considerable interest in the role of inequality in affecting social outcomes yet there is also uncertainty and disagreement about the appropriate scale at which to measure inequality within such analyses. Whilst some have argued for larger scale inequality measures to be used there are good theoretical, empirical and intuitive grounds to think that local inequality may have relevance as a driver of social ills. This paper explores whether differing understandings of 'local' inequality does – or can – matter and, if so, within which contexts this is the case. Contrasting findings across the two areas support the notion that local inequality does have relevance to social outcomes but that the socio-spatial context matters.

Introduction

There has been renewed focus in recent years on the impact of inequality on a range of social outcomes, with the weight of evidence from a multitude of studies suggesting that greater inequality tends to be associated with less positive social outcomes (for reviews see Wilkinson and Pickett, 2009, 2006; Kondo et al, 2009). Whilst research into the links between inequality and health outcomes is particularly widespread there is also considerable theoretical and empirical research into these issues within the criminological literature. This body of evidence similarly finds that inequality tends to be associated with higher levels of crime, whether based on bivariate (Hseih and Pugh, 1993) or multivariate (Kelly, 2000; Demombynes and Ozler, 2005) analyses, studies at national level (Lederman et al, 2002; Fajnzylber et al, 2002) or, in the US context, within states (Kennedy et al, 1998), counties (Kelly, 2000), metropolitan areas (Blau and Blau, 1982). Elsewhere, Whitworth (2012) finds consistent evidence of links between inequality and crime across English local authorities whilst Demombynes and Ozler (2005) find robust associations between inequality and crime within small areas in the South African context.

An issue emerging in this literature is the geographical scale at which analyses ought to be conducted, driven in part by meta-evaluations of the health research which find more consistent evidence of harmful inequality effects in analyses conducted at larger scales (e.g. nations, regions or US states) rather than at smaller geographies (e.g. cities or local areas) (Subramanian and Kawachi, 2004; Franzini et al, 2001; Wilkinson and Pickett, 2006). This has led some to suggest that analyses ought to be conducted at these larger scales (Wilkinson and Pickett, 2006) although others call in contrast for more inequality research at smaller scales (Kelly, 2000; Demombynes and Ozler, 2005).

To explore how variations in the scale of the inequality measure affects crime outcomes this paper analyses links between varying measures of 'local' inequality and four different crime types across two contrasting case study contexts in England.

Inequality and the geographical scale of analysis

In influential meta-analyses, Wilkinson and Pickett (2006; 2009) argue that the best way to explain consistent evidence of links between greater inequality and less positive outcomes is through the relative meaning of income within a society rather than the absolute level of that income. In this account, within more unequal societies the feelings of failure, stress, anxiety and competition resulting from these differences are more acute so that individuals – whether rich or poor – see less positive outcomes. One feature of this body of evidence is the greater consistency of associations between inequality and poorer social outcomes when analyses are conducted at larger spatial scales (Wilkinson and Pickett, 2006; Subramanian and Kawachi, 2004). Wilkinson and Pickett (2006), for example, in a synthesis of 155 peer-reviewed papers on these relationships, find that 83% of studies at national level find robust evidence of such an association compared to 73% of studies at state, region or city level and only 45% of studies at the level of US county, census tract or parish. As a consequence they argue that inequality ought to be measured at relatively large geographical scales within such analyses.

Two main arguments are presented by Wilkinson and Pickett (2006) to support this view. First, the greater consistency of findings at larger scales is taken as indicative that it is at such scales where individuals – potential offenders from a criminological perspective – make their comparisons of relative positioning and is therefore most relevant from a measurement perspective. In short, it is not reasonable to expect individuals in deprived areas to be unaware of – and therefore unaffected by – wealth across broader geographies. Second, on a technical level as the spatial scale of analysis shrinks then more of the inequality in the larger areas is converted into inequality *between* rather than *within* areas. The consequence is that the within-area inequality measures which such analyses use – and the heterogeneity within the social hierarchy which that inequality represents – can essentially be 'measured away' by using smaller spatial units. This in turn makes it more difficult to find evidence of a relationship between inequality and social outcomes at small scales.

These are important arguments but they do not seem to disallow the possibility that local inequality may have relevance to social outcomes. In the study of crime this seems particularly true for acquisitive crime such as burglary where, according to the economic theory of crime for example, it is *local* inequality that best captures the economic trade-off of costs and benefits to a potential burglar within any particular location given that journeys-to-crime tend to be relatively short (Wiles and Costello, 2000). As Hirschfield and Bowers (1997) argue, temptation for potential offenders may be expected to be greater when deprived individuals are in daily contact with affluence. Empirically, the fact that some research does find evidence of a link between greater local inequality and less positive outcomes (Demombynes and Ozler, 2005; Wilkinson and Pickett, 2006; Whitworth, 2012) supports the idea that it may have relevance in some – though perhaps not in all – local contexts.

It is possible when faced with the existing evidence to reach an alternative explanation about the potential place of local inequality as a driver of social ills. One possibility is that localized inequality may be of conceptual importance to people in terms of their comparison groups there may still be greater consistency of findings at larger spatial scales due to the averaging out of varying local level findings. So long as the weighted aggregation of local results is statistically significant and positive it is logically possible that the two core findings – that nationally more unequal societies see worse outcomes and that analyses at local scales give less consistent evidence of a relationship – could hold *even if* it was local rather than regional or national inequality which lay behind the processes affecting social outcomes.

This paper offers an initial investigation of whether variation in the spatial scale at which inequality is measured affects the direction and strength of the relationship between inequality and crime outcomes. The paper explores whether local inequality does – or can – matter and, if so, within which contexts this is the case. The selection of the South Yorkshire and London case studies presents two contrasting local contexts in which to explore these issues, with South Yorkshire being fairly highly and consistently deprived with highly spatially concentrated pockets of affluence contrasted with London as an exemplar of the (on average) economically successful yet highly unequal and spatially mixed 'global city' (Hamnett, 2003).

Crime, place and inequality: theoretical perspectives

The theoretical literature on environmental criminology is vast yet three main perspectives – routine activity theory, rational choice theory and crime pattern theory – dominate the field.

Routine activity theory see crimes as the result of a convergence of three key factors – motivated offenders, suitable targets, and an absence of effective controllers which can take a range of forms (e.g. capable guardians, intimate handlers, place managers) (Cohen and Felson, 1979; Felson, 1998).

Rational choice theory begins instead from the assumption that offending is purposive behavior designed to benefit the offender with the offender cast as a rational agent evaluating the potential gains and risks of alternative targets (Cornish and Clarke, 1986). In contrast to the 'pure' rationality of the theory, research shows that in practice offenders typically employ a rationality which is bounded by local knowledge gained during what are often routine, non-criminal local and that crimes, whilst based on broadly rational considerations of environmental cues about target suitability, tend to be relatively unplanned (Rengert and Wasilchick, 1990).

Finally, crime pattern theory complements these two perspectives by drawing attention to the ways in which offenders and targets – and therefore crimes – are distributed across time and space (Brantingham and Brantingham, 1991). Central to the theory is how offenders and targets move around within their daily lives, passing along known 'paths' between key 'nodes' (e.g. home, work) and venturing less frequently across 'edges' into unfamiliar areas. Hence offenders hold cognitive maps of local areas in which they tend to remain and within which they encounter and evaluate a series of potential criminal opportunities during what are often non-criminally motivated local journeys. Urban land use and planning developments can act to shape these travel patterns as well as to spatially distribute crime generators (places such as shopping centres where offenders do not visit to offend but where criminal opportunities present themselves) and crime attractors (places such as bars where motivated offenders travel for their known criminal opportunities) (Brantingham and Brantingham, 1995). Transport networks and road layouts are important in shaping offenders' awareness space whilst housing often acts to cluster similar individuals together, perhaps to separate and hence protect certain individuals – whether by distance or by the construction of 'gated' apartment blocks – or to juxtapose contrasting areas where 'edges' may create opportunities for criminality.

Thus, these environmental theories can be seen to offer complementary explanations of how crimes come to be distributed across time and space. It is within these broader frameworks that differing theories linking inequality and crime should be understood, emphasizing as they do the way in which spatial context shapes any relationships between such inequality-crime relationships. Three such theories dominate understandings of the relationships between inequality and crime – Becker's (1968) economic theory, Shaw and McKay's (1942) social disorganization thesis and Merton's (1938) strain theory – and each offers different explanations of how and why inequality might be expected to drive crime outcomes.

The economic theory suggests that crime outcomes are the result of the differential economic returns to criminal activity compared to legitimate employment, where inequality encourages criminal rather than legitimate activity (Becker, 1968). In terms of local inequality, the spatial proximity of low-income and high-income individuals or properties feed into offenders' cost-benefit analyses around whether to commit crime and, if so, which targets to select. In these ways the economic theory links almost directly to the rational choice theory but also, through the shaping of suitable targets, to routine activities theory.

In contrast, Shaw and McKay's (1942) social disorganization theory links crime outcomes to networks of social trust and social control whereby a lack of effective social control is said to enable and facilitate criminality through weakened informal controls or less effective lobbying for formal interventions from the police. Inequality is hypothesised to affect crime indirectly through its influence on the presence or absence of 'stabilizing' factors (e.g. stable families or low residential turnover) such that social disorganization theory relates most clearly to the idea of ineffective guardianship within routine activities theory.

Finally, Merton's (1938) strain theory draws a distinction between culture ends (society's valued goals) and culture means (the socially accepted means of achieving those goals). Whilst most people confirm to dominant social constructions of both (i.e. paid work in order to achieve a degree of material success) five potential responses to these socially dominant goals and ends are outlined. Of particular relevance to inequality and crime is the response of 'innovation' in which some individuals feel unable to legitimately achieve the material possessions which society elevates and seek to gain these ends instead via crime. Strain theory maps most obviously onto the supply of motivated offenders with routine activities theory.

Whilst the broader theories from environmental criminology highlight the range of factors which affect the spatial and temporal distribution of crimes these three theories each hypothesise different mechanisms through which inequality might be expected to affect crime outcomes. In particular, local inequality seems of potential relevance within all three theories. At a practical level the theories also suggest a range of explanatory variables of relevance to their causal theories which the methodology used seeks to take into account in order to test the apparent salience of each of these theories.

Data and methods

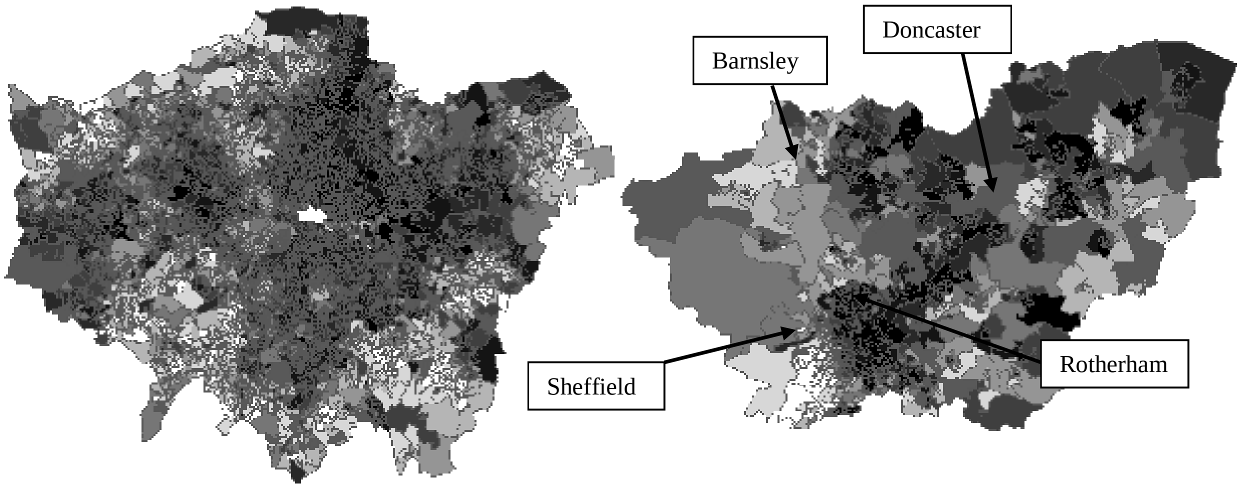
The analyses explore the relationship between local inequality and different crime types across two case study areas – South Yorkshire and London. The choice of case study areas is of relevance to the analysis in that they offer contrasting socio-economic and spatial systems within which to explore the impact of variation in the spatial scale of the inequality measure on the relationship between inequality and crime.

The detailed spatial analysis of crime has a considerable heritage in the South Yorkshire context, not least Baldwin and Bottoms' (1976) ethnographic work in Sheffield. Three decades later South Yorkshire is today a relatively deprived area of northern England which is in many ways still struggling to respond to the decline in heavy industry since the 1970s. Figure 1 below maps multiple deprivation across the region according to the English Indices of Multiple Deprivation 2010 (CLG, 2011). In Figure 1 small areas are ranked nationally into deciles of deprivation whereby areas shaded black fall in the nationally most deprived decile with the shading gradually changing through to those small areas shaded white which fall in the nationally most affluent decile. Whilst pockets of affluence certainly exist in South Yorkshire the area is in general one of relatively widespread deprivation compared to the rest of England. Figure 1 also suggests that it is arguably four socio-spatial systems rather than one in the sense that it is dominated by four distinct and spatially separated urban cores.

London, by contrast, is a global city of extreme affluence alongside some of England's deepest concentrations of deprivation. Figure 1 highlights concentrations of relative deprivation towards the centre of the city and running north and south of the River Thames as well as the contrasting areas of affluence further out from the centre. Figure 2 also suggests that whilst London does of course contain distinct areas it can be understood as a single urban system in terms of its density and connectedness. In terms of prior expectations, therefore, one might expect it to be more likely to see significant relationships between local inequality and crime outcomes in London than South Yorkshire.

Methodologically the analyses focus on multivariate spatial regression models using two years of pooled crime data from 2007/08-2008/09 (South Yorkshire Police) and 2008/09-2009/10 (Metropolitan Police) with explanatory variables based on these years unless indicated otherwise. Analyses are carried out at the Middle Layer Super Output Area (MSOA) level which is an administrative geography of relatively equal population size. There are 6,781 MSOAs in England with an average population size of 7,200 with 172 MSOAs across South Yorkshire and 982

Fig 1: Multiple deprivation across London (left) and South Yorkshire (right)



MSOAs across London[1]. Crime data relate to police recorded crime for both acquisitive (burglary, robbery, and vehicle crime) and non-acquisitive (violence) crime types. It is known that police recorded crime data suffer from under-reporting and crime counts are therefore adjusted by applying Home Office multipliers (Dubourg et al, 2005).

In terms of explanatory variables the inequality measure is based on published estimates of mean MSOA equivalised income before housing costs in 2007/08. There are several ways in which inequality can be measured[2] and the Gini coefficient, perhaps the most common measure, is used throughout. A range of additional controls are incorporated into the models with several of these relating to the theories linking inequality and crime outlined above.

In relation to the economic theory of inequality and crime the percentage of the working age population in each MSOA in receipt of Jobseeker's Allowance (unemployment) benefits is taken as a proxy for legitimate economic opportunities available. The attractiveness of an area to potential offenders is proxied by the price of houses sold in the MSOA in each year. Additionally, Demombynes and Ozler (2005) find that being the richest area amongst one's neighbours can attract crime and a dummy variable identifying the MSOA with the highest average house prices amongst its neighbours is also included.

For social disorganization, residential turnover appears the most conceptually robust of the commonly used indicators (turnover, lone parent families, ethnic heterogeneity and poverty). Turnover here is measured as total residential inmigration plus outmigration in each MSOA over the period 2006-2008. As secondary indicators, ethnic heterogeneity and lone parenthood (as a proxy for family instability) are also explored though are considered conceptually weaker proxies. Ethnic heterogeneity is measured by the percentage of the MSOA population who are non-white according to the 2001 Census whilst lone parenthood is measured by the percentage who are lone parents in receipt of Income Support social security payments.

The percentage of adults with at least basic qualifications as recorded in the 2001 Census is taken as an indicator relating to strain theory. Unemployment may also potentially relate to strain theory as well as to the economic theory given that the unemployed may feel frustrated at their economic position and lack of material resources.

A range of demographic controls are also included. Population density may relate to reduced risk of apprehension, to increased criminal opportunities or to residents knowing each other less well (Kelly, 2000). It has been argued that young people are most likely to be the victims of crime as well as the offenders (Cohen and Land, 1987; Felson, 1993) and the percentage of the MSOA population in each year aged between 16 and 29 is therefore included. Finally, dummy terms are incorporated relating to years and, in recognition of the organizational structure of police activity, to Community Safety Partnerships (CSPs)[3] which broadly relate to local authority geographies.

In terms of the modelling specification the outcome variables are overdispersed crime counts (i.e. variance exceeds mean), as is common with crime data, and negative binomial regression is therefore employed (Osgood, 2000; Demombynes and Ozler, 2005). Two additional specification issues require mention. First, although MSOAs are a statistical geography designed to be of relatively similar population size there remains some population variation between them. The natural logarithm of the MSOA's total population is therefore added as an additional explanatory variable with a fixed coefficient of one in order to take account of population size but without implying a substantively meaningful link between total population and the crime counts (Osgood, 2000: 27; Willits et al., 2011). Doing so effectively changes the regression from an analysis of counts to one of rates per capita. Second, Moran's I tests highlight statistically significant spatial autocorrelation of the crime outcomes[4]. As a consequence spatially lagged crime counts are incorporated as an additional explanatory factor in order to account for this spatial dependence in the data.

Results

Simple correlations between the variables are shown in Table 1 below with statistically significant results at the 5% level shown in bold. Correlations for London are shown above the diagonal and those for South Yorkshire below the diagonal.

The measure of local inequality shown in Table 1 is a Gini coefficient of MSOA mean income in the area immediately surrounding the target MSOA itself[5] plus the target MSOA itself. Givent he discussion above, this highly localised inequality measure is proposed as an extreme test of the relevance of local inequality to crime. Table 1 however shows some evidence of statistically significant – albeit weak – positive correlations between this localised inequality measure and burglary, robbery and vehicle crime in London and with robbery in South Yorkshire.

Amongst the other variables, population turnover, unemployment and the presence of young people are most strongly correlated with the crime outcomes. It is interesting that there are markedly weaker correlations between average MSOA house prices and crime in London compared to South Yorkshire as well as, more specifically, MSOA unemployment and burglary. These findings suggest that local spatial context plays a role in shaping the relationship between inequality and crime and seems linked to the greater physical residential separation between rich and poor in South Yorkshire compared with the greater socio-economic residential mixing (and possibly more extensive public transport networks) within London. These differing socio-spatial compositions may have the effect of more powerfully insulating wealthier areas of South Yorkshire from crime compared with London.

In terms of collinearity issues for the regression models, unemployment and lone parenthood are highly correlated in both areas and therefore only unemployment is retained in the models. The percentage of adults with at least basic qualifications is highly correlated with both lone parenthood and average house prices in South Yorkshire. It is therefore included only in the London models.

Multivariate negative binomial regression models are used to further explore the relationship between local inequality and crime and results are presented in Table 2. Due to the inclusion of the natural logarithm of the MSOA population results can be most easily interpreted as exponentials of the beta coefficients so that they centre around one and relate to the multiplicative change in the expected crime count given each unit change in the explanatory variable (Osgood, 2000: 39; Willits et al., 2011). Coefficients are reported in this way in Table 2. For example, controlling for other factors a 1% increase in unemployment in London is on average associated with a 4% increase in robbery whilst a 1% increase in inequality is on average linked to a 1% increase in vehicle crime.

After controlling for other factors there remains no evidence of a statistically significant link between highly localised income inequality and crime across South Yorkshire. In London, significant associations remain in relation to vehicle crime, robbery and violence though with the latter two crime types now exhibiting a negative rather than positive association.

Unemployment is consistently found to be a significant and positively associated predictor of all four crime types in both areas. The fact that unemployment is also strongly linked to non-acquisitive violent

Table 1: Correlations between variables
(with London shown above and South Yorkshire below the diagonal)

	Burg Rate	Rob Rate	Veh Cri Rate	Viol Rate	Pop Dens	% Youth	Turn-over	% Unem (JSA)	% LP (IS)	Av House Price	% Non White	% Basic Educ	Gini
Burglary Rate	1	**0.62**	**0.62**	**0.59**	-0.01	**0.25**	**0.34**	**0.09**	**0.05**	**0.09**	**0.05**	**0.09**	**0.09**
Robbery Rate	**0.61**	1	**0.49**	**0.79**	**0.26**	**0.42**	**0.40**	**0.34**	**0.22**	-0.01	**0.38**	0.01	**0.05**
Vehicle Crime Rate	**0.78**	**0.75**	1	**0.51**	-0.00	**0.25**	**0.34**	**0.20**	**0.23**	0.04	**0.14**	-0.04	**0.05**
Violence Rate	**0.64**	**0.68**	**0.73**	1	**0.19**	**0.43**	**0.40**	**0.35**	**0.32**	**-0.08**	**0.26**	**-0.13**	0.03
Pop Density	**0.28**	**0.36**	**0.27**	**0.12**	1	**0.56**	**0.20**	**0.28**	**0.14**	**0.17**	**0.37**	**0.19**	**0.24**
% Youth	**0.45**	**0.65**	**0.50**	**0.36**	**0.66**	1	**0.38**	**0.29**	**0.16**	-0.01	**0.48**	**0.08**	**0.22**
Turnover	**0.59**	**0.57**	**0.60**	**0.47**	**0.51**	**0.81**	1	**0.21**	**0.17**	**-0.12**	**0.25**	**0.14**	0.02
% Unem (JSA)	**0.47**	**0.29**	**0.38**	**0.48**	**0.14**	**0.11**	**0.20**	1	**0.72**	**-0.40**	**0.48**	**-0.47**	**-0.08**
% Lone parent (IS)	**0.37**	**0.14**	**0.22**	**0.29**	0.10	-0.00	0.04	**0.86**	1	**-0.46**	**0.35**	**-0.63**	**-0.12**
Av. House Prices	**-0.28**	**-0.16**	**-0.25**	**-0.32**	-0.10	-0.04	-0.01	**-0.69**	**-0.69**	1	**-0.25**	**0.66**	**0.35**
% Non White	**0.35**	**0.58**	**0.52**	**0.36**	**0.33**	**0.52**	**0.46**	**0.30**	0.10	-0.05	1	**-0.18**	**-0.10**
% Basic Educ	**-0.16**	0.05	-0.08	**-0.19**	**0.21**	**0.28**	**0.27**	**-0.69**	**-0.78**	**0.84**	**0.12**	1	**0.38**
Gini	0.11	**0.16**	0.10	0.05	-0.01	0.09	**0.12**	-0.05	**-0.17**	**0.24**	**0.28**	**0.30**	1

Table 2: Estimated coefficients with inequality within one contiguous layer

	London				South Yorks			
	Burglary	Vehicle crime	Robbery	Violence	Burglary	Vehicle crime	Robbery	Violence
Inequality	1.00	1.01*	0.98*	0.98*	0.99	0.98	1.02	0.98
% Non-white	0.99*	0.99*	0.99	0.99*	0.99*	1.00	1.00	1.00
Richest area	1.04	0.99	1.04	0.91*	1.05	0.99	1.21	1.11
Av house price	1.00*	1.00*	1.00*	1.00	1.00	1.00*	1.00	1.00*
% Unemployed	1.02*	1.02*	1.04*	1.05*	1.04*	1.02*	1.06*	1.06*
Turnover	1.00*	1.00*	1.00*	1.00*	1.00	1.00	1.00*	1.00*
% Youth	1.02*	1.01*	1.04*	1.05*	1.02*	1.00	1.01	1.01*
Density	0.97*	0.97*	0.98*	0.97*	0.99	0.96*	0.97	0.93*
% Basic educ	1.01*	1.01*	1.01*	0.99*	NA	NA	NA	NA
Lagged crime	1.00*	1.00*	1.00*	1.00*	1.00*	1.00*	1.01*	1.00
Year	0.91*	0.80*	0.80*	0.76*	0.77*	0.79*	0.80*	0.71*
CDRP dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.01*	0.01*	0.00*	0.01*	0.01*	0.02*	0.00*	0.05
Pseudo-R^2	*0.06*	*0.07*	*0.08*	*0.07*	*0.08*	*0.08*	*0.11*	*0.11*
Obs	*1964*	*1964*	*1964*	*1964*	*344*	*344*	*344*	*344*

crime and that weak coefficients are seen for the average house price variable points towards the relevance of strain theory rather than the economic theory. Interestingly, the generally positive estimates in London between the percentage of adults with basic education and crime run counter to strain theory. It may be that these findings reflect the otherwise unaccounted for wealth effects of education which attracts crime to the area rather than, as hypothesized, seeing low education as a driver of offending.

Both ethnic heterogeneity and residential turnover show only weak coefficients and also present conflicting evidence in terms of social disorganization theory: turnover tends to show significant and positive associations with crime whilst the size of the non-white population displays negative (and somewhat less statistically consistent) relationships. On balance this seems to support the notion that turnover is the more conceptually valid indicator as well as a belief that this theory is of relevance, albeit recognizing that the effect sizes for turnover are modest.

Relationships between the youth population and crime in the two areas are generally positive and statistically significant though it is unclear whether this reflects the risk of offending or, conversely, of victimization for this group. There is also consistent significant evidence of a negative link between population density and crime, in contrast to expectations.

The focus of the paper though is how variation in the spatial scale at which inequality is measures affects the direction and strength of the relationship between inequality and crime. As outlined above, the results in Table 2 represent an extreme test in that they use a highly localised measure of inequality and so can be understood as a first step in the analysis. *If* one is to argue that local inequalities might matter as a driver of social ills then a moot point in the literature is uncertainty as to what the meaning of 'local' is, or ought to be, within such analyses. To explore this issue the analyses gradually extend the area of contiguity within which inequality is measured by one contiguous layer at a time until at the broadest measure there are ten contiguous layers – equating to ten differently scaled inequality measures – around each MSOA.

Figure 2 below illustrates the approach. Assume that the focus is on creating inequality measures for the one black target MSOA shown in the centre of Figure 2. The most highly localized inequality measure is calculated as a Gini coefficient of average MSOA income amongst the five MSOAs in the first contiguous layer (labeled 1) plus the target MSOA itself. This is the inequality measure used in Table 1 and Table 2 above. The second inequality measure incorporates all those MSOAs in the second contiguous layer (labeled 2) as well as retaining those in the first contiguous layer plus the target MSOA itself. The third measure adds to this list of MSOAs all those in the third contiguous layer (labeled 3), and so on, until inequality measures have been computed for ten increasingly broad contiguous layers around each target MSOA.

As outlined above, one concern in the literature is that highly localized inequality measures risk 'measuring away' inequality by simply transferring it to between rather than within areas (Wilkinson and Pickett, 2006). Before turning to the modeling, therefore, Figure 3 therefore simply explores the variation in the size of the inequality measures themselves (left pane) as well as the bivariate correlations between inequality and robbery (right pane) across the ten contiguous layers. Similar correlations are seen across the other crime types in each area.

As one would expect, inequality is lower in South Yorkshire than in London and for both areas the Gini coefficient increases as the size of the geography within which inequality is measured increases. It is interesting to note that in both areas much of the total increase in inequality over the ten contiguous layers takes places over the first few layers, suggesting that concerns about 'measuring away' inequality in localized analyses may be less serious than sometimes suggested in the literature.

Fig 2: Varying the understanding of 'local' within the inequality measure

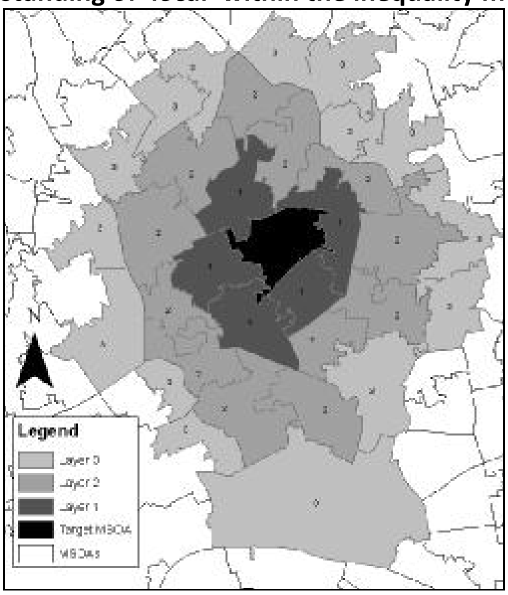
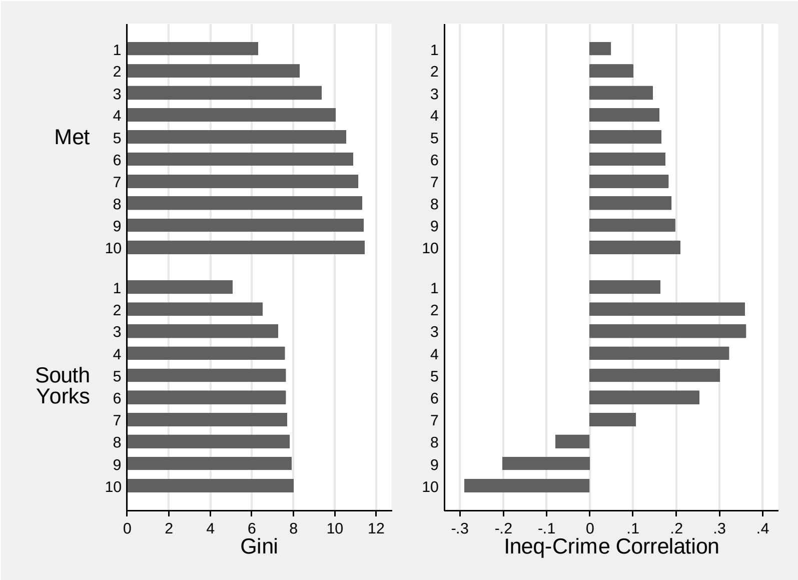


Fig 3: Average inequality for the ten contiguous layers (left pane) and correlations between inequality and robbery (right pane)



The right pane of Figure 3 shows a clear contrast between the two areas in terms of the relationship between local inequality and robbery over the ten contiguous layers and highlights the need to understand the local socio-spatial system in interpreting findings. In Figure 4 London MSOAs present a clear, gradual increase in the size of the positive correlations as the scale within which inequality is measured increases. This is the pattern that one might have initially hypothesized. All of these correlations are significant at the 5% level. For South Yorkshire the pattern appears fractured in that the correlation at first increases, next begins to decrease before finally changing direction and becoming negative across the broadest contiguous layers. All of these correlations except for the eighth contiguous layer (i.e. the first negative correlation) are significant at the 5% level.

These differing findings suggest a need to place the analyses within a clear understanding of the local socio-spatial system. London is made up of around just under 1000 MSOAs and the capital's density results in around 500 MSOAs on average within the broadest tenth contiguous layer. Hence, even in these outermost contiguous layers MSOAs will be drawn mainly from within the London socio-spatial system and make sense therefore as a coherent surrounding to the target MSOA. Indeed, any non-London MSOAs brought into the contiguity layers from outside the capital's boundaries arguably represent a continuation of the capital's urban sprawl rather than a distinct socio-spatial system.

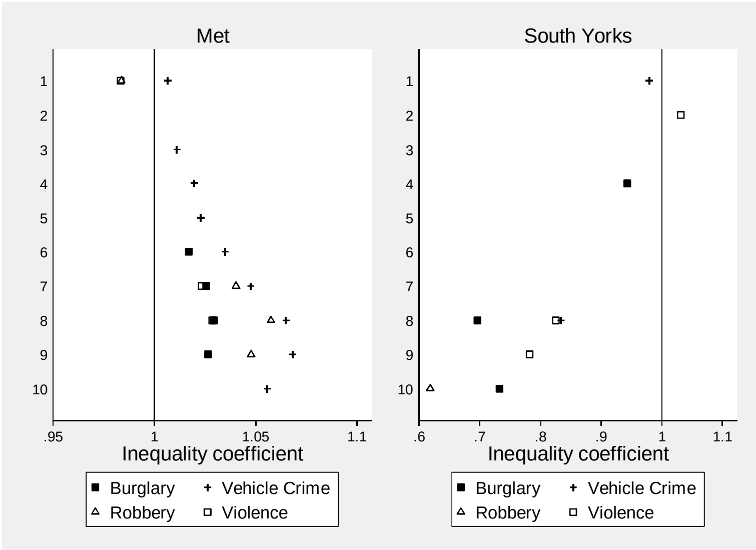
South Yorkshire, by contrast, is made up of around 170 MSOAs and its lower density means that the outer contiguous layers spread farther and take in more MSOAs (around 1000 on average). Figure 3 suggests that the inequality measures across the ten contiguous layers do not relate to a coherent urban system, both through the reductions in inequality from contiguous layer 3 and, more abruptly, the flip from positive to negative correlations from layer eight. This can be explained by linking these findings back to the nature of the South Yorkshire socio-spatial system(s) as shown in Figure 1 which highlights both internal and external fractures in the analyses. Internally, Figure 1 shows that most MSOAs in South Yorkshire fall within the four distinct urban cores of Sheffield, Barnsley, Doncaster and Rotherham. As contiguous layers are grown outwards from MSOAs within one of these urban cores the inequality measure moves relatively quickly into surrounding areas and then into a separate urban system relating to one of the other three urban areas. Externally, given South Yorkshire's relatively small size many of the MSOAs within the outermost contiguous layers lie well beyond the region and bear little social or physical connection to the original MSOA.

As a consequence the South Yorkshire analyses can be understood to cross socio-spatial systems rather than being holistic within-system analyses reflecting a local context that can coherently be conceptualized to affect social outcomes. The findings inevitably reflect these fractures, inconsistencies and disconnections in the analytical foundations. First, the inequality measures are less stable, less predictable and more subject to averaging out when one crosses spatial systems in this way. Second, compared with London many MSOAs in South Yorkshire have relatively low crime levels. At very local scales (i.e. the inner contiguous layers) inequality measures are also relatively low but as the measure broadens the size of the inequality estimate increases yet the MSOA crime levels remain unchanged. This leads to a gradual weakening – and eventual reversal – in the average inequality-crime relationship though this is more a technically driven finding rather than a result of any substantively meaningful relationship.

To test the stability of the inequality findings when controlling for other factors each of the models reported in Table 2 is repeated ten times exactly as above except with the inequality measure replaced each time with a different one from across the ten contiguous layers. Figure 4 shows the inequality coefficient for each contiguous layer and for each of the four crime types, with only those coefficients that are statistically significant at the 5% level shown. Remaining coefficients do not change markedly from those displayed in Table 2 and are not presented again.

For London the results suggest that the two negative inequality coefficients shown in Table 2 relating to the innermost contiguous layers are outliers. Across the findings more broadly there is statistically significant evidence of a link between local inequality and vehicle crime from the third contiguous layer outwards and consistent evidence of a significant links between inequality and three of the four crime types amongst the broadest contiguous layers (violence being the exception). As with the correlations in Figure 4 there is also evidence of a gradual upwards drift in the size of these coefficients, reaching a level implying that a 1% increase in inequality is associated on average with around a 0.5% increase in crime after controlling for other factors.

Fig 4: Inequality coefficients across the ten contiguous layers



For South Yorkshire there is only sporadic evidence of links between inequality and crime across the inner contiguous layers. The negative correlations seen in Figure 4 across the broadest contiguous layers remain within this multivariate framework yet despite the relative strength of those coefficients which are significant the evidence is inconsistent. It is also difficult to explain the emergence of these negative coefficients theoretically, particularly when recognizing that they extend far beyond the South Yorkshire socio-spatial system, and reinforce the need for a clear understanding of the local socio-spatial system.

Discussion

There has been much theoretical and empirical focus on the relationship between inequality and a range of social outcomes including crime but there is uncertainty and disagreement about the appropriate scale at which to carry out such analyses. The present analyses have sought to respond to these debates by exploring how variations in the spatial scale of the inequality measure affect the direction and strength of the relationships between inequality and crime.

Given the differing socio-spatial profiles of the two contrasting case study areas hypotheses prior to the analyses would have expected London to be a more likely context than South Yorkshire in which to find evidence for links between local inequality and crime. The findings are in line with these hypotheses and support the view that local inequality is, or at least can be, of relevance to social outcomes. At the same time, however, the discussion offers a warning note by emphasizing the importance of understanding the local socio-spatial context in order to interpret the substantive sense of findings and, indeed, of the analyses themselves.

The London findings suggest that consistent evidence of links between local inequality and crime *can* be evidenced. It is interesting that both the consistency and size of effects gradually increase as the geographical scale (and, as a consequence, the size) of the inequality measure increases. These findings contrast to some extent with concerns that local analyses *necessarily* 'measure away' inequality and, consequently, relationships between inequality and social outcomes. At the same time, however, Figure 4 also suggests that a minimum threshold may exist in terms of the size of the inequality measure before consistent relationships with social outcomes can be found. No doubt such a threshold effect would be contextually and outcome specific but occurs in London at a Gini coefficient of around eleven (the sixth contiguous layer) in these analyses.

The South Yorkshire findings offer a contrasting message, somewhat unsurprisingly given its differing socio-spatial profile. In the inner contiguous layers there is little consistent evidence of relationships between inequality and crime, perhaps due to the greater physical separation of affluence and deprivation across the region compared with London or possibly more a technical consequence of simply being unable to capture sufficient within-area inequality at this localized scale within this context. The results across the broadest contiguous layers, particularly the shift from positive to negative correlations seen in Figure 3, suggest a fracture in the socio-spatial system being analysed and offer a warning note around the need to carefully consider the nature of the local context in terms of whether findings – and, indeed, the analyses themselves – make sense given this local context. In the South Yorkshire case it is suggested that the analyses are as a result not substantively meaningful at the broadest layers.

The differing findings between the two areas make sense in terms of prior expectations and their differing urban systems and reinforce the notion that local inequality may well be of relevance to social outcomes, perhaps in addition to inequalities at other scales. However, the results prove only that statistically significant relationships between local inequality and crime can be found but perhaps only within certain local contexts. This of course does not prove that local inequality drives these outcomes – correlations do not equal causality. It may well be that local inequality is indeed a red herring, despite some evidence and theory to suggest otherwise. In the absence of clear theoretical or empirical evidence to the contrary, however, it is important to extend these analyses so as to further assess whether a consistent and theoretically meaningful body of evidence emerges around the extent to which – and the precise local contexts within which – local inequality relates to crime outcomes. A two-pronged future research agenda is proposed to this end. First, a logical next step to the present paper's case study approach would be to extend the same framework to a broader range of local contexts. Rather than treat areas as separate entities it seems fruitful instead to consider geographically weighted regression models across the whole of England so as to flexibly allow for local variation in the parameter estimates, with spatial variation in the inequality estimates being of particular interest. A second step could then map these locally varying estimates onto geodemographic profiles of local areas in order to examine systematically how local context relates to spatially varying inequality-crime relationships. Alongside this quantitative work a second strand of future work should involve qualitative work with offenders to explore the extent to which, and the ways in which, any consistent story emerges around the geographical scale at which inequality – and the inter-personal comparisons inherent within the inequality debate – flow into offenders' thinking. This would add valuable first hand qualitative data to the existing body of quantitative findings around inequality and crime linkages. Taken together this future research agenda offers the potential for innovative insights into the role of geographical scale and context in shaping inequality-crime relationships and will assist in moving beyond the broad associations generally found within the existing evidence base to differentiate at a much more spatially detailed level precisely where and why such inequality-crime relationships are seen.

Notes

1. The Metropolitan Police Service covers the entirety of London with the exception of the small central City of London area (a single MSOA). For simplicity, the remainder of the paper refers to London to describe the area covered by the Metropolitan Police despite this minor discrepancy.
2. For a summary see De Maio (2007).
3. Community Safety Partnerships (CSPs) were previously known as Crime and Disorder Partnerships (CDRPs) in England.
4. In the order of +0.4 for all four crime types in London and all except violence in South Yorkshire (+0.12). All were statistically significant at the 5% level.
5. Using a queen contiguity weights matrix so that any shared boundary (including only a corner point) is included as adjacent.

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