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The Impact of Neighbourhood on the Income and Mental Health of British Social Renters

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Abstract

This paper examines the impact of neighbourhood on the income and mental health of individuals living in social housing in the United Kingdom. We exploit a dataset that is representative and longitudinal to match people to their very local neighbourhoods. Using this, we examine the effect of living in a neighbourhood in which the population is more disadvantaged on the levels and change, over a 10-year window, of income and mental health. We find that social renters who live with the most disadvantaged individuals as neighbours have lower levels of household income and poorer mental health. However, neighbourhood appears to have no impact on changes in either household income or individual mental health.

Keywords: Neighbourhood effects, income, mental health, social renters

JEL Classification: I30

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Introduction

The argument that neighbourhood affects life chances has been long standing in the social sciences. The issue has been given impetus by research on US cities where it is argued that the poor are concentrated in small areas that create additional impacts which prevent individuals in them from escaping poverty. The issue is given considerable importance by the high levels of income segregation or clustering found in the US (e.g. Jargowsky 1997) and also in Britain (e.g. Dorling and Thomas 2004). However, the emerging empirical evidence is mixed: the quasi-empirical evidence finding little impact of neighbourhood for adult outcomes, many observational studies finding somewhat more (Durlauf 2004).

As many researchers have noted, there are formidable methodological problems in identifying area or neighbourhood effects (e.g. Manski 1993, Moffitt 2001, Durlauf 2004 and Dietz 2002). One key issue is that of selection arising because individuals choose where they live. This selection effect means that simple regressions of area effects on individual outcomes cannot be straightforwardly interpreted, as the correlation between individual and area characteristics will bias the estimates of the area effect. In addition, the direction of this bias cannot necessarily be determined a priori. Whilst in theory this selection effect could be dealt with by the use of instrumental variables (the use of measures of the area which are uncorrelated with unobserved characteristics of the individuals or families living in them) in practice these are very difficult to find, precisely because individuals have choice over where they live.

In this paper we attempt to overcome this issue by examining the impact of neighbourhood for a set of individuals who are more constrained in their choice of residential location than others in society. We focus on social renters in early 1990s UK. In the UK, allocations to social housing have historically been on the basis of point systems. These points systems were broadly based on categories of need and often local residence (Malpass and Murie 1999; Ravetz 2001, Mullins and Pawson 2005). Prior to the advent of choice based letting policies, first introduced in England during the late 1990s (Paskell and Power 2005), once in social housing individuals often had little chance of moving voluntarily from their initial allocation (Mullins and Pawson 2005, Ravetz 2001). While there is heterogeneity of tenants within the sector, 'right to buy' policies that operated in the 1980s caused the exodus of more affluent tenants, leaving those in social housing to become more narrowly based socially and

economically (Forrest and Murie 1990). Burrows (1999) estimated that in 1995 about one half of tenants in social housing were in the poorest fifth of the population. In parts of the sector the quality of housing stock is low (the result of under-investment in the sector) and the housing located in broader areas characterised by poorer physical appearance, poorer amenities, and poorer access to transport (Paskell and Power 2005). If the local environment is poor – either in terms of human connections or physical conditions – individuals trapped in these areas may be more likely to experience poorer outcomes than those who can choose where they live. Social renters are therefore a group for which neighbourhood may be particularly important in shaping life outcomes.

To test this idea we examine the impact of neighbourhood on two aspects of life chances - household income and individual mental health - amongst adults in social housing in the UK. Income and mental health are both important outcomes and have been the focus of recent research on neighbourhood effects. We first define very small neighbourhoods around individuals based on their location in 1991 (Buck 2001, Johnston and Pattie 2004) and characterise these on the basis of the deprivation of the population who lived in them in 1991 using census data (Johnston et al, 2004). This very local focus is in contrast to much of the literature that examines relatively large areas such as wards and census tracts. Then, within all those who were social renters in 1991, we differentiate between those living in the most socio-economically disadvantaged neighbourhoods and all other social renters. To test for neighbourhood effects we compare outcomes - income and mental health ten years later and the change in incomes and mental health – across the two groups. We use data from a large household survey, the British Household Panel Study (BHPS), which allows us to control for individual and household characteristics that may be associated with neighbourhood type. In addition, our examination of changes in the outcomes allows us to control for unobserved heterogeneity that may be correlated with initial location in poorer neighbourhoods. Whilst the sample is not large enough to look just at children or young people (who may be most affected by neighbourhood effects), we do allow explicitly for heterogeneity of response across adults by examining not only outcomes at the mean, but at other points in the distribution.

We find that social renters who were in poorer neighbourhoods in 1991 experience lower income and poorer mental health ten years on. However, we find little effect of neighbourhood on the change in income and mental health over the 10-year window. We

therefore find clear evidence of correlation between people and place, but considerably less support for an independent effect of neighbourhood on income and mental health.

2. Literature

The impact of neighbourhood on life chances

The possible effects that neighbourhoods have on their residents' life chances have been given much attention across the social sciences. In this paper we measure neighbourhood in terms of the peers that individuals live close to. So our focus is on whether the nature of the individuals within the neighbourhood affects an individual's life chances, rather than on the impact of neighbourhood measured in terms of its physical or geographical attributes, though the two facets are obviously linked by the fact that individuals are not randomly located in geographical space.

In terms of the effect of neighbours on the behaviour of individuals, sociologists have been responsible for identifying the mechanisms by which a neighbourhood effect may arise and operate. Jenks and Meyer (1990) distinguish between models of contagion or epidemics, based on the influence of peers to spread problem behaviour; models of collective socialisation, associated with the spread of some socially positive behaviour due to the interaction of individuals with role models or community networks; models of competition, in which the presence of social or economic winners has detrimental effects on the rest of the community, and models of relative deprivation, in which individuals evaluate their situation relative to their neighbours. The first two types of model predict that better environments promote positive development. The last two suggest that individuals may be negatively affected by exposure to higher socio-economic status environments.

These theories can be applied very widely. In the specific context of residential location, Atkinson and Kintrea (2001) draw attention to the following peer group effects – the social isolation of the poor into ghettos which have a culture that stresses short term goals and deviant norms; the lack of role-models occasioned by the absence of a successful middle class; and the development of forms of social capitals which are constraining rather than enabling. They also note that areas dominated by deprived people may be subject to stigmatisation, and that poor housing estates have reputations which lead to discrimination

against their residents in terms of credit, education and employment (Atkinson and Kintrea 2000). Ellen and Turner (1997) distinguish a set of mutually exclusive areas effects – concentration, location, socialisation, physical and service effects. These may all impact on an individual's ability to earn income, their behaviour, and their health. For example, a concentration of poor individuals may lead to a stress on services, reducing the resources available to any one individual for their health care or education. Location may lead to isolation from the wider labour market. Socialisation may result in a worklessness-culture (Atkinson and Kintrea 2001).

Focusing specifically on the impact of neighbourhood and health, Ellen et al (2001) identify four causal mechanisms which may affect health. These are neighbourhood resources and institutions, physical stress in the neighbourhood environment, social stress in the neighbourhood environment and neighbourhood based social networks. All of these might impact on mental as well as physical health, for example, by putting limits on social interactions or by engendering feelings of isolation or lack of hope.

The empirical evidence

Despite a large body of empirical research seeking to test these ideas, there is no general consensus as to the magnitude of the impact of neighbourhood on adult life changes. We focus here mainly on the quasi-experimental studies of neighbourhood effects as they side-step some of the identification problems associated with observational studies. These experiments, provided principally by the Moving to Opportunity (MTO) demonstration and the Gautreaux programme in the USA, moved households in public housing to less segregated and better off communities respectively. Rosenbaum (1995) for Gautreaux, and Katz, Kling and Liebman (2001), Ludwig, Duncan and Hirschfield (2001) and Goering, Feins and Richardson (2002), among others for MTO, detail the results. From these studies, there appears to be agreement that moving to better neighbourhoods generally has some positive effects for children. Better neighbourhood is associated with higher college attendance, better health outcomes and reduced behavioural problems. Those that moved to middle-class areas were also found to have higher rates of labour force participation and earn higher wages than those that moved to inner city neighbourhoods. On the other hand, Keels et al (2003) conclude that MTO had little impact on school test scores. Jacob (2003) (using neighbourhood change for children who were residents of Chicago housing projects) finds no

significant differences in test scores and dropout rates between children who moved to different neighbourhoods and Oreopoulos (2003) exploits the random assignment of children to housing projects in Toronto and finds no long-run effect of living in a poor neighbourhood on labour market outcomes.

However, the results for adults – the focus of the present paper – are more mixed. Katz et al (2001) found decreased rates of depression amongst women after moving from high to lower poverty neighbourhoods from the MTO data. But Katz, Kling and Liebman (2001) and Goering, Feins and Richardson (2002) report little impact on adult outcomes. Note that in the former study, the minimum length of time which sample members had lived in their new residence was 9 months, and the average time between assignment and the follow up survey was only 2.2 years, and it may be that over a longer time span stronger effects would emerge. For the much larger body of non-experimental studies on neighbourhood effects, Durlauf (2004) notes that "the bulk of empirical studies … find evidence of their presence". Since most of the studies he refers to discuss adults, albeit often young ones where we might expect to find more of an effect, this finding is in contradiction to the quasi-experimental evidence.

For mental health the non-experimental literature is smaller but several studies have found (for example, Silver et al 2002, Ross 2000, Goldsmith et al. 1998) an association between the disadvantage of the geographic area, as measured by Census tract, and poor mental health (depression or schizophrenia), as well as greater substance abuse (Silver 2002, Goldsmith et al 1998). There is less evidence that mental illness is associated with socio-economic inequality (Muntaner et al 2004), though Kahn et al (2000) found that state level income inequality was associated with higher odds of depressive symptoms in women, net of individual income. In commenting generally on this literature, Ellen et al (2001) note that while there are many studies that show an association between local area and health, most of these do not distinguish between whether those living in poor communities are sicker because they are of lower socio-economic status or because there is something unhealthy about these communities.

In the UK the literature on neighbourhood effects is growing fast, but there have been no experimental studies to date. We focus here on research using large scale survey data. McCulloch (2001) examines the relationship between a ward-level disadvantage index and a number of financial, health and social support outcomes for individuals using a multi-level

approach with data from the BHPS. Treating the sample as a cross-section, and controlling only for region of residence and year, area disadvantage increases significantly the probability of a negative outcome for seven of the eight outcomes considered. However, once a number of individual and household characteristics are controlled for, the effects reduce and remain significant for only four of the outcomes: employment (not for women), current financial situation, self-assessed health and dislike of the neighbourhood. Using data from the same data set for 1991-1999, Buck (2001) finds significant associations between a measure of neighbourhood disadvantage and six income and employment related outcomes even after controlling for an extensive range of background characteristics. He defines neighbourhood at a number of scales and finds the impact of neighbourhood to be greatest when it is defined as the nearest 500 persons. However, using a similar definition of neighbourhood and the same data set, Bolster et al (2004) find little evidence of a neighbourhood effect on income change, suggesting that the association between levels of income and place may be due to selection: poorer individuals live in poorer neighbourhoods.

In terms of mental health, recent UK studies have found an association between region (Cox et al 1987; Lewis and Booth 1992; Duncan et al 1995; Dorling and Gunnell, 2003) and neighbourhood, defined as electoral ward (Weich et al 2003, McCulloch 2001) and mental health, but all these studies have also found that after controlling for the characteristics of the individuals in these regions or neighbourhoods, this association was not statistically significant. A study that used the same small neighbourhood definition as Buck (2001) found little association between adult mental health trajectories and the nature of individuals in the neighbourhood (Propper et al 2005).

In summary, the evidence on the effect of neighbourhood is mixed and is less strong for adult than child outcomes. A core problem in this literature is being able to identify whether people who experience worse outcomes experience them due to their own characteristics or due to the characteristics of their neighbourhood. These problems arise because individuals are not randomly located across neighbourhoods: rather, selection mechanisms operate that assign poor people to poor neighbourhoods and rich people to rich neighbourhoods.

3. Methodology

In this paper, we attempt to reduce this problem by examining the effect of neighbourhood among individuals who have limited choice of residential location.[1] As our measure of neighbourhood effect, we follow the long tradition of using measures of disadvantage of the neighbourhood population (more details are provided below). We do not know the exact geographical location of individuals[2], nor do we know anything about the physical nature of that location. We therefore do not seek to directly test ideas about the influences of physical location (e.g. proximity to city centres) or physical attributes (e.g. cleanliness of streets) or the availability of jobs or of health care facilities. Instead, we implement a more general test - whether the disadvantage of the neighbours who live close to an individual impact on that individual's income or mental health. This could be through role model or peer group influences, through informational interactions, through competition for resources, or preference interactions. We do not seek to distinguish these different routes, but instead seek to establish whether there are *any* effects which are robust to controls for observed and unobserved heterogeneity at the individual level.

We select all individuals who were social renters in 1991. Within this population we examine whether those who lived in more socio-economically disadvantaged neighbourhoods in 1991 fared worse ten years later. We examine whether they have poorer income or mental health 10 years later or have worse income or mental health trajectories over the 10 year period. More formally, let d_i be an indicator variable with value 1 if an individual lives in a more disadvantaged neighbourhood in 1991 and value 0 otherwise. We estimate models of the form:

(1) $y_i = \boldsymbol{a} + \boldsymbol{b}X_i + \boldsymbol{g}d_i + e_i$

where *y* is the outcome, *X* is a set of individual control variables, *d* indicates whether the individual lived in a disadvantaged neighbourhood in 1991, *e* is random noise and *i* indexes the individual. All outcomes and controls are defined at individual level. Our interest is in the value of $\boldsymbol{g}$. We examine several definitions of *y*: income in 2000, mental health in 2000, the

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[1] Jacob (2003), Oreopolous (2003) and Gibbons (2003) also examine social renters because of their lack of choice over location.

[2] This data was used to construct the measures of neighbourhood used in this paper, but the exact location of the households in the BHPS was withheld for reasons of confidentiality.

trajectory of income between 1991 and 2000 and the trajectory of mental health between 1991 and 2000. We do not condition on location between 1991 and 2000. We therefore allow the impact of neighbourhood in 1991 to affect outcomes by a variety of paths, including moving out of the social rented sector or the area.

We estimate (1) by linear regression and then allow for heterogeneity in responses by using quantile regression techniques to measure the effect of the treatment on the outcome variables at different points in the distributions of income and mental health. For computational ease, we run the quantile regressions as a two-step procedure. The first step uses linear regression of the outcome on the control variables. From this, we obtain the residuals, which we treat as that part of the outcome that cannot be explained by the control variables. We then explain variation in the residuals at different points of the distribution by performing quantile regressions of these residuals on the neighbourhood treatment group dummy variable. We also conduct a second level of analysis where we augment model (1) with interactions between the treatment group dummy variable and each of the individual control variables.

4. The data and definition and measurement of neighbourhood

We use the first ten waves of the British Household Panel Survey (BHPS) covering 1991-2000. The first wave of the BHPS was designed as a nationally representative sample of the population of Great Britain living in private households in 1991, and had a sample size of over 5,500 households covering over 10,000 people.

The sample used for the present study

All individuals who lived in social rented accommodation in 1991 (the first wave of the BHPS) and who were also present in the data in 2000 were selected. In wave 1 the BHPS contained 2084 such individuals for whom there was also information on the local definition of neighbourhood used here plus background variables of age, gender, ethnicity and education. Of these 1813 also have income and health data. Of these, 1075 have no missing mental health and 980 have no missing net household income data at wave 10. An examination of the samples at wave 1 and wave 10 shows that the attrition is not random: the better educated and those who live in neighbourhoods with lower levels of disadvantage tend

to drop out less. Of the 1813 in wave 1, the mean education level is 2.0 (1.3); the corresponding figure for the 980 sample is 2.2 (1.37) (standard deviations in parentheses; education is a categorical variable). The mean 1991 score of the disadvantage index for the (smallest scale) neighbourhood is 0.78 (1.0) for the 1813 sample and is 0.67 (0.96) for the 980 sample. While there is no statistical difference in the two samples on these measures, the sample we analyse (the 980) are less likely to come from the very poorest neighbourhoods or to have no qualifications. To the extent that this protects them from the impact of neighbourhood our analyses will underestimate the impact of neighbourhood. Note that in our final sample we do not observe those who are in, or move into between 1991 and 2001, institutional or residential care: in the context of this study this would include those who have, or develop, very poor mental health.

Bespoke Neighbourhoods

We create a set of 'bespoke neighbourhoods' for each individual in 1991. The smallest of these is based on the characteristics of the people in the nearest few streets; larger ones are constructed to reach certain size thresholds in terms of distance or numbers of persons. Each individual's home postcode is matched to an enumeration district (ED). These are the smallest data units for which UK census data are made available. At the 1991 census they contained around 500 people. Adjacent districts are then identified according to the distance between their centroids, and enumeration districts are aggregated into the bespoke neighbourhood until the required population or distance threshold is reached.

For the main analyses in this paper we use the smallest spatial scale defined by population that is possible given the constraint of data confidentiality. This is approximately the nearest 500-800 people to the respondent's home address[3]. This small measure would seem best suited to characterising the nature of those persons that an individual might have daily social interactions with. But we also use a larger distance based definition, based on the characteristics of the population within 2 km of the respondent's home address, so measuring the disadvantage of the wider geographical space that the individual lives in.

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[3] For reasons of confidentiality, no bespoke neighbourhood covers only one enumeration district. This means that the number of persons in the neighbourhood definition we use here ranges from 500 to 800.

Having defined the bespoke neighbourhood for each individual in the sample, we characterise it using Census 1991 data for these ED sets. Eighteen variables were extracted from Census data, describing the socio-economic and demographic character of people, households and housing in the ED. We construct a composite index of area characteristics at each of the spatial scales using factor analysis extracting the scores via principal components analysis (Johnston et al 2004). We identify five factors: the factor loadings are given in Table A1. In this paper we focus on the first factor, which is essentially a measure of socio-economic disadvantage of the population in the neighbourhood. Table A1 shows loadings on this factor of over 0.75 for 5 variables, these being the proportion of the population living in local authority rented accommodation, having no car, being a single parent, being long-term sick, and being unemployed. The factor is also decreasing in the proportion owning their homes outright, and employed in professional or managerial occupations. However, while the measure is affected by the proportion of individuals who live in the rented sector, it is not simply a dummy variable indicating whether an individual lives in the centre of a council estate. The factorial nature of the variable means individuals will have a high score on this factor if those around them are unemployed but own their own homes, or are in the private rented sector with low incomes.

This definition of neighbourhood is based on the characteristics of the residents surrounding the sample individual, which follows the long literature that characterises neighbourhood with respect to population deprivation. But it means that we do not directly measure the physical attributes of the neighbourhood. However, an earlier analysis indicates that this measure of socio-economic disadvantage of the population is reasonably correlated with perceptions of the neighbourhood but not with perceptions of the individual's own dwelling (Bolster et al 2004).

The remaining factors in the table are also measures of the population in the neighbourhood. These are not the focus of our analysis here, but we use the ethnicity factor in additional tests of our results[4].

We define d – the most disadvantaged neighbourhoods - on the basis of the relative position of each neighbourhood. We define $d=1$ if the individual was resident in 1991 in a

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[4] The second, third and fourth factors classify neighbourhoods in terms of the ethnicity, mobility and age of their residents whilst the final factor describes how urban neighbourhoods are.

neighbourhood that was in the bottom quartile of the distribution, where the distribution is defined with respect to all tenure types. The proportion of social renters in the bottom 25% of the distribution is 63.3%, reflecting the fact that individuals in social rented housing are poorer and live in less affluent areas. The fact that the figure is not 100% indicates that there is some heterogeneity in the neighbourhoods in which social renters live. This does not seem unexpected given that some individuals in social housing are more affluent than others, that there is variation in the size of social housing estates, their quality and the cost of renting properties in this sector. However, it does mean that over half the sample are in the most disadvantaged neighbourhoods. To get a more narrowly based measure of disadvantage, we also repeat all our analyses using the bottom 10% of the distribution. The proportion of the sample in the most disadvantaged neighbourhoods using this definition is 32.8%.

We also use a tighter definition of exposure to a poor neighbourhood in which, in addition to living in a neighbourhood characterised by the worst 25th percentile of the disadvantage factor, individuals are only classified as living in the most disadvantaged neighbourhood if they also live in a local authority which is in the top 25th percentile of distribution of private to public rent ratios. These social renters are likely to have even less choice over where they live than the rest of the social rented population, since for these individuals, living in the private sector is a particularly expensive alternative to social renting[5].

Finally, as noted above, we also undertake analyses using the same factor to characterise the neighbourhood, but measuring the neighbourhood at a larger scale than the closest 500-800 persons. This is the nearest 2 km. This is a check that our measure does not simply identify *only* the effect of living in a community where most of the population are social renters, but does measure living in a neighbourhood where individuals are socially disadvantaged[6].

Definition of Outcomes

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[5] We use data on private to public rent ratios from the Nationwide Building Society data base of ward level house prices. Using data on house prices in the mid 1990s, the average private to public rent ratio across Local Authority Districts (LADs) was 6.43.

[6] One of the 5 factors on which our measure loads highly is social renters, so one interpretation of our very small scale measure is that it distinguishes between those individuals who live in the centre of council estates versus those who live on the edges. We are grateful to Danny Dorling for pointing this out.

We examine two outcomes. The first outcome is net[7] annual household income, deflated to January 2001 prices and equivalised using the McClements scale, before housing costs. This variable is collected at each wave and has been constructed by Bardasi et al (2003) using data from the BHPS. This net income figure includes net income from employment, investments, pensions, benefits and other transfers. The second is the individual's score on the 12 item General Health questionnaire. The General Health Questionnaire, developed by Goldberg (1988), is a self-administered questionnaire where respondents are presented with a number of statements concerning concentration, loss of sleep due to worry, perception of role, capability of making decisions, whether constantly under strain, perception of difficulty in overcoming problems, enjoyment of day-to-day activities, ability to face difficulties, depression, loss of confidence, self-worth, and general happiness. They are asked to compare recent experience of these items to their usual state on a four-point scale of severity. The scores to all twelve questions are summed. Thus the measure used here ranges from 0 (least distressed) to 36 (most distressed). The questionnaire gives an assessment of an individual's position on an axis from normality to undoubted illness, and can be thought of as giving a probability estimate of that individual being a psychiatric case. The GHQ is highly correlated with standardised clinical interviews (Goldberg and Williams, 1988; Bowling, 1991).[8]

We also analyse the trajectories of both of these outcomes over the whole sample window. This is measured by the slope coefficient of the regression of the outcome against time, computed separately for each individual, for all individuals with more than seven non-missing observations of the dependent variable.

Control Variables

We control only for variables that are exogenous to the individual, in order to allow neighbourhood to operate through non-exogenous events such as divorce and marriage, employment, childbearing and location subsequent to 1991. We thus include a small set of control variables in our regressions. These are age, age squared, gender, white/non-white and educational qualifications in 1991. Table A2 presents the means of all the variables for the sample used in the analysis.

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[7] Of national but not local taxes.
[8] We also defined mental ill health in terms of caseness, where individuals scoring 3 or above on the GHQ12 are classed as cases. The results were very similar to those reported below.

Institutional details on social renting

The appendix provides institutional details on social renting in the UK in the early 1990s. We also show in the Appendix that social renters move less out of local authority than individuals in other tenure types[9].

5. Results

Variation in neighbourhood conditions among social renters

Before estimating the impact of neighbourhood on the outcome variables, we first examine how the neighbourhoods in which social renters live compare to those of the rest of the population and then establish that there is variation in neighbourhood conditions among social renters.

Figure 1 (top left panel) graphs the kernel density estimate of the distribution of the disadvantage factor for social renters and for all other individuals. It shows what we would expect: social renters live in neighbourhoods composed of more disadvantaged individuals. There is, however, an overlap between the distributions of the factor for individuals living in social housing and private tenure, indicating that the levels of neighbourhood disadvantage of some social renters are similar to those experienced by individuals living in private tenure. There is also considerable variation in neighbourhood conditions within social renters on the measure.

The rest of the figure graphs the distribution of the four other bespoke neighbourhood factors. These show that there is substantial overlap in the social renter and private tenure distributions for the ethnicity, age, mobility and urban-ness measures. So for these aspects of neighbourhood, social renters experience almost exactly the same conditions as those outside the sector. The main difference between the populations of neighbourhoods lived in by social renters and those in private tenure is in terms of economic disadvantage.

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[9] In our sample, approximately 80 percent of the individuals that were social renters in 1991 remain social renters 10 years later.

The impact of treatment on levels of income and mental heath ten years on

Tables 1 and 2 report results from analyses in which being in the poorest neighbourhood is defined as being in the lowest 25% percentile of the distribution of the disadvantage factor. Table 1 reports the results for levels of income and for mental health using OLS analyses: Table 2 reports results using quantile regression. Within each table, results from four regressions are reported. Column 1 in each table is a regression of the dependent variable on just the neighbourhood dummy variable and the control variables. Column 2 in each table is the estimates of column 1 augmented with interactions between all the control variables and the neighbourhood dummy. In the first row income is the dependent variable, in the second row mental health is the dependent variable.

Table 1, column 1, shows that living in a disadvantaged neighbourhood in 1991 has a negative association with levels of both income and mental health ten years later. Individuals who lived in the 25% most disadvantged areas in 1991 have equivalised incomes that are on average £1,332.50 lower in 2000, a difference equal to approximately 10% of the mean level of income. Their GHQ score is on average 1.27 higher (the higher the score the poorer the mental health): this is also around 10% of the mean score. In column 2 we augment our regressions with interactions between being in the treatment group and individual characteristics. We no longer find a main effect on income of living in a disadvantged neighbourhood, but the interaction terms are not significant, and the F-test indicates that the interactions do not add significantly to the model. We continue to find a negative effect of deprivation on mental health: again the interactions do not add significantly to the model.

Table 2 allows for greater heterogeneity of response by using quantile regression. Column 1 examines the effect of living in a more disadvantaged neighbourhood on income and mental health levels at the 25th, 50th and 75th percentile of the outcome variable. The first column shows that living in a disadvantaged neighbourhood is negatively associated with income at both the median and the 75th percentile of the income distribution. Interestingly, the negative impact of deprivation is largest at the upper end of the income distribution: in other words, the impact of deprivation is to narrow the income distribution. A negative effect of living in a disadvantaged area on mental health can be seen at all three points of the whole distribution and in this case, a poor neighbourhood is more strongly association with poor mental health

for those with the worst mental health. These results both confirm and extend the negative effects found at the mean using OLS for both outcomes.

In column 2, where interactions are included in our regressions, we find there is no common effect on income of living in a poor neighbourhood across all social renters, but that certain groups of social renters are worse affected by their neighbourhoods than others. However, it is only at the 25th percentile of the income distribution that we find the interaction effects to be significant. Individuals who are better educated or male at the 25th percentile of the income distribution who more negatively affected by living in disadvantaged areas. For the other percentiles of the income distribution and for all percentiles of the mental health distribution, none of the interaction effects add significantly to the model.

The impact of living in the most disadvantaged neighbourhoods on income and mental heath trajectories

Tables 3 and 4 analyse the impact of neighbourhood on income and mental heath trajectories. The OLS regressions in table 3, column 1, show no association between living in a disadvantaged neighbourhood with subsequent changes in either income or mental health. After allowing for interactions between the control variables and the disadvantaged neighbourhood dummy, we continue to see no effect at the mean of living in a disadvantaged neighbourhood on income. There may be heterogeneity in the effect of neighbourhood on outcomes. The OLS results suggest that non-white individuals have more positive income trajectories than whites conditional on living in a more disadvantaged neighbourhood in 1991. The quantile regression in Table 4, column 1, indicates that living in a more disadvantaged neighbourhood in 1991 is associated with a poorer median income trajectory. Column 2 allows for interactions: this extends the main effect to the 25th and the 50th percentile of the distribution. The interactions indicate that income trajectories are found to be more positive for older individuals who are also at the bottom end of distribution of income: there are no significant interactions at the other two percentiles of the distribution.

Living in a disadvantaged neighbourhood has no effect on mental health trajectories at any point in the distribution even after allowing for interactions terms.

We conclude from these results that there is considerable evidence that individuals living in more disadvantaged areas have lower income and poorer mental health 10 years on. These results are robust to allowing for greater heterogeneity of response through quantile regression. So there is evidence for an association between neighbourhood and levels of income and health ten years on.

But there is considerably less evidence that neighbourhood is associated with changes in income and mental health. For income, there is a little evidence of a main effect, but some heterogeneity of response: income trajectories are worse for those who lived in more disadvantaged areas in 1991, and some indication that those who are younger fare worse in terms of income growth if they lived in disadvantaged areas. There appears to be no effect of deprivation on mental health trajectories. As most of the interaction terms were neither individually significant nor added significantly as a group to the model, we conclude that there is relatively little indication of differential responses across individuals according to a small set of observable factors (age, education, ethnicity and gender).

Extensions

This section summarizes our findings from several extensions to our analyses. First, we examine how sensitive our results are to the definition of disadvantage; second, we measure neighbourhood along a second dimension; third, we consider one other outcome variable.

a. Definition of neighbourhood deprivation

First, as the number of individuals who live in a disadvantaged neighbourhood is large (over half the observations) we redefined being in the most disadvantaged neighbourhood as living in the worst 10th percentile of the distribution instead of the worse 25th percentile. All analyses were repeated. The results were very similar to those reported here.

Second, we allowed for the fact that individuals may have greater choice of location if they are more easily able to move into private tenure. If private rents are high relative to public ones, individuals will not find it easy to move out of social rented housing. Conversely, there are areas where rent differences are small, so individuals are less tied to social housing. We redefined a disadvantaged neighbourhood to be both in the highest 25th percentile of the deprivation factor and in a local authority that was in the highest 25th percentile of private to

public rent ratios in the mid 1990s[10]. Using this tighter definition, we find that our results for the effect of neighbourhood on levels of income and mental health are broadly similar. For trajectories of the two outcomes, we find that living in more extreme neighbourhoods has a slightly stronger negative effect on income and a slightly stronger positive effect on mental health.

Third, the treatment variable is defined above on the basis of whether or not an individual lived in the most disadvantaged neighbourhoods in 1991. The BHPS allows us a measure of exposure to the neighbourhood in 1991, calculated by subtracting the date at which the individual moved to their current address from 1991. The resulting figure is divided by the individual's age in 1991 to get an age adjusted length of residence variable. We then interact this variable with deprivation measured as being in the 25% most disadvantaged neighbourhood. We find our earlier levels and trajectories results are robust to the inclusion of length of residence and also find no evidence of variation in the effect of a disadvantaged neighbourhood by length of residence.

Fourth, to check that we are not simply estimating the effect of being in the centre of a large council estate relatively to being located at the fringes, we repeated the analyses of tables 1-4 using a 2 kilometre definition of neighbourhood. The results (available from the authors) show similar patterns to those reported here.

b. Characterising the neighbourhood in terms of ethnic mix

There has been considerable recent interest in the impact of segregated neighbourhoods on individual's lives. Using the Census data, we can characterise neighbourhoods along the dimension of ethnic mix. This is not segregation: rather it is a measure of ethnic composition (which is also associated with other characteristics of individuals). Table A1 shows the ethnic mix factor is a measure of the extent to which the population in the neighbourhood is non-white and contains high loadings on and is increasing in the proportion that is of Pakistani, Bangladeshi, Indian or Black ethnic origin. Research which used this definition of bespoke neighbourhood found some evidence that individuals living in more ethnically mixed areas had poorer mental health (Propper et al 2005).

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[10] Local authorities generally contain between 0.25 million to 0.5million persons. The BHPS contains observations on households from 162 LADs in 1991. The 1118 social renters in our sample are drawn from 142 of these LADs.

We repeated the analyses defining exposure as being resident in 1991 in neighbourhoods in the top quartile of the distribution of ethnically mixed neighbourhoods. The proportion of social renters in the top 25th percentile of ethnically more mixed neighbourhoods was 29.5%. Figure 1, top right hand panel, shows that there is almost total overlap between the distributions of the social renter group and the private tenure group on the ethnicity dimension.

Tables 5 and 6 report the results for levels of income and mental health using OLS and quantile regression respectively. Table 5, column 1, shows that social renters that lived in ethnically more mixed areas in 1991 have higher levels of income ten years later relative to those that lived in white areas. The magnitude of the treatment effect is similar to that of deprivation (though of opposite sign). This is not robust to interactions, but few of these are significant and the interaction terms as a group do not add significantly to the explanatory power of the model. We find no significant association between living in an ethnically mixed area and levels of mental health. Allowing for interactions shows that, within those social renters that live in ethnically mixed areas, individuals who are non-whites and/or educated have relatively better mental health, but the main effect remains insignificant. Table 6, repeats these analyses using quantile regression. The results basically show no effect of ethnic mix on either income or mental health. These analyses were repeated for income and mental heath trajectories[11]. The results show that living in an ethnically more mixed area has no effect on either income or mental health trajectories. In summary, we conclude there is little impact of the extent of ethnic mix of the neighbourhood on the income and mental health outcomes within social renters[12].

c. Non-work

We also examine a third outcome, which contributes to household income and has been shown to be associated with mental health (Propper et al, 2005). This is non-work, defined as equal to one if the respondent is not in work and zero if she is in work. This variable is derived from a question in the BHPS that asks respondents about their current economic

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[11] Available from authors.
[12] We also analysed the impact of neighbourhood using the top 25th percentile of the mobility factor, as mobility has been argued to be an important determinant of mental health (Silver et al 2002). We found no impact on income of living in a mobile neighbourhood and only limited evidence of an impact on levels of mental health. There was no association of this factor with trajectories in income or mental health.

activity. We categorise those classified as self-employed, employed and on maternity leave as being in work, and those in the other categories as not being in work. Our results are similar to, but weaker than, those for income reported in Table 1. We find that living in a disadvantaged neighbourhood in 1991 increases the chances of being out of work in 2000 but little evidence that this leads to worse non-work trajectories.

6. Conclusions

This paper has investigated the effect of neighbourhood on UK individuals who lived in social rented housing in 1991. We argue that low income, limited choice of housing location, possibly low levels of local amenity and dependency of individuals on local networks for employment and friendships make this group of individuals more likely to be affected by their neighbourhood than the rest of the population. We use a large panel data set and a very small definition of neighbourhood; the closest 500-800 persons around each individual in the sample. This very local focus is in contrast to much of the literature that examines relatively large areas such as wards and census tracts. We characterise these small neighbourhoods according to the disadvantage of the population in the neighbourhood in 1991. In response to recent calls for researchers to allow for non-linearity in area effects (e.g. Ellen et al 2001) we allow for heterogeneity of response. We also allow for the correlation of individual and place by examining changes in, as well as levels of, outcomes.

Our results show that neighbourhood disadvantage is significantly associated with levels of income and mental health. Social renters who lived in neighbourhoods with more socio-economically disadvantaged populations experience lower levels of income and worse mental heath ten years on. However, we find much less support for the impact of disadvantaged neighbourhoods on the change in income and mental health. There is weak indication that income growth is less for those who lived in the most disadvantaged neighbourhoods: however, we find no effect on mental health change. Our interpretation is that social renters are sorted into better or worse areas based on their individual circumstances, resulting in a correlation between neighbourhood and individual income and mental health, but that the almost zero effect of neighbourhood on income or mental health change suggests that this relationship does not appear to be causal.

But we note a number of data limitations and caveats. First, one interpretation of our findings is that income and mental health are associated with neighbourhood conditions among social renters, but that the variation in income and mental health changes are either too small or too random to show any association with neighbourhood. Our descriptive statistics indicate considerable variation in income and mental health trajectories, so lack of variation does not appear to be the issue. Second, the sample sizes are not large, but our data is drawn from the largest household panel survey available in the UK and has the advantage of being longitudinal, so that we are able to control for unobserved characteristics of the individual that may be associated with place through residential sorting. Third, our measure of neighbourhood is one of the socio-economic disadvantage of the population around the individual. While this follows much of the literature that has explored the potential impact of neighbourhood interactions, the measure does not directly map into the attributes of the physical landscape, or of the quality of links to other places, or of the job opportunities in the local labour market, or of the specific nature and quality of social interactions. All of these have been argued to affect individual's lives: our measure can only pick up the impact of these specific features of neighbourhood indirectly to the extent that they are correlated with the socio-economic disadvantage of the individuals living in an area. To the extent that poor people live in poor areas, there is obviously some correlation, but our measure may be too broad to pick up the specific paths by which place affects individuals. Fourth, the BHPS, as any longitudinal sample, has attrition. In our sample, those who are less educated and live in more disadvantaged neighbourhoods are less likely to remain in the sample. To the extent that this group are more open to the impact of neighbourhood our analyses will underestimate the effect of neighbourhood. Fifth, whilst some of the adults in our sample are young and may have been born into social housing, there are not enough of these to examine this group alone using BHPS data. If the primary impact of neighbourhood is on children and young people, as the experimental literature is perhaps beginning to suggest, we might expect less effect on a sample of adults.

Finally, while our results do not give strong support for area policies aimed solely at adults, they do not say anything about the efficacy of policies directly aimed at children or which impact positively on children through their effect on adults. In addition, even if it is the case that there are no neighbourhood effects, it may be that an area focus is the most efficient way of reaching poor individuals because of concentration of poor individuals in poorer areas.

References

Atkinson, R and K Kintrea (2001) Disentangling Area Effects: Evidence from Deprived and Non-Deprived Neighbourhoods. *Urban Studies*, 38, 12, 2277-2298.

Atkinson, R and K Kintrea (2000) Owner Occupation, social mix and neighbourhood impacts, *Policy and Politics* 28, 93-108.

Bolster, A., Burgess, S., Johnston, R., Jones, K., Propper, C., Sarker, R. (2004) Neighbourhoods, Households and Income Dynamics: A semi-parametric investigation of Neighbourhood Effects. CMPO, University of Bristol WP 04/106

Buck, N. (2001) Identifying neighbourhood effects on social exclusion. *Urban Studies*, 38, 2251-2275.

Burrows, R (1999) Residential Mobility and Residualisation in Social Housing in England. *Journal of Social* Policy 28, 1, 27-52.

Cox, B. D., Blaxter, M., Buckle, A. L. J., et al. (1987) *The Health and Lifestyle Survey*. First Edition Cambridge, United Kingdom: Health Promotion Research Trust 1987.

Dietz, R. D. (2002) The estimation of neighborhood effects in the social sciences: An interdisciplinary approach. *Social Science Research,* 31, 539-575.

Dorling, D and Thomas, B (2004) *People and Places: A 2001 Census Atlas of the UK.* Bristol: Policy Press

Dorling, D. and Gunnell, D. (2003). Suicide: the spatial and social components of despair in Britain 1980-2000. *Transactions of the Institute of British Geographers* Volume 28, Issue 4, Page 442-460, Dec 2003

Duncan, C., Jones, K., and Moon, G. (1995) Psychiatric morbidity: a multilevel approach to regional variations in the UK. *Journal of Epidemiology and Community Health*, 49, 290-295.

Durlauf, S. (2004) *Neighborhood Effects.* Handbook of Regional and Urban Economics, Volume 4, Cities and Economics, J.V. Henderson and J.-F. Thisse, eds., Amsterdam: Elsevier, 2004.

Ellen, I, Mijanovich, T and Dillman, K (2001) Neighborhood Effects on Health: Exploring the Links and Assessing the Evidence. *Journal of Urban Affairs*, 23, 3-4, 341-408.

Ellen, I and Turner, M (1997) Does Neighborhood Matter? Assessing Recent Evidence. *Housing Policy* Debate 8, 833-866.

Forrest, R and Murie, A (1990) *Selling the Welfare State.* London: Routledge.

Gibbons, S. (2002) Neighbourhood Effects on Educational Achievement, *CEE Discussion Papers 0018, Centre for the Economics of Education, LSE*

Goering, J., Feins, J. and T. Richardson (2002) *A Cross-Site Analysis of Initial Moving to Opportunity Demonstration Results.* Journal of Housing Research, 13, 1, 1-30.

Goldsmith, H.F., Holzer III, C. E. and Manderscheid, R. W. (1998) *Neighbourhood characteristics and mental illness.* Evaluation and Program planning, 21, 211-225

Harding, D. (2002). "Counterfactual Models of Neighborhood Effects: The Effect of Neighborhood Poverty on High School Dropout and Teenage Pregnancy." *American Journal of Sociology* 109(3): 676-719.

Jacob, B. (2003) Public Housing, Housing Vouchers, And Student Achievement: Evidence From Public Housing Demolitions In Chicago. NBER Working Paper 9652.

Jenks, W and Meyer, S (1990) The Social Consequences of Growing Up Poor in a Poor Neighbourhood. In Inner-City Poverty in the United States, M McGeary and I Lynn (eds). Washington DC: National Academy

Jargowsky, P A (1997) *Poverty and Place: Ghettos, Barrios and the American City.* New York: Russell Sage Foundation.

Johnston, R., Jones, K., Burgess S., Propper, C., Sarker, R., Bolster, A. (2004) Scale, factor analyses and neighbourhood effects. *Geographical Analysis* 36, 350-368.

Johnston R.J. and Pattie C. J., (2004) 'Putting voters in their place: local context and voting in England and Wales, 1997' in A S Zuckerman (ed) *The Social Logic of Politics: Family, Friends, Neighbors, and Workmates as Contexts for Political Behavior,* , 184-208, (Philadelphia: Temple University Press)

Kahn, R.S., Wise, P.H., Kennedy, P., and Kawachi, I., (2000) State Income Inequality, Household Income, and Maternal Mental and Physical Health: Cross Sectional National Survey. *British Medical Journal* 321 (7272): 1311-5.

Katz, L.F., Kling, J.R., and Liebman, J.B. (2001) Moving To Opportunity in Boston Early Results of a Randomized Mobility Experiment *The Quarterly Journal of Economics,* 607-654

Keels, M., Duncan, G., Deluca, S., Mendenhall R., and Rosenbaum (2003) *15 years later: Can residential mobility programs provide a long-term escape from neighbourhood segregation, crime and poverty?* JCPR Working Paper 330

Lewis, G., and Booth, M. (1992) Regional differences in mental health in Great Britain. *Journal of Epidemiology and Community Health*, 46, 608-611.

Ludwig, J., Duncan, G., J. and Hirschfield, P. (2001) *Urban Poverty and Juvenile Crime: Evidence from a Randomized Housing-Mobility Experiment*. Quarterly Journal of Economics. 116, 2, 655-680.

McCulloch, A. (2001) Ward-level deprivation and individual social and economic outcomes in the British Household Panel Study. *Environment and Planning A*, 33, 667-84.

Manski, C (1993) Identification of Endogenous Social Effects: The Reflection Problem. *Review of Economic Studies,* 60, 3, 531-542.

Malpass, P and Murie, A (1999) *Housing Policy and Practice 5th Edition*. Basingstoke: MacMillan.

Moffit, R (2001) Policy Interventions, Low-Level Equilibria and Social Interactions. In *Social Dynamics*, 45-82. S Durlauf and H P Young (eds). Cambridge: MIT Press.

Mullins, D and Pawson, H (2005) The land that time forgot: reforming access to social housing in England, *Policy and Politics,* 33, 2, 205-230.

Muntaner, C., Eaton, W. W., Miech, R. and O'Campo, P. (2004) Socioeconomic Position and Major Mental Disorders *Epidemiologic Reviews*, 26, 53-62

Oreopoulos, P. (2003) The long-run consequences of living in a poor neighborhood *Quarterly Journal of Economics.* Vol. CXVIII pp. 1533 – 1575.

Parker, J., Smith, R. and Williams, P. (1992), *Access, Allocations and Nominations: The Role of Housing Associations*, London: DOE

Paskell, C and Power, A (2005). The future's changed: local impacts of housing, environment and regeneration policy since 1997. CASE, London School of Economics Case report 29.

Propper, C., Bolster, A., Burgess S., Johnston, R., Jones, K. and Sarker, R. (2005) Local Neighbourhood and Mental Health: Evidence from the UK *Social Science and Medicine 61* (10) 2065-2083.

Ravetz, A (2001) *Council Housing and Culture: The History of a Social Experiment*. London: Routledge.

Rosebaum, J., (1995) *Changing the Geography of Opportunity by Expanding Residential Choice: Lessons from the Gatreaux Program*. Housing Policy Debate, 6, 1, 231-269.

Ross, C. E. (2000) Neighbourhood disadvantage and adult depression. *Journal of Health and Social Behaviour,* 41, 177-187

Silver, E., Mulvey, E. P., and Swanson, J. W. (2002) Neighborhood Structural Characteristics and Mental Disorder: Faris and Dunham Revisited. *Social Science and Medicine*, 55, 1457-1470.

Weich, S., Holt, G., Twigg, L., Jones, K., and Lewis, G. (2003) Geographic Variation in the Prevalence of Common Mental Disorders in Britain: A Multilevel Investigation. *American Journal of Epidemiology*, 157, 730-737.

Table 1: Neighbourhood disadvantage and level of income and mental health, OLS

Deprivation Factor		No Interactions (1)	With Interactions (2)	Significant interactions	F-test
Income	coef	-1332.53 ***	1332.19	No	0.51
	se	(438.81)	(3150.76)		
	R^2	0.056	0.054		
	N	980	980		
Mental health	coef	1.27 ***	5.85 **	No	1.57
	se	(0.37)	(2.69)		
	R^2	0.030	0.033		
	N	1075	1075		
Control variables (5)		YES	YES		
Interactions (5)		NO	YES		

Standard errors in parenthesis. *** significant at 1% level, ** 5% level, * 10% level

Control variables are: age, age squared, female, nonwhite, olevels.

Interactions are between neighbourhood dummy and all the control variables

F-test compares the restricted (no interactions) and unrestricted (with interactions) model.

Table 2: Neighbourhood disadvantage and levels of income and mental health, Quantile Regressions

Deprivation Factor			No Interactions (1)	With Interactions (2)	Significant interactions	F-test
					+ve female, -ve olevels	
Income	Q25	coef	-837.09	-1877.54		6.64 ***
		se	(632.97)	(2080.08)		
		R^2	0.003	0.020		
	Q50	coef	-876.82 **	-314.45	No	0.38
		se	(363.43)	(1547.49)		
		R^2	0.004	0.006		
	Q75	coef	-1496.40 ***	666.62	No	1.39
		se	(544.02)	(2625.14)		
		R^2	0.007	0.012		
		N	980	980		
Mental health	Q25	coef	0.40 *	3.17	-ve age, +ve agesq	0.78
		se	(0.23)	(1.95)		
		R^2	0.001	0.007		
	Q50	coef	1.24 ***	2.07	No	1.39
		se	(0.20)	(1.35)		
		R^2	0.008	0.010		
	Q75	coef	1.98 ***	1.09	No	0.50
		se	(0.70)	(4.25)		
		R^2	0.010	0.012		
		N	1075	1075		
Control variables (5)			YES	YES		
Interactions (5)			NO	YES		

Standard errors in parenthesis. *** significant at 1% level, ** 5% level, * 10% level
Control variables are: age, age squared, female, nonwhite, olevels.
Interactions are between neighbourhood dummy and all the control variables.
F-test compares the restricted (no interactions) and unrestricted (with interactions) model.

Table 3: Neighbourhood disadvantage and income and mental health trajectories, OLS

Deprivation Factor		No Interactions (1)	With Interactions (2)	Significant interactions	F-test
Income	coef	-72.66	-95.90	+ve nonwhite	2.26 *
	Se	(47.28)	(341.46)		
	R^2	0.021	0.027		
	N	966	966		
Mental health	coef	0.04	0.05	No	0.74
	se	(0.04)	(0.26)		
	R^2	0.003	0.001		
	N	1096	1096		
Control variables (5)		YES	YES		
Interactions (5)		NO	YES		

Standard errors in parenthesis. *** significant at 1% level, ** 5% level, * 10% level

Control variables are: age, age squared, female, nonwhite, olevels.

Interactions are between neighbourhood dummy and all the control variables

F-test compares the restricted (no interactions) and unrestricted (with interactions) model.

Table 4: Neighbourhood disadvantage and income and mental health trajectories, Quantile Regressions

Deprivation Factor			No Interactions (1)	With Interactions (2)	Significant interactions	F-test
Income	Q25	coef	-37.16	-512.09 ***	+ve age, -ve agesq	6.72 ***
		se	(42.46)	(122.05)		
		R^2	0.001	0.009		
	Q50	coef	-82.39 **	-444.41 **	+ve age	1.63
		se	(34.34)	(195.82)		
		R^2	0.002	0.006		
	Q75	coef	-15.43	-99.52	No	0.24
		se	(67.93)	(366.03)		
		R^2	0.000	0.003		
		N	966	966		
Mental health	Q25	coef	0.00	0.12	-ve olevels	1.61
		se	(0.04)	(0.18)		
		R^2	0.000	0.003		
	Q50	coef	0.01	-0.06	+ve female	1.40
		se	(0.04)	(0.14)		
		R^2	0.000	0.002		
	Q75	coef	0.04	0.06	No	1.43
		se	(0.03)	(0.26)		
		R^2	0.001	0.006		
		N	1096	1096		
Control variables (5)			YES	YES		
Interactions (5)			NO	YES		

Standard errors in parenthesis. *** significant at 1% level, ** 5% level, * 10% level

Control variables are: age, age squared, female, nonwhite, olevels .

Interactions are between neighbourhood dummy and all the control variables.

F-test compares the restricted (no interactions) and unrestricted (with interactions) model.

Table 5: Ethnic composition of neighbourhood and level of income and mental health, OLS

Ethnicity Factor		No Interactions (1)	With Interactions (2)	Significant interactions	F-test
Income	coef	1381.40 ***	-5015.57	+ve age	1.16
	se	(472.62)	(3432.98)		
	R^2	0.056	0.056		
	N	980	980		
				-ve nonwhite, -ve olevels	
Mental health	coef	0.02	0.77		2.34 **
	Se	(0.41)	(2.92)		
	R^2	0.020	0.026		
	N	1075	1075		
Control variables (5)		YES	YES		
Interactions (5)		NO	YES		

Standard errors in parenthesis. *** significant at 1% level, ** 5% level, * 10% level

Control variables are: age, age squared, female, nonwhite, olevels.

Interactions are between neighbourhood dummy and all the control variables

F-test compares the restricted (no interactions) and unrestricted (with interactions) model.

Table 6: Ethnic composition of Neighbourhood and levels of income and mental health, Quantile Regressions

| Ethnicity Factor			No Interactions (1)	With Interactions (2)	Significant interactions	F-test
Income	Q25	coef	564.61	-1574.06	No	2.69 **
		se	(459.00)	(3131.83)		
		R^2	0.002	0.010		
	Q50	coef	650.73	-3590.38	No	1.09
		se	(426.43)	(2510.32)		
		R^2	0.001	0.006		
	Q75	coef	1429.67 **	-1754.10	No	1.04
		se	(570.27)	(4611.30)		
		R2	0.005	0.007		
		N	980	980		
Mental health	Q25	coef	-0.09	3.77 *	No	1.43
		se	(0.34)	(1.99)		
		R^2	0.000	0.003		
	Q50	coef	0.44	2.03	-ve olevels	0.99
		se	(0.29)	(2.91)		
		R^2	0.000	0.003		
	Q75	coef	0.35	-2.98	+ve age, -ve agesq	1.62
		se	(0.66)	(3.44)		
		R^2	0.000	0.009		
		N	1075	1075		
Control variables (5)			YES	YES		
Interactions (5)			NO	YES		

Standard errors in parenthesis. *** significant at 1% level, ** 5% level, * 10% level

Control variables are: age, age squared, female, nonwhite, olevels.

Interactions are between neighbourhood dummy and all the control variables.

F-test compares the restricted (no interactions) and unrestricted (with interactions) model.

Figure 1. Kernel density estimates of each of the bespoke neighbourhood factors by tenure group
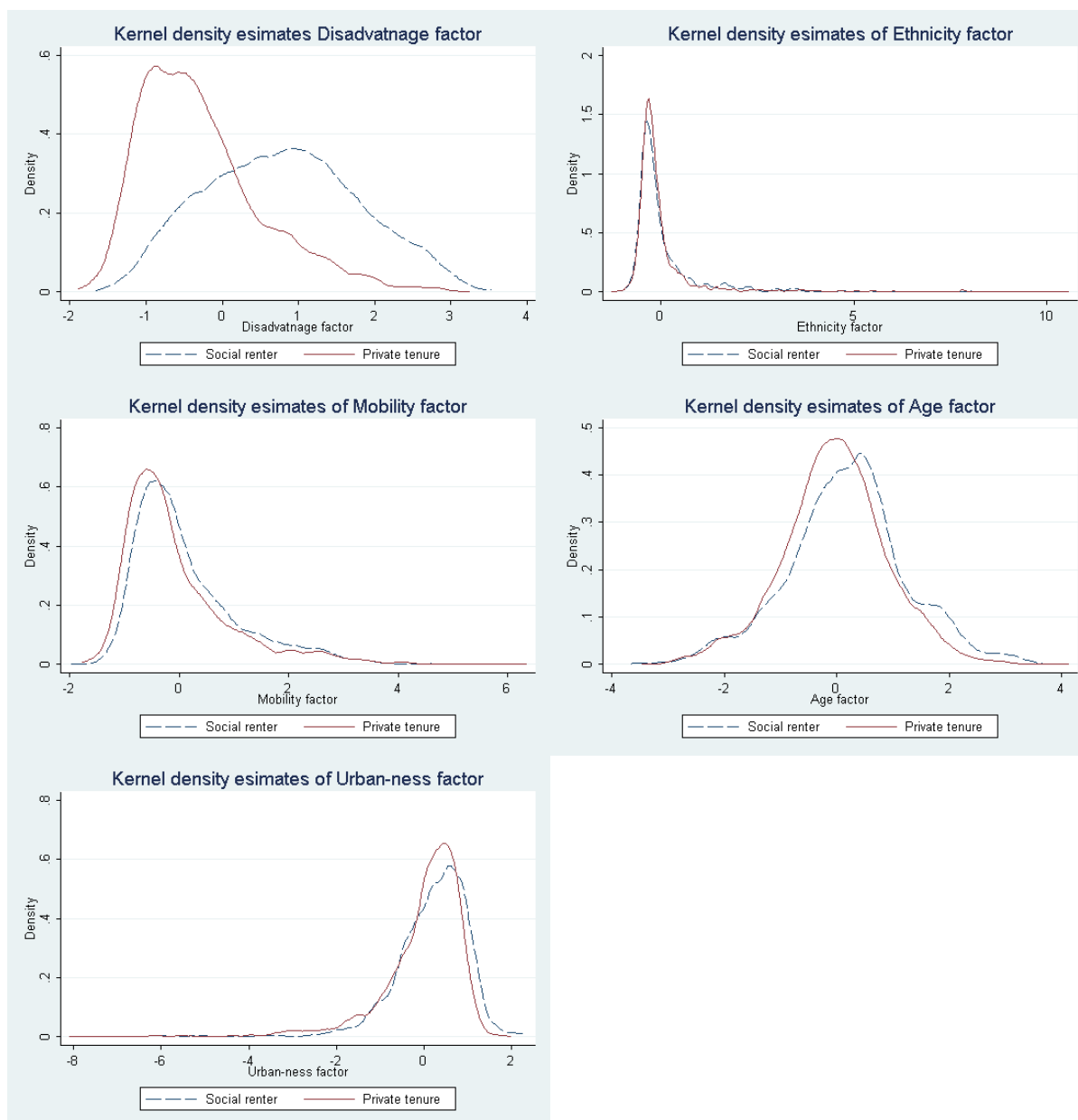
Notes.
1. Kernel density estimates of the sample in wave 1 (n=10,263)
2. Each neighbourhood factor is normalised to have mean 0

Appendix

Table A1. Loadings on the five principal component factors of bespoke neighbourhood characteristics at the nearest 500 people scale

	Disadvantage	Ethnic mix	Mobility	Age	Urban-ness
% Unemployed	0.823	0.422	0.344	0.06	-0.061
% Long term sick aged 16-60/64	0.813	0.135	-0.056	-0.165	-0.028
% Owned outright	-0.611	-0.073	-0.452	-0.485	-0.171
% Local authority	0.862	-0.023	0.039	0.127	0.157
% Central heating	-0.372	-0.303	-0.298	0.175	0.541
% Exclusive facilities	0.015	-0.149	-0.385	0.104	0.631
% No Car,	0.862	0.297	0.424	-0.256	0.009
% Density > 1 person per room	0.5	0.761	0.299	0.27	-0.165
% Lone parent	0.771	0.205	0.239	0.424	0.121
% One person pensioner	0.261	-0.089	-0.025	-0.818	0.011
% One person non-pensioner	0.173	0.235	0.887	-0.132	-0.123
% Black	0.229	0.544	0.425	0.174	0.143
% Indian	-0.008	0.768	0.07	0.072	0.09
% Pakistani & Bangladeshi	0.146	0.83	0.109	0.077	-0.142
% Migrant in last year	-0.028	0.127	0.825	-0.003	-0.093
% Working in agriculture	-0.16	-0.186	-0.214	0.087	-0.662
% children (aged 0-15 years)	0.299	0.26	-0.222	0.823	0.096
% prof-managerial	-0.703	-0.142	0.125	-0.011	0.048

Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization

Table A2: Variable names and descriptive statistics

| Variabl e name	Variable description	N	Mean	Std. Dev.	Min	Max
Dependent variables: wave 10 values						
Income	Total household disposable annual income, equivalised using McClements before housing costs index, deflated to Jan 2001 prices using RPI less local taxes. Unit: British pounds.	980	13898.75	6710.00	3113.83	102811.10
Mental health	General Health Questionnaire	1075	12.40	5.96	0	36
Income trajectory	Household income trajectory: OLS coefficient of income on wave for each individual with more than 7 observations in waves 1-10.	966	307.75	716.70	-3491.53	6759.16
Mental health trajectory	GHQ trajectory: OLS coefficient of mental health on wave for each individual with more than 7 observations in waves 1-10.	1096	0.05	0.57	-2.99	2.4
Individual characteristics: wave 1 values						
Age	Age of individual on 1st December of year of interview.	1118	44.17	18.35	16	90
	Highest known educational qualification of the individual:	1118	22.88	17.44	2.56	81
Age squared	=age*age					
Female	=1 if individual is female, 0 if male.	1118	0.61	0.49	0	1
Non-white	=1 if race is not white, 0 if white.	1118	0.04	0.19	0	1
Qualifications	=1 if individual is educated to O-level or beyond	1118	0.41	0.49	0	1
Treatment variables: wave 1 values						
Disadvantage factor	Disadvantage Factor, nearest 500 people	1118	0.80	0.99	-1.66	3.43
Ethnic mix factor	Ethnic mix Factor, nearest 500 people	1118	0.04	1.00	-0.90	8.08
Treatment group: disadvantage	=1 if social renter lives in top quartile of disadvantaged neighbourhoods in 1991	1118	0.63	0.48	0	1
Treatment group: ethnic mix	=1 if social renter lives in top quartile of ethnically mixed neighbourhoods in 1991	1118	0.29	0.46	0	1
Private/public rent ratio	Private to Public rent ratio of LAD	8752	6.49	3.95	0.39	18.33

Social renting in the UK

Social renters are individuals who, unable to afford housing in the private sector, become eligible for assistance and are allocated on a needs basis to subsidised housing in their local area. In 1991, there were two methods of obtaining social housing: through the local authority (LA) and through Housing Associations (HA).[13] The HAs typically offered better quality housing and acquired better individuals by asking for higher rents, moreover by not advertising themselves, only the more organized informed individuals applied. Although both LAs and HAs broadly cater for people in the greatest housing need, there was no universal method of allocating individual to housing in 1991. Each LA and HA placed different emphasis in terms of priority given to different groups of people. Many organisations had a needs-based points allocation system. However, some organisations used priority group categories, e.g. homelessness or disability and some simply used raw waiting lists where individuals are housed when they reach the top of the list (Parker et al, 2002). Whatever the allocation method used, individuals had very little choice in where their LA placed them and once applicants were served and offered a property they rarely refused. Movements between different social housing properties are rare, mainly occurring when the households circumstances and needs change rather than a desire to live in a better area. Where social renters move between social housing properties, these moves are typically constrained to movements within a particular LA. Movements between LAs are hampered by the considerable variation in allocation methods across local authorities.

Social renters move less

Analyses using the BHPS data show that social renters move less out of local authority. Figure A1 shows the proportion of the sample moving out of 1991 Local Authority District (LAD) in any of the following years 1992-2000 (waves 2 to 10) by tenure and the by twenty quantiles of the wave 1 LAD private to public rent ratio. The fitted line is the average of the observations. It shows that individuals living in private accommodation tend to move more out of LAD than social renters. In the lowest of the 20 quantiles of private to public rent ratios around 11% of wave 1 social renters had moved out of their LAD by wave 10, whereas the figure for those owning their home or renting from the private sector is 17%. The difference in moving rates is more marked in LADs with high private to public rent ratios: in the highest 20 quantiles of private to public rent ratios around 9% of wave 1 social renters had moved by wave 10 against approximately 22% for the private tenure group of individuals.

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[13] In the BHPS, approximately 80 percent of social renters had obtained housing through their LAs. Our data indicates that HA social renters live in less disadvantaged areas.

Figure A1. Proportion moving out of wave 1 (1991) LAD by tenure and quantiles of private to public rent ratios
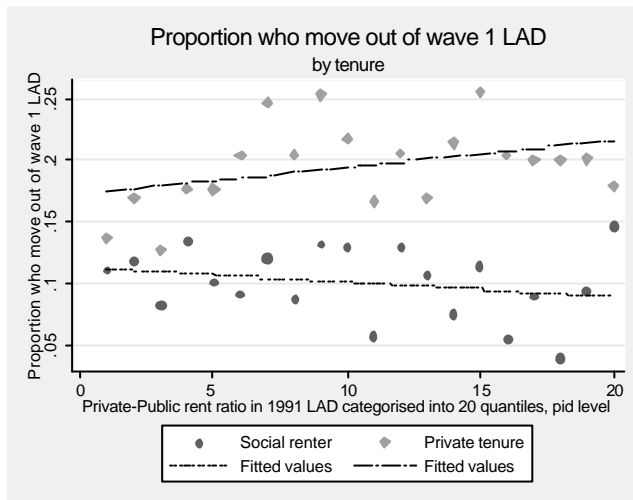
1. Sample is wave 1 of BHPS. Sample retains all individuals present in at least 2 waves in waves 2-10.

We also estimate the probability that social renters move less out of LAD allowing for a set of individual control variables. We find that social renters and social renters in LADs with high private to public rent ratios move less even after conditioning on these. These results are shown in table A3. The dependent variable is a binary variable that indicates whether the individual moved LAD between 1992 and 2000. The demographic controls are: age, age squared, whether there are children in the household, whether the household contains some or all adults in work. The variables of interest are whether the individual is a social renter, the private to public rent ratio and the interaction of these two terms. We also allow for the interaction term to differ across the demographic variables. The coefficient on the social renter dummy is significantly negative for moves out of LAD.

Table A3: Probit regression of individual probability of moving out of 1991 LAD between waves 1992 and 2000

Private to Public rent ratio	0.009*
	(0.005)
Private to Public rent ratio*Social renter	-0.035
	(0.032)
Social renter	-0.312***
	(0.100)
Control variables	YES
Control variables interacted with Private to Public rent ratio interacted with Social renter	YES
Constant	YES
Observations	7050
Log likelihood	-2977.2

1. Standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%
2. Sample is wave 1 of BHPS and contains all individuals present in at least 2 waves in waves 2-10.
3. Control variables are measured in 1991 and are: age, age squared, number of children, some individuals in work in household, all individuals in household in work Interactions are: private to public rent ratio*Social renter* age, Private to Public rent ratio*Social renter* number of children.