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Moving into the Projects: Social Housing Neighbourhoods and School Performance in England

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Abstract
This study estimates the effect of living in a very deprived neighbourhood, as identified by a high density of social housing, on the educational attainment of fourteen years old (9th grade) students in England. Neighbourhoods with markedly high concentrations of social housing have very high unemployment and extremely low qualification rates, as well as high building density, rooms over-crowding and low house prices. In order to identify the causal impact of neighbourhood deprivation on pupil attainments, I exploit the timing of moving into these neighbourhoods. The timing of a move can be taken as exogenous because of long waiting lists for social housing in high-demand areas. This is a new strategy that by-passes the usual sorting and reflection problems. Using this approach, there is no evidence for otherwise negative effects, which has potentially wide-ranging implications for social housing policy.

Keywords: neighbourhood effects on education
JEL Classifications: I21, J24

"When these children grow up, the adverse wage consequences of lower education will cause their own children to once again be consigned to poorer neighbourhoods with the same absence of role models, thus repeating the cycle" (Bowles et al. 2006, p. 9)

1 Introduction

Neighbourhoods with markedly high concentrations of social housing in England have very high unemployment and extremely low qualification rates, as well as high building density, rooms over-crowding and low house prices. If living in a bad neighbourhood has negative effects on outcomes such as school results, these effects will be most extreme in social housing neighbourhoods. This can have wide-ranging implications as it could in the extreme constitute a locking-in of the disadvantaged into a spatial poverty trap: 'once you get into a bad neighbourhood, you and your children won't get out'. As a consequence of these concerns, the relationship between place and poverty has become a key issue for policy makers worldwide. In England, the debate has focussed on dispersing social housing into "mixed communities" (e.g. Cheshire *et al.* 2008). However, the evidence on negative neighbourhood effects is still inconclusive.

The aim of this paper is to establish if the observed relationship between place and people outcomes is truly causal. In particular, I test if living in high density social housing neighbourhoods[1] in England causes deterioration in school attainments of fourteen years old pupils. In order to identify the causal impact of neighbourhood deprivation on pupil attainments, I exploit the timing of moving into these neighbourhoods. The timing of a move can be taken as exogenous because of long waiting lists for social housing in high-demand areas. Naturally, a pupil's result in the Key Stage 3 test, a centralised nationwide assessment of school attainment, can only be influenced by the low quality of her new neighbourhood if she moved into this neighbourhood before the test was taken. This setting hence allows comparing school results of pupils who moved into deprived social housing neighbourhoods before versus after taking the test. This comparison of like with like allows uncovering the causal effect of low quality social housing neighbourhoods on Key Stage 3 results. Controls

[1] The average neighbourhood contains 125 households.

for a potential direct effect of moving, earlier attainments, family background and school quality are also included.

Importantly, this study controls for segregation that is purely an outcome of sorting. It is a well established fact that housing markets lead to spatial income segregation (Kain and Quigley 1972, Black 1999, Cheshire and Sheppard 1995, Gibbons *et al.* 2008). Parental income also correlates with school attainments (e.g. Taubman 1989); I hence expect to find that the weakest pupils live in the worst neighbourhoods purely based on the sorting mechanism. As a result, own characteristics might correlate with neighbourhood characteristics, which confounds causal interpretation (Manski 1993, Moffitt 2001). This study addresses this problem directly by focussing on the exogenous timing that results from social housing waiting lists. This allows the inclusion of neighbourhood fixed effects and relaxing the usual assumption that social housing neighbourhood allocation as such is quasi-random. This novel identification strategy allows demonstrating the importance of identifying a suitable control group[2].

The main finding of this study is that early movers into deprived social housing neighbourhoods experienced no negative effects on their school attainments relative to late movers. Conventional estimation strategies that fail to control for unobservable characteristics common to all pupils who move into highly concentrated social housing neighbourhoods show significant negative correlations between neighbourhood quality and school attainments. This suggests that one way to control for unobservable characteristics in neighbourhood research is to focus on temporal differentiation in situation where supply restrictions or other randomisation of the time of movement are present. In summary, the finding of no negative effect of low social housing neighbourhood quality on school attainments raises interesting questions regarding the current social housing policy of mixed communities.

The rest of the paper is structured as follows: The next section reviews the literature with an emphasis on methodological problems. I then explain in detail the identification strategy used by this study. Next, I present the data, the results and discuss their robustness before concluding.

[2] Another problem is the so-called "reflection problem" (Manksi 1993, Moffitt 2001), which states that since neighborhood effects work in both directions, neighborhood and own quality are simultaneously determined. This study circumvents this technical problem by focusing on pupils who move, which allows using pre-determined information on neighborhood quality in the estimation of effects.

2 Review of the Literature

There are numerous reasons why neighbourhood effects could exist. For example, peer group and role model effects could explain why our behaviour depends on others around us (Akerlof 1997, Glaeser and Scheinkman 2001). Others pointed at the importance of social networks (Granovetter 1995, Calvó-Armengol and Jackson 2004, Bayer *et al.* 2008, Zenou 2008) or conformism (Bernheim 1994, Fehr and Falk 2002)[3]. Finally, local resources like school qualities or other environmental amenities could also induce neighbourhood effects (Durlauf 1996). However, it is notoriously difficult to actually measure the size of any effect due to the self-selection of individuals into their neighbourhoods. The recent literature has made these concerns central to the analysis and focussed on establishing if there exists a causal link between place and people outcomes. Four different approaches to estimating neighbourhood effects can be identified:

First, Cutler and Glaeser (1997) use variations in physical features like number of rivers as instrument for segregation. More recently, Goux and Maurin (2007) use the date of birth of neighbouring pupils, which is a determinant of educational success in France to instrument for "neighbourhood quality". Both studies find significant negative neighbourhood effects using instruments.

The second group of studies focuses on institutional factors that affect the sorting mechanism itself: Goux and Maurin (2007), for example, finding strong negative neighbourhood effects argue that people in social housing are not free to choose the neighbourhood they live in, at least compared to everyone else. They think that assignment to social housing in France is quasi-random as waiting lists are very long and choice limited. Hence, they argue that the use of OLS-regressions is justified in order to estimate the contextual neighbourhood effect[4]. Conversely, using a similar intuition Oreopoulos (2003) does not find any long term effects on labour market outcomes from growing up in new-build social housing projects that were quasi-randomly allocated in Toronto. Gurmu (*et al.* 2007) look at TANF recipients who also live in public housing and find little evidence for neighbourhood effects on employment probabilities. Gibbons (2002) is yet another study that

[3] See Sampson (et al. 2002) for a survey on potential causes of neighborhood effects.

[4] They do not control for differences in school qualities. If school quality is negatively correlated with social housing neighbourhoods, then this can be mistaken as the neighbourhood effect. At least in the UK, "there is a systematic deficit in quality" [of schools] "precisely in the areas where a high-quality education in needed most." Lupton (2005, p. 590). Hence, the "strong contextual effects" (2007, p. 3) that Goux and Maurin find using their social housing identification strategy could be biased by differences in school qualities across neighbourhoods.

uses the idea that social tenants cannot sort into their neighbourhood and that the "neighbourhood status of any socially housed tenant is unrelated to their family resources" (p. 27). Even after controlling for school quality, Gibbons finds small but significant effects on the probability of gaining A-levels for social housing tenants in the 1970s.

Another study by Jacob (2004) uses public housing demolitions in Chicago as source of variation. This study finds that pupils affected by the demolitions did not do any better or worse compared to their public housing peers. However, these pupils also moved to neighbourhoods and schools very similar to the ones they had to leave. Hence, while Jacob identifies a situation where the decision to move seems exogenous, this setting does not create much variation in the neighbourhood quality indicators. He concludes that he can say little about neighbourhood effects but that the relocation as such did not seem to have negatively affected school results. To summarize, studies that have an institutional identification strategy tend to find at maximum small negative effects.

Thirdly, move conventional fixed effects strategies are used: Aaronson (1998) tries to identify neighbourhood effect in a time-series context by looking at differences between siblings. He finds small negative effects on school outcomes looking at families who move so that their siblings have different exposures to different neighbourhoods. The idea is that family characteristics proxy for unobservable characteristics that cause sorting. Looking at differences between siblings should then control for all family related observable and unobservable characteristics. The identifying assumption is that all family characteristics stay constant over time. This is questionable as the decision to move could very well be endogenous to unobserved changes in family characteristics. Note that this is a general problem of the siblings-family fixed effects-approach. One the one hand, you want to compare children with a considerable age difference in order to maximise variation in the neighbourhood quality the children are exposed to, on the other hand choosing a larger time frame makes the assumption that family characteristics stay constant over the whole period even more problematic.

Another control-strategy is assuming that while people can sort into their neighbourhood (i.e. block group), they are unable to sort into their micro-neighbourhood (i.e. block) due to supply constraints. Bayer (*et al*. 2008) argue along these lines and use block-group characteristics to account for neighbourhood sorting. Using this strategy, they find evidence for block-level referrals for labour market outcomes.

Finally, in order to find truly exogenous variation in neighbourhood quality, much attention has been paid to quasi-experimental and experimental settings where people

relocate into better neighbourhoods. Early examples are the Gautreaux and Yonkers programs (Briggs 1998; Rosenbaum 1995). The best known recent example is the "Moving to Opportunity experiment". In the experiment some families were randomly given vouchers that allowed them to move out of public housing into much better neighbourhoods with much better schools. The idea is that if neighbourhood effects exist, school performances of the children who moved should improve. In the context of academic achievements the findings are that there are no significant effects on school performances (Sanbonmatsu *et al*. 2006). Also, note that the MTO experiment assesses effects that 'good' neighbourhoods could have on educational outcomes of disadvantaged children, while assessing the effect of `bad' neighbourhoods on disadvantaged children is certainly equally relevant. Another study by Gold (*et al.* 2004) uses the 1991 over-night airlift of fifteen thousand Ethiopian Jews and their random assignment into neighbourhoods and schools in Israel to study effects from quality of initial schooling assignment on school outcomes. They find significant effects arising from initial school quality but no evidence for further effects on the neighbourhood level.

Summarising, most studies focus on movers to identify neighbourhood effects. This is because neighbourhoods do not change much over time. In fact, Charles Booth's London poverty maps from 1889 correlate highly with contemporary neighbourhood level measures of social deprivation (Orford *et al.* 2002). Somewhat surprisingly at least to my knowledge Aaronson (1998) remains the only study to use the *timing* of a neighbourhood change to distinguish treatment from non-treatment groups. The approach developed by this study is a combination of ideas from Aaronson (1998) and an institutional argument (like in Gibbons 2002, Oreopoulos 2003 and Goux and Maurin 2007), which I spell out in detail in the next section.

3 Empirical Strategy

3.1 Institutional background: the English school system

The English school system is organised around four key stages, in which learning progress is assessed on the national level. Of interest for this study are the Key-stage 2 (Ks2) assessment at the end of primary/junior school, and the Key-stage 3 (Ks3) assessment, which assesses pupils' progress in the first three years of compulsory secondary school education (figure 1).

The Ks2 assessment is at the age of 10/11, while the Ks3 is carried out at the age of 13/14. I use the average performance across the three core subjects English, Mathematics and Science to measure attainment. Since I compute cohort-specific percentiles of the respective Ks2 and Ks3 scores, individual results between the two tests and cohorts are directly comparable.

3.2 Institutional background: Social Housing

The quality and social composition of social tenants has changed much over the past sixty years. After the Second World War when Britain like most other European countries faced an acute housing shortage, social housing provided above average quality accommodation. A move into social housing was regarded as moving up from private renting and most houses had gardens and good amenities (Lupton *et al.* 2009). The social housing sector continued to expand during the 1960s and 1970s and peaked at 31 percent of the total English housing stock in 1979 (Hills 2007, p. 43). Social housing still provided much diversity in terms of both, quality and social and neighbourhood composition but some of the older stock required refurbishments. As a response to this, housing associations, non-profit entities that provide social housing, started to grow in number and importance (Lupton *et al.* 2007).

From the 1980s on until today the social sector shrunk both in absolute size and importance relative to other types of tenure. Construction levels in the social sector declined sharply from almost 150,000 dwellings to 50,000 dwellings/year in the early 1980s and stagnate on the historically lowest level since the second world war at around 20,000/year since the late 1990s (Hills 2007). In 2004, councils and housing associations provided about 4 million social dwellings (18.5 percent of stock), down from almost 6 million dwellings in 1979. This decline of social housing resulted from a combination of the "right-to-buy" scheme introduced by Margaret Thatcher in 1985 and public spending cuts on new construction (Hills 2007). The "right-to-buy" scheme also altered the socio-economic composition of social tenants as it allowed those who could afford it move into owner-occupation (Hills 2007, Lupton *et al.* 2009). Admission criteria also changed during this period when the Homeless Persons Act in 1977 forced councils to provide accommodation to certain groups in extreme need (Holmans 2005). These trends continued through the 1980s and 1990s and since 1991[6] growing demand even faces a negative net supply of absolute

[5] More than 1.5m homes have been sold off since the scheme was introduced in the 1980s (Source: Communities and Local Government, official statistics).

[6] Housing statistics from the Department of Communities and Local Government, table 101.

numbers of social rented dwellings (Hills 2007). As a result of these changes and the increasingly needs based allocation, in 2004 70 percent of social tenants belonged to the poorest two-fifth of the income distribution and hardly anyone to the richest fifth. This is in contrast to 1979 when 20 percent of the richest decile lived in social housing (Hills 2007, pp. 45, 86).

Today, demand for social housing grossly exceeds supply. Currently, nine million social renters live in four million social dwellings (Turley 2009). With negative net changes of social housing supply, spaces can only free up if existing tenants die or move out. Yet, movement within or out of the Sector is very low, 80 percent of social tenants in 2007 were already there in 1998, if already born (Hills 2007, p. 54). As a results, there are currently 4.5 million people (or about 1.8m household) on waiting lists for social housing. Taking these numbers at face value, if nothing was to change and no-one was born into social housing, this means that about 800,000 dwellings (20 percent of 4m) could free up every ten years. Even assuming zero new demand over the coming years it would take over 22 years to provide housing to all of those who are currently on a waiting list[7].

The social housing allocation system as it exists today continues to operate on a need based system, where the Homelessness Act 2002 defines these groups. Importantly, families with children belong to groups that are treated with priority. In the current situation of excess demand it is in fact very difficult to get into social housing without belonging to one of the needs groups. While the needs groups are defined nationally, provision is decentralised and administered through councils or housing associations. Local authorities operate different systems, where some use a banding system and others a point based system to ensure that those with the highest need and waiting time get a permanent place in social housing next. (Hills 2007)

About a third of local authorities complement their waiting list system with a choice based element, where new social housing places are announced publicly and prospective tenants asked to show their interest in this specific place (Hills 2007, p. 163). The prospective tenant with the highest score as determined through the waiting list mechanisms then gets the offer. However, most places are still directly allocated through the council or housing association. Regan (*et al.* 2001) writes that one of their interviewees in Reading, who rents

[7] Rough calculation based on the previous figures: every ten years 20 percent of stock, that is 800,000 dwellings become available with 1.77m households on waiting lists. This is of course grossly simplifying reality. First, the number of people on the waiting list might over-estimates actual demand due to double-subscriptions, secondly future demand will not equal zero, and last but not least the government committed to building 3m new social homes until 2020 (Rutter and Latorre 2009).

from a social landlord complained: "Most of the people I know who have been offered flats or houses or anything have no choice… it is that or nothing" (2001, p.22). As I will argue later, it is not central to our identification that people cannot exhibit influence on the neighbourhood or place where they get social housing offered.

As already mentioned, mobility within the social housing sector is extremely low. Reagan (ibid., executive summary, no page numbers) conclude in their qualitative study on housing choice and affordability in Reading and Darlington that "Moving within social housing was curtailed by allocation procedures and a lack of opportunity to move or swap properties". Quantitative evidence confirms that mobility within the social rented sector is extremely low, in spite of mobility schemes that the government started to implement in the recent years (Hills, 2007, p. 109). It is still the exception to move within the social housing sector once you got in.

Finally, there is a widespread perception that immigrants receive priority over social housing allocation. If this was the true, changes in migration flows could confound my analysis. However, this is not the case because immigrants are generally ineligible for allocation of social housing, as pointed out by a recent report (Rutter and Latorre 2009).

3.3 The general identification strategy

Figure 1 illustrates our identification in the context of the English school system. The time when the Key Stage 3 test is taken is denoted with t, the time for the Key Stage 2 with t-1. Hence, t-1 and t span the academic years 7 to 9, between the Ks2 and Ks3 tests. Contrary, t to t+1 the year 10 and 11 after the Ks3. I hence compare test scores of pupils who moved into deprived social housing neighbourhoods before taking the Ks3 test, in the period from t-1 to t, to pupils who also moved into deprived social housing neighbourhoods, but in the period between t and t+1. Formally, this reads:

$$
\begin{aligned}
Test\ Score_{i,\,n,\,t,} = {} & + \gamma_1\, d(SH\text{-}Move)_{i,\,t,t-1} \\
& + \gamma_2\, d(SH\text{-}Move)_{i,\,t-1,t+1} \\
& + \theta_1\, d(Move)_{i,\,t,t-1} \\
& + \theta_2\ d(Move)_{i,\,t-1,t+1} \\
& + \theta_2 \boldsymbol{D}_{n,\,t+1} \\
& + \theta_3\, Test\ Score_{i\,,\,t-1} \\
& + \ further\ controls_{i,\,t} \\
& + \varphi\, d(cohort)_i \quad + \varepsilon_{i,\,n,\,t}
\end{aligned}
\tag{1}
$$

The dependent variable is the Ks3 test score. The first four dichotomous dummies constitute a multiple difference-in-difference setup where γ_1 is the coefficient of interest. The first group consists of all pupils who do not move at all during the observed period. This group is only included in the constant and controls in order to gain precision. The second group consists of pupil who moved once, denoted by the fourth dummy [$d(Move)_{t-1,t+1}$]. The third-group, which is a sub-group of the second, consists of pupils who moved into social housing neighbourhoods [$d(SH\text{-}Move)_{t-1,t+1}$]. Some pupils who moved once, moved before the Ks3 test at time t was taken [$d(Move)_{t-1,t}$]. Finally, of those pupils who moved once and before the test, some moved into social housing neighbourhoods [$d(SH\text{-}Move)_{t-1,t}$]. Hence, an estimate of γ_1 gives the association between moving once and into a social housing neighbourhood (before the test) and the Key Stage 3 test result, controlling for moving once θ_2, moving before the test θ_1 , and other effects that potentially correlated with moving into social housing at some point γ_2.

The Ks2 test score is included to proxy pre-treatment ability [$Test\ Score_{i,\,t-1}$]. $\boldsymbol{D}_{n\,t+1}$ is a matrix of neighbourhood-dummies that captures all unobservable constant neighbourhood characteristics and [*further controls*] include information on parental income, proxied by free school meal eligibility, ethnicity, gender and school specific variables.

As a results of focussing on pupils who move into social housing neighbourhoods at different times, the hope is to single out variation in neighbourhood quality that is exogenous, i.e. independent of own characteristics. This strategy exploits the fact that people who apply for social housing in England are not directly allocated a place but have to remain on waiting lists for quite a while. Since our identification relies on long waiting lists, as additionally safety net, I only include local authorities in our analysis in which at least 5 percent of the population have been on a waiting list in 2007. Crucially, this should ensure that families who get into social housing at different points in time are, on average, very similar in their characteristics. That is, the *timing* of the move, but neither the decision to move itself nor the wish to get into social housing, should be exogenous in high demand areas[8]. In these areas, pupils of parents who applied to social housing at different times should share similar observable and unobservable characteristics but have different "exposure"-times to a social housing neighbourhood as generated through the precise time of when they got a place offered. As I show later, our data allows supporting this identifying assumption directly regarding observable characteristics. Technically, if this assumption is met, this ensures that

[8] Figure 2 shows these areas.

γ_2 captures constant "correlated effects" that could otherwise confound causal interpretation of the estimate for γ_1.

Importantly, identification is achieved even if there exists discrimination or an institutional preference for certain types of families. I can still obtain causal estimates if families or children with certain unobserved characteristics are favoured in the social housing allocation process. This is because in expected outcomes the setting can be represented as follows[9]:

$$\begin{aligned} &E\{Y_i \mid \textit{SH-Move}_{i,\,t-1,t}=1\} - E\{Y_i \mid \textit{SH-Move}_{i,\,t-1,t}=0\} \\ &\quad = E\{Y_{1i} - Y_{0i} \mid \textit{SH-Move}_{i,\,t-1,t}=1\} \\ &\qquad + [\,E\{Y_{0i} \mid \textit{SH-Move}_{i,\,t-1,t}=1\} - E\{Y_{0i} \mid \textit{SH-Move}_{i,\,t-1,t}=0\}] \end{aligned} \tag{2.1}$$

The term in the second row represents the effect of the treatment on the treated and the term in the square brackets sorting into treatment. The worry is that the latter expression does not equal to zero. It represents the difference between test scores of pupils who did not move into social housing compared to the counterfactual of what pupils who moved into a social housing neighbourhood would have obtained if they had not moved. The identification assumption of this study is that the timing of move is independent of individual characteristics conditional on moving into a social housing neighbourhood in a high demand area at some point. Formally, where $\{Y_{1i}, Y_{0i}\}$ denote the two potential outcomes for individual i:

$$\{Y_{1i}, Y_{0i}\} \perp\!\!\!\perp \textit{SH-Move}_{i,\,t-1,t} \mid \textit{SH-Move}_{i,\,t-1,\,t+1}=1 \tag{2.2}$$

Hence, if the timing of the move is exogenous, then conditional on moving into social housing at some point, the timing of the move is not related to observable and unobservable characteristics. Importantly, this setting does not rule out the existence of any institutional factor, discrimination or selection that is constant over time. Intuitively, if a social planner always offers places in nicer neighbourhoods to families with certain characteristics, this is equally going to happen before and after the Key Stage 3 test[10]. Therefore, γ_1 uncovers the

[9] For simplicity let us ignore other control variables and the dummy variables that control for general effects of moving once and before the test.

[10] Using (2.2) in (2.1) allows uncovering the effect of the treatment on the treated by iterating expectations (for example in Angrist and Pischke 2009, pp70f)

effect of the treatment on the treated, conditional on moving into a social housing neighbourhood at some point [$SH\text{-}Move_{i,\ t-1,\ t+1}$=1]. Note that this is a relaxation of the assumption that discrimination or institutional preferences for certain types of families do not exist at all. Here, it is only required that these factors do not change over the time of the study period.

A second reason why constant unobservable factors do not cause any bias is because I can include neighbourhood fixed effects in the specification. This means that I will effectively compare pupils who moved into 'the same' neighbourhood at different points in time. Any constant unobservable characteristic that is then related to neighbourhood quality will be captured by the fixed effect.

Summarizing, the identifying assumption is that the average characteristics of pupils whose parents move into highly concentrated social housing neighbourhoods do not change over the study period. If this assumption is met, identification is not obscured by individual or any constant unobservable factors such as sorting preferences or institutional discrimination that influence both, neighbourhood quality and school results.

4 Data

4.1 Background

Since the 1996 Education Act each school in England and Wales is required to report census information to the Department for Children, Schools and Families (DCSF), formerly the Department of Education and Skills (DfES). From 2001/02 onwards this Pupil Level Annual School Census (PLASC) includes detailed pupil-level information, like the pupils' postcode of residence, information of ethnic background and the status regarding eligibility of free school meals (FSME). People eligible for FSME are likely to receive Income Benefits, Job-seeker allowances and to be single parents with a dependent child (Hobbs *et al.* 2007). This variable serves as proxy for the lowest income groups. I can hence observe two cohorts for five consecutive years and track individual pupils from their first (year 7) to fifth (year 11) year in secondary education. For the first cohort this corresponds to the period from 2001/02 to 2005/06, for the second from 2002/03 to 2006/07.

The PLASC is collected mid of each January, close to when the Key Stage 3 tests are taken in May. I ignore this time-mismatch of four month here, but addressed it directly in one

of the robustness checks. I can use the residential information to identify all pupils who moved during the academic years 8, 9, 10 or 11. Furthermore, the National Statistics Postcode Directory obtained directly from the Office of National Statistics (ONS), until 2002 called All Fields Postcode Directory, matches all 2.3 million postcodes of the UK to their corresponding Output Area (OA) of the 2001 Census. OAs were constructed to include a comparable number of households, each OA contains about 4 to 5 postcodes and on average 125 households. I use the OA to define what I understand as a "neighbourhood". Importantly, this scale is detailed enough to avoid the downward-bias that can occur in the estimation of neighbourhood effects if the level of aggregation is too large (Goux and Maurin 2007).

Unfortunately, the PLASC does not contain any information on housing tenure. Hence, the next and crucial step is to identify who lives in a social housing neighbourhood and who does not. I do this using neighbourhood information from the 2001 Census of Population. The 2001 Census of Population is the most recent survey of all people and households living in England and Wales that is carried out every decade. A wide range of socio-economic variables was collected and made available at various levels of geographical aggregation. Importantly the census was collected one year before our analysis starts. Hence I can extract pre-treatment neighbourhood-level information on the total number of households that rent from the council (local authority) or a registered social landlord or housing association, the male unemployment rate, the level of education, the level of car ownership, building density, overcrowding, average number of rooms per household and the percentage of lone parents with dependent children. The first two are used to calculate the percentage of households living in social housing for each OA.

Following our identification strategy, the timing of movers into 100 percent social housing neighbourhoods must be exogenous, whereas movers into zero percent social housing neighbourhoods are never constrained by social housing waiting lists on the other extreme. However, only a very few of OAs are completely social housing. This is why I am forced to use a lower threshold of 80 percent. If 80 percent of all households in a particular OA live in social housing, then it is still very likely that a pupil who lives in that OA also lives in social housing. Therefore, everyone living in an OA with 80 percent or more households being in social housing is treated as living in a social housing neighbourhood, and all others are not. Using this threshold, by tracking OA-changes over the years it is now possible to identify those who moved out of an area with less than 80 percent of social tenants into an area with 80 percent or more households living in social housing. As I already know, mobility within the social housing sector is close to zero. Hence to identify pupils who

moved into social housing I focus the analysis those who moved into an OA with more than 80 percent of households in social housing and stayed. From now on this will be referred to as "moving into a social housing neighbourhood"[11]. It turns out that a total of 2094 pupils moved into social housing neighbourhoods between their 7th and 11th academic year. 703 pupils moved into social housing from year 7 to 8, 516 from year 8-to 9, 433 from year 9 to 10 and 442 between the academic years 10 and 11. Numbers are slightly higher for the earlier years, but this merely reflects the general decline in mobility and is not social housing neighbourhood specific.

Finally, the analysis is restricted comprehensive, grammar, modern and technical schools that span the whole period between Ks2 and two years after the Ks3. Other school types like middle schools are not organized around the Key Stages the same way and often require school changes after year 9, which could confound any analysis that focuses on moves between years 7 and 11. The schools included cover 90 percent of pupils in English state education[12].

4.2 Descriptive statistics

Table 1 contains summary statistics for pupils in social housing neighbourhoods. Columns (a) and (b) give information for pupils who lived in a social housing neighbourhood throughout their academic years 7 to 11, and columns (c) and (d) for pupils who moved into social housing neighbourhoods during this period.

The first thing to notice in the first two columns of Panel A is that pupils who lived in social housing neighbourhood for the whole period have Key Stage test scores much below the national average, which is at 50. Their average Key Stage 2 score is only 38.64, and the respective Key Stage 3 score is even worse at 35.63. These pupils already belonged to the weakest when they started secondary schools, but results deteriorated even further until Key Stage 3. Also, about half of them are eligible for free school meals (FSME), which is a proxy for a low income background.

[11] When I discuss our results I will show that our findings are sensitive to the choice of the threshold of 80 percent in the expected way. Furthermore, focusing on 80%+ OAs also helps to identify high demand areas. For example, the vast majority of OAs with 80%+ SH tenants lies within Authorities with more than 5% on the waiting list anyway as high density social housing is directly associated to high demand. As another check that I identify high demand areas, all results are also robust to focussing on the biggest ten cities in the England only.

[12] No consistent data is available for the private sector, which has a market share of about 6-7 percent.

Panel B summarises neighbourhood characteristics. Still focussing on columns (a) and (b), it becomes evident that social housing neighbourhoods are characterised by a very high average unemployment rate of almost 12 percent, low qualification levels, room overcrowding, high building densities and low property prices. Only half of the households have access to a car or van and about a fifth are lone parents with at least one dependent child and 43 percent have at least one household member with a limiting long term illness.

Columns (c) and (d) show statistics for pupils who moved into a social housing neighbourhood. Panel A shows that they have individual characteristics very similar to pupils who always lived in a social housing neighbourhood. As discussed, one general problem in neighbourhood research is that neighbourhoods do not change much over time. As a result I have to rely on movers to identify the effect. It is hence comforting to see that "movers" are similar to "stayers" with respect to their observable characteristics. This is important for the external validity of this study, as the main estimation will be carried out based on the 2094 pupils who moved into social housing neighbourhoods during their academic years 7 to 11. Overall pupils who moved into social housing neighbourhoods seem similar to pupils who always lived in a social housing neighbourhood.

Panel B columns (c) and (d) show neighbourhood statistics for pupils who moved into social housing neighbourhoods. Importantly, these are the characteristics of the neighbourhoods those pupils move out of. These non-social housing neighbourhoods are significantly better than those of the social housing neighbourhood stayers.

Table 2 gives the complementary summary statistics for pupils who lived in non-social housing neighbourhoods throughout, columns (a) and (b), and pupils who moved between non-social housing neighbourhoods (c) and (d). First, note that individual Key Stage scores are much higher and that only few pupils are eligible for free school meals. Note, however, that movers have slightly lower scores compared to "stayers". Secondly, panel B shows that non-social housing neighbourhoods are much 'nicer' places to live, with unemployment rates around 5 percent, high qualification levels and low overcrowding etc. Comparing panels C across columns and tables it turns out that teacher to pupil rations do not differ much for the various groups of pupils.

Finally, table 3 looks explicitly at changes that pupils who moved into social housing neighbourhoods experienced. The neighbourhoods they moved into are described in column (a); column (b) gives the percentage change in neighbourhood quality for each indicator. For example, the first row shows that unemployment rates are 50% higher in the new social housing neighbourhood, etc. In fact, we can see that neighbourhood quality deteriorated in *all*

characteristics for pupils who moved into a social housing neighbourhood. Pupils who moved into a social housing neighbourhood moved into a neighbourhood with higher unemployment and density and lower house prices and qualification levels, for example. The third column expresses these changes in terms of standard deviations. Hence, what this study identifies is the aggregate effect on school results that arises from this general deterioration in neighbourhood quality.

Note that there is a small fraction of pupils who moved more than once or out of social housing, for which no summary statistics are given. This is because I focus on pupils who move only once to identify those who move into social housing. Furthermore, pupils who move more than once are not representative for "stayers".[13] Therefore, multiple movers are not included in my main analysis. The next section presents the main results.

5 Results

5.1 Balancing of individual characteristics

Recall the identifying assumption of this study that early and late movers into social housing neighbourhood are statistically identical. If early and late movers had different characteristics, this could potentially confound the analysis that links differences in exposure-times to social housing neighbourhoods to school performance. The data allows me to directly address this concern. Figure 3 shows the percentage of pupils who were eligible for free school meals in year 7, the gender and Key Stage 2 result by the year of movement. Notably, all these characteristics are determined before anyone moved and can hence not be endogenous to the quality of the new neighbourhoods. The figure clearly shows that pupils who moved into social housing neighbourhoods are very similar across the years. Regardless of the year, about 50% are eligible for free school meals, slightly less than half are male and Key Stage 2 results average around 34 percentile points.

I can also test if early movers differ from post-KS3 test movers into social housing neighbourhoods formally with a probit regression. Here, P=1 denotes the probability of moving into social housing in the years before the KS3, Φ the cumulative distribution function of the standard normal distribution (probit function), X the matrix of regressors and β the coefficients that are estimated with Maximum Likelihood.

[13] Descriptive statistics available from the author on request.

$$\Pr[d(SH\text{-}Move)_{t-1,t}=1|X] \quad = \quad \Phi\,(X'\beta) \qquad (2)$$

Table 4 presents estimates of marginal effects for regression (2). In particular, the Key Stage 2 score, which correlated highly with the Key Stage 3, should be prone to pick up differences between early and late movers. But as I can see from the table, early and late movers are literally identical with respect to previous attainment. The same holds for the other pre-determined variables like gender, ethnicity or free school meal eligibility in year 7.

Even free school mean eligibility in year 8 and 9, which are not a pre-determined measure at least for early movers, fails to predict the timing of the move. This indicates that there are no relevant social-housing specific income effects.

The last line shows that I fail to reject the null hypotheses of the joint test that all coefficients equal zero. This is despite not conditioning on school fixed effects or neighbourhood fixed effects, which I am able to do in the analysis and robustness checks.

To summarise, observable characteristics of pupils who moved into social housing are balanced against the timing of their move. This does not rule out that those moving later are different on unobservable characteristics but makes it unlikely if one assumes that unobservable characteristics track observable characteristics (Altonji et al. 2005).

5.2 Balancing of neighbourhood characteristics

I have already established that pupils who moved into social housing neighbourhoods experienced large deteriorations in the quality of their neighbourhood (table 3). In our setting, I can also check if these changes in neighbourhood quality differed depending on the year of the move. This is another way to indirectly test for identification. I would expect that the change in neighbourhood quality (the treatment) is balanced with respect to the year of moving into a social housing neighbourhood. Figure 4 shows the negative changes in neighbourhood quality that pupils experienced by year of move. What I can see now is that these shocks are similar over the years. Regardless of the year of movement, they moved into neighbourhoods with larger percentages of lone parents, more overcrowding, higher unemployment rates, lower qualification levels, lower access to cars and lower house prices. This further supports the causal interpretation of the social housing neighbourhood effects in our setup.

5.3 "Traditional" approach

Before I turn to the main results, it is useful to inform the discussion with benchmark regressions (table 5). These regressions are for comparative purpose only and do not focus on identification and simply correlate Ks3 results to the areas where the pupils lived or moved to. Table 5 is organised in three panels with three regressions each, where additional controls and school fixed effects are added subsequently in columns (a) to (c), (d) to (f) and (g) to (i). Panel A shows estimates for the effect on Ks3 scores of living in a social housing neighbourhood at the start of secondary education (year 7). In panel B the effect is estimated for pupils who moved into social housing neighbourhoods before the test in year 8 and 9, and panel C shows estimates for pupils who moved into social housing neighbourhood before or after the test.

The regression estimated in the last column (i), panel C, is the following:

$$\begin{aligned} Test\ Score_{i,t} = {} & + \gamma\, d(SH\text{-}Move)_{i,\,t-1,t+1} \\ & + \theta_1\, d(Move)_{i,\,t-1,t+1} \\ & + \theta_2\, \boldsymbol{S}(school)_{i,\,t-1} \\ & + \theta_3\, Test\ Score_{i\,,\,t-1} \\ & + \ further\ controls_{i,\,t} \\ & + \varphi\, d(cohort)_i \quad + \phi_{i,\,t} \end{aligned} \tag{3}$$

The dependent variable is the Key Stage 3 result. The first dummy equals one for all pupils who moved into a social housing neighbourhood before or after the Key Stage 3 test and the second controls for the direct effect of moving. The third term $\boldsymbol{S}$ is a matrix of dummies for each individual school in year 7 and θ_3 estimates the effect of previous attainment (Ks2 score). Further, a dummies for school changes, FSME eligibility, ethnicity and gender are included.

Panel A, column (a) shows the associations between living in a social housing neighbourhood at the beginning of secondary education and Key Stage 3 scores. Without further controls, row one shows that pupils who lived in social housing neighbourhoods in year 7 score 14.84 percentile points lower than their peers. It is hence not surprising that educational underperformance has been linked to neighbourhood quality in the past. However, this association between place and test score reduces to about -2.9 percentile points once a rich set of controls including prior Key Stage 2 results are added (b). With school

fixed effects, this association reduces further to about one and a half percentile points, while remaining significant at the 1 percent level (c). Note that variables such as the number of years of free school meal eligibility –an income proxy- are more important in determining school improvements.

The results are similar in size and significance in panel B, where the effects are estimated for pupils who moved into a social housing neighbourhood between the tests, hence for "SH-movers" rather than for "SH-stayers". The unconditional association is now -13.251 percentile points (d) and it again reduces substantially to about minus one and a half percentile points once additional controls (e) and school fixed effects (f) are added.

The estimates are hence quite similar for pupils who lived in social housing and those who moved into social housing. If anything, the associations between moving into a social housing neighbourhood and the test results are somewhat weaker compared to those who lived in social housing in year 7. Summarizing the results from panels A and B: We see large and negative associations between neighbourhood quality and school results. These associations reduce to about one and a half percentile points once controls for a rich set of background characteristics including previous test scores and school fixed effects are included.

Note that an effect of one and a half percentile points is not trivial in size and comparable to estimates of effects that arise from other social interactions like peer effects. With a similar dataset, Lavy et al. (2009) estimate that moving a pupil from a school where 20% of peers belong to the worst 5% in the national distribution to a school where 0% belong to this group increases Key Stage 3 scores by 1.2 percentile points. However, recall that these neighbourhood effect estimates are pure cross-sectional comparisons. As discussed earlier, unobserved correlated effects potentially bias these results. Therefore, these results cannot be interpreted as causal effects.

Finally, panel C presents estimates for pupils who moved into social housing before or after the Ks3 test. If the previous negative associations were causal estimates for the true effect of the social housing neighbourhoods, then the estimates in panel C should be much smaller then the previous ones. This is because a substantial share of pupils who moved into a social housing neighbourhood before or after the test did of course only move after the Ks3 test was taken. For those pupils, the new neighbourhood cannot exhibit any negative influences on educational attainment by definition. The fact that the estimates in panel C are very similar to the previous ones might hence suggest that it is not the neighbourhood but

unobserved correlated effects that cause the negative findings. The next section looks at this specifically.

5.4 Main results: early and later movers into social housing neighbourhoods

Table 6 shows the main results. All specification now control for moving into social housing neighbourhoods before or after the test. Column (a) only controls for the direct effect of moving, column (b) includes previous test scores, ethnicity, school characteristics and gender and in column (c) school fixed effects are added to the specification. Finally, in column (d) school fixed effects are replaced with neighbourhood fixed effects. This is the specification (1) as discussed in the earlier section on identification.

The first row shows estimates for moving into a social housing neighbourhood before the test [γ_1], which are now non-significant in all specifications. Importantly, this is not driven by increases in the standard errors but by actual changes in the estimates. After controlling for moving into social housing and a potential direct effect of moving before the Ks3, there is no evidence for any detrimental neighbourhood influence on educational attainment. This means that although pupils who moved into a social housing neighbourhood before the Ks3 test underachieved, they did not underachieve to any different degree compared to their peers who moved into a similar neighbourhood after the Ks3 test. This becomes evident when we compare the 'traditional' estimates from table 5, panel B to columns (a) to (c) table 6. Taking the first column in Panel B, for example, the negative association of 13.251 percentile points for early SH-movers is now fully captured by the dummy variable that controls for moving into social housing before or after the test (a), row 2. This strongly suggests that the previous negative associations between moving into social housing neighbourhoods were driven by unobservable characteristics common among all pupils who moved into social housing neighbourhoods at some point.

This conclusion is further substantiated in column (d) that includes neighbourhood destination fixed effects. Here, the estimate in the first row shows the difference in Ks3 results for pupils who moved into "the same" social housing neighbourhood before or after the test. Again, there is no evidence for detrimental effects on test scores. This is an important finding because the neighbourhood fixed effect absorbs any constant selection of groups or individuals into specific social housing neighbourhoods, as well as for potential institutional discrimination. Note that the coefficient in row 2 is now also insignificant, which illustrates that the Ks3 performance of "SH-movers" does not generally differ from "SH-stayers".

It is worth noting that this main finding holds in all specifications and is not sensitive to the inclusion of control variables like previous test scores or fixed effects. This is a direct result of the strong balancing of individuals who moved into social housing neighbourhoods at different times. In fact, if the timing of moving is exogenous, the inclusion of control variables should not make any difference. In small samples, however, there is a trade-off between precision and finite sample bias. I prefer the last specification because the control variables are all *a-priory* relevant to Key Stage scores and the sample size is large.

Summarising the results, the traditional regressions estimate large and significant negative associations between living or moving into social housing neighbourhoods and school. These effects persist even on the inclusion of a rich set of control variables including a test-score measure of prior ability and school fixed effects. However, our main results show that the negative associations between moving into deprived social housing neighbourhoods and test scores are driven by unobservable characteristics common to pupils who moved into these neighbourhoods at some point. Using the timing of a move as source of variation, there is no evidence for detrimental short term effects from moving into deprived social housing neighbourhood.

6 Robustness Checks

The main data limitation of this study is that I am unable to exactly identify pupils who move into social housing neighbourhoods. I need to rely on Output Area information from the UK 2001 Census of Population to determine if a neighbourhood is social housing or not. Since only a handful of neighbourhoods have 100 percent social tenants all OAs with at least 80 percent social tenants were classified as social housing neighbourhood. Note that neighbourhood quality is negatively correlated to the threshold level. Neighbourhoods with at least 20 percent social tenants are worse compared to neighbourhoods with at least 10 percent social tenants but better than those with at least 30 percent regarding the various neighbourhood characteristics, etc. I imposed the somewhat arbitrary threshold to focus on pupils who move into neighbourhoods with at least 80 percent of social renters. This means that someone who moved from a neighbourhood with 79% social renters to one with 81% is now coded as "moving into social housing". Taking the regression from table 6 (d) as a benchmark, the first row of table 7 addresses this concern directly and only counts a move as into social housing if it was out of a neighbourhood with a maximum of 20 percent and into a

neighbourhood with at least 80 percent of social tenants. The results are insensitive to this modification.

Another way of testing if the choice of the threshold level influenced our findings is to run separate regressions for different cut-off points. The sensitivity of the main result to the definition of this threshold is shown in figure 5. Panel A shows results for the traditional approach table 5 (e) and table 6 (b), panel B for the respective specifications including school fixed effects. The dashed black line gives estimates for the 'traditional' control strategy and the solid line for the DID estimates. First, we can clearly see that the estimated negative neighbourhood effect becomes larger as we increase the threshold in the 'traditional' approach. The estimated effect of moving from a neighbourhood with less than 10 percent of social to a neighbourhood with at least 10 percent of social tenants is zero (panel A) or close to zero (panel B) but increases quickly in size and significance shifting the threshold level up. The difference-in-difference estimate, on the other hand, remains constant around zero, suggesting that there is no neighbourhood effect regardless of the definition of the threshold. This suggests that the increasing negative effects in the 'traditional' estimates reflect unobserved characteristics that correlate negatively with KS3 results and neighbourhood quality. This is in line with the main finding that the negative association between neighbourhood quality and school results disappears once controlling for moving into the social housing neighbourhood at some point.

I further checked the sensitivity of the main finding against specific sample selection issues. One concern is that the Key Stage 3 test is not taken on the exact date that residential information is collected. In particular, the residential information is collected mid of each January, while the Key Stage 3 is taken over the spring. This means that up to a third of pupils that are coded as moves in year 9 to 10 might in fact have moved just before the Key Stage 3 tests were taken. In the second row in table 7 I therefore do not count all pupils that moved in this period, where I cannot be one-hounded percent sure that they moved after the test was taken. This means that here I compare Key Stage 3 test results of pupils who moved into social housing neighbourhoods in the academic years 7-8 or 8-9 to pupils who moved into social housing neighbourhoods in the years 10-11 only. The estimates for this sample remain in line with our main results.

The third row estimates the specification using the first cohort only. All specifications include a cohort effect but this cohort effect is not interacted with all the other variables. If our results were cohort specific this would cast serious doubts on the external validity of our findings. However, the effect of moving before the Key Stage 3 test is non-significant for

both cohorts. As it turns out, for the first cohort, the estimate is negative and non-significant and for the second (not shown here) it is positive and insignificant. This strengthens the interpretation that there is no significant effect from moving into high density social housing neighbourhoods. Finally, the last row excludes "stayers" from the regression. "Stayers" were included to gain precision but their inclusion does not drive the results.

To summarise the findings form table 7 and figure 5: the main results do not seem to be driven by the specific way in which I identify movers into social housing neighbourhoods.

7 Discussion and Conclusions

This study estimates the effect of living in a very deprived neighbourhood, as identified by a high density of social housing, on the educational attainment of fourteen years old (9th grade) students in England. Neighbourhoods with markedly high concentrations of social housing have very high unemployment and extremely low qualification rates, as well as high building density, rooms over-crowding and low house prices. In order to identify the causal impact of neighbourhood deprivation on pupil attainments, I exploit the timing of moving into these neighbourhoods. The timing of a move can be taken as exogenous because of long waiting lists for social housing in high-demand areas. Contrary to previous studies in the social housing context, this strategy does not rely on exogenous allocation of people to neighbourhoods. Here, it is only required that the timing of such moves is unrelated to personal characteristics. This is a new strategy that by-passes the usual sorting and reflection problems.

Using this approach, there is no evidence for otherwise negative short term effects. This suggests that the underachievement of pupils who moved into social housing neighbourhoods cannot be causally linked to place characteristics during the formative teenage years.

What I regard as a more general contribution to the literature is that I highlight the importance of control strategies in neighbourhood research. I demonstrate that 'traditional' control strategies that simply include more variables on observable characteristics fail to identify the effect. I think that the focus on temporal differentiation must not remain limited to the social housing context but is applicable to all situations where supply restrictions in a specific neighbourhood introduce randomness into the timing of residential moves.

Finally, my findings potentially have implications for the current UK social housing policy, which favours mixed-income neighbourhoods and dispersed construction of social

housing in order to avoid the negative neighbourhood effects (Hills 2007:179). For example, Holmes (2006) concludes a report on a particular Mixed Income Communities Program stating that these neighbourhoods "[…] had become pleasant places to live, learn and work." (Key findings, no page number). This study casts doubts on the existence of negative short-term effects from living in high-density, low-income, low qualification and highly concentrated social housing neighbourhood. These areas are certainly less 'pleasant places to live, learn and work', but I find no evidence for negative effects on school performance during the first years of secondary education.

8 References

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Table 1: Pupils and social housing neighbourhoods

	Pupil stayed in SH neighbourhood during study period		Pupil moved into SH neighbourhood during study period	
	(a)	(b)	(c)	(d)
	Mean	Std. Dev.	Mean	Std. Dev.
Panel A: Individual characteristics				
Key Stage 2 Score	38.641	24.229	37.258	24.332
Key Stage 3 Score	35.629	23.721	33.332	23.710
Changed school before, year 7-9	0.043	0.202	0.106	0.308
FSME eligibility year 7	0.494	0.500	0.498	0.500
FSME eligibility year 8	0.484	0.500	0.494	0.500
FSME eligibility year 9	0.467	0.499	0.493	0.500
Gender (male=1)	0.500	0.500	0.484	0.500
Ethnicity-White British Is.	0.629	0.483	0.694	0.491
Ethnicity-Other White	0.036	0.187	0.032	0.176
Ethnicity-Asian	0.065	0.246	0.053	0.223
Ethnicity-Black	0.166	0.372	0.138	0.345
Ethnicity-Chinese	0.008	0.088	0.007	0.082
Ethnicity-Mixed	0.043	0.203	0.036	0.187
Ethnicity-Other	0.028	0.164	0.019	0.137
Panel B: Neighbourhood characteristics, pre move (if any)				
Unemployment rate	0.117	0.048	0.079	0.045
Level 4+ qualification[1]	0.489	0.114	0.548	0.130
Access to car or van[2]	0.500	0.128	0.649	0.169
Lone parent with dep. child	0.199	0.090	0.124	0.070
Limiting long term illness	0.431	0.100	0.386	0.098
Overcrowding[3]	0.198	0.131	0.132	0.110
Number of rooms	4.291	0.537	4.782	0.648
Population density[4]	133.978	158.608	86.643	91.936
Average house price[5]	0.617	0.630	0.716	0.496
Panel C: Secondary school characteristics, year 7				
Pupil to teacher ratio	15.734	1.856	15.877	1.808

Notes: Neighbourhood classified as Social housing if at least 80% of residents in social rented sector. Key stage scores are percentiles computed on the whole cohort. Only pupils who always lived in Local Authority with more than 5% of population on Social Housing waiting list included. For SH stayers 10k observations, SH movers 2,094 observations. All movers only moved once. Panel B: Neighbourhood characteristics as in academic year 7 (before the move). 1) First degree, Higher degree, NVQ levels 4 and 5, HNC, HND, Qualified Teacher Status, Qualified Medical Doctor, Qualified Dentist, Qualified Nurse, Midwife or Health Visitor, 2) percentage households that can access at least on car or van, 3) Index as used in Census 2001, a value of 1 implies there is one room too few, 4) people per hectare, 5) Average house price: All property sales in neighbourhood between 2000 and 2006 divided by monthly national average price.

Table 2: Pupils and non-social housing neighbourhoods

	Pupil stayed in non-SH neighbourhood during study period		Pupil moved between non-SH neighbourhoods during study period	
	(a)	(b)	(c)	(d)
	Mean	Std. Dev.	Mean	Std. Dev.
Panel A: Individual characteristics				
Key Stage 2 Score	51.317	25.902	47.064	25.685
Key Stage 3 Score	51.507	26.439	46.409	26.111
Changed school before KS3	0.021	0.144	0.095	0.293
FSME eligibility year 7	0.143	0.350	0.205	0.404
FSME eligibility year 8	0.139	0.346	0.197	0.398
FSME eligibility year 9	0.133	0.340	0.187	0.390
Gender (male=1)	0.508	0.500	0.497	0.500
Ethnicity-White British Is.	0.830	0.376	0.804	0.397
Ethnicity-Other White	0.017	0.130	0.020	0.139
Ethnicity-Asian	0.066	0.248	0.065	0.247
Ethnicity-Black	0.030	0.169	0.044	0.205
Ethnicity-Chinese	0.003	0.055	0.003	0.054
Ethnicity-Mixed	0.021	0.145	0.025	0.156
Ethnicity-Other	0.006	0.080	0.010	0.098
Panel B: Neighbourhood characteristics, pre move (if any)				
Unemployment rate	0.045	0.037	0.054	0.042
Level 4+ qualification[1]	0.618	0.131	0.603	0.133
Access to car or van[2]	0.830	0.151	0.787	0.167
Lone parent with dep. child	0.344	0.100	0.087	0.066
Limiting long term illness	0.344	0.100	0.351	0.103
Overcrowding[3]	0.066	0.076	0.081	0.086
Number of rooms	5.439	0.824	5.230	0.797
Population density [4]	53.187	49.823	61.066	62.365
Average house price[5]	0.931	0.537	0.840	0.499
Panel C: Secondary school characteristics, year 7				
Pupil to teacher ratio	15.850	1.555	15.894	1.601

Notes: Neighbourhood classified as "not Social housing" if at least 20% of residents not in social rented sector. Only pupils who always lived in Local Authority with more than 5% of population on Social Housing waiting list included. For non-SH stayers 474k observations, non-SH movers 109k observations. All movers only moved once. Panel B: Neighbourhood characteristics as in academic year 7 (before the move). 1) First degree, Higher degree, NVQ levels 4 and 5, HNC, HND, Qualified Teacher Status, Qualified Medical Doctor, Qualified Dentist, Qualified Nurse, Midwife or Health Visitor, 2) percentage households that can access at least on car or van, 3) Index as used in Census 2001, a value of 1 implies there is one room too few, 4) people per hectare, 5) Average house price: All property sales in neighbourhood between 2000 and 2006 divided by monthly national average price.

Table 3: N'hood changes for SH-mo

	(a)	(b)	(c)
	New SH-n'hood	% ch.	S.D. ch.
Unemployment rate	0.122	54.43%	1.089
Level 4+ qualification	0.470	-14.08%	-0.589
Access to car or van	0.497	-23.42%	-0.947
Lone parent with dep. child	0.194	56.45%	1.116
Limiting long term illness	0.441	14.25%	0.542
Overcrowding	0.169	28.03%	0.453
Number of rooms	4.333	-9.39%	-0.540
Population density	112.151	29.44%	0.446
Average house price	0.550	-23.08%	-0.312

Notes: Only pupils who always lived in Local Authority with more than 5% of population on Social Housing waiting list included. 2094 obs. Variables defined as in previous tables.

Table 4: Balancing on individual characteristics

Probability of moving into SH neighbourhoods in the two years before versus after the KS3 test, marginal effects

Key Stage 2 score	-0.000 (0.000)
FSME eligibility year 7	-0.030 (0.033)
FSME eligibility year 8	0.051 (0.038)
FSME eligibility year 9	0.006 (0.032)
Gender (male==1)	0.011 (0.021)
Ethnicity-White British Isles	0.121 (0.075)
Ethnicity-Other White	0.051 (0.093)
Ethnicity-Asian	0.130 (0.080)
Ethnicity-Black	0.121 (0.073)
Ethnicity-Chinese	0.163 (0.127)
Ethnicity-Mixed	-0.228 (0.095)
Ethnicity-Other	-0.001 (0.006)
Teacher to pupil ratio (y7)	-0.001 (0.006)
Cohort	-0.010 (0.022)
School FX	No

H0: All coefficients equal zero.
chi2(13) 15.12; Prob > chi2 = 0.2996

Notes: Dependent variable equals one if pupil moved before KS3 in sample where everyone moved once and into Social Housing neighbourhoods, hence either before or after KS3. Obs: 2094. Probit regression, marginal effects. Standard errors in brackets and clustered at neighbourhood level. Only pupils who always lived in Local Authority with more than 5% of population on Social Housing waiting list included.

Table 5: Social housing and school performance, traditional approach

	Panel A			Panel B			Panel C		
	Lived in SH neighbourhood in year 7			Moved into SH neighbourhood before KS3 test			Moved into SH n'hood before or after the test		
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Estimated effect on Key Stage 3 score:	-14.837 (0.260)**	-2.899 (0.161)**	-1.540 (0.140)**	-13.251 (0.703)**	-2.722 (0.413)**	-1.454 (0.373)**	-13.077 (0.534)**	-2.882 (0.316)**	-1.667 (0.299)**
Key Stage 2 score	-	0.849 (0.001)**	0.820 (0.001)**	-	0.850 (0.001)**	0.820 (0.001)**	-	0.850 (0.001)**	0.820 (0.001)**
Changed secondary school before KS3	-	-3.060 (0.107)**	-1.669 (0.115)**	-	-3.252 (0.107)**	-1.854 (0.006)**	-	-3.086 (0.107)**	-1.670 (0.115)**
FSME eligibility year 7	-	-2.935 (0.091)**	-1.920 (0.087)**	-	-3.005 (0.092)**	-1.948 (0.087)**	-	-2.998 (0.092)**	-1.944 (0.087)**
FSME eligibility year 8	-	-1.468 (0.112)**	-0.991 (0.106)**	-	-1.494 (0.112)**	-0.999 (0.106)**	-	-1.494 (0.112)**	-0.999 (0.106)**
FSME eligibility year 9	-	-2.118 (0.097)**	-1.459 (0.092)**	-	-2.162 (0.097)**	-1.469 (0.092)**	-	-2.998 (0.092)**	-1.470 (0.092)**
Gender (male==1)	-	-1.411 (0.035)**	-1.249 (0.036)**	-	-1.412 (0.035)**	-1.251 (0.036)**	-	-1.410 (0.035)**	-1.249 (0.036)**
Pupil to teacher ratio, year 7	-	-0.499 (0.014)**	(absorbed)	-	-0.497 (0.014)**	(absorbed)	-	-0.498 (0.014)**	(absorbed)
Control for moving into social housing	No	No	No	No	No	No			
Controls for effects of moving	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ethnicity-controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
School fixed effects	No	No	Yes	No	No	Yes	No	No	No

Notes: Neighbourhood classified as Social housing if at least 80% of residents in social rented sector. Over 596k obs., errors clustered at neighbourhood level. Only pupils who always lived in Local Authority with more than 5% of population on Social Housing waiting list. Standard errors in brackets. ** sig. at 1%.

Table 6: Social housing and school performance, the causal effect

	(a)	(b)	(c)	(d)
Moved into SH neighbourhood before KS3 test	-0.365	0.426	0.539	0.267
	(1.056)	(0.628)	(0.597)	(0.651)
Moved into SH neighbourhood before or after KS3 test	-12.886	-3.152	-2.000	0.097
	(0.801)**	(0.481)**	(0.454)**	(0.515)
Key Stage 2 score	-	0.850	0.820	0.830
		(0.001)**	(0.001)**	(0.001)**
Changed secondary school before KS3	-	-3.251	-1.854	-2.763
		(0.107)**	(0.116)**	(0.120)**
FSME eligibility year 7	-	-3.001	-1.946	-1.439
		(0.092)**	(0.087)**	(0.101)**
FSME eligibility year 8	-	-1.494	-1.466	-0.924
		(0.112)**	(0.092)**	(0.123)**
FSME eligibility year 9	-	-2.156	-1.466	-1.058
		(0.097)**	(0.092)**	(0.107)**
Gender (male==1)	-	-1.412	-1.251	-1.525
		(0.035)**	(0.036)**	(0.040)**
Pupil to teacher ratio, year 7	-	-0.497	(absorbed)	-0.549
		(0.014)**		(0.019)**
Control for moving into social housing	Yes	Yes	Yes	Yes
Controls for effects of moving	Yes	Yes	Yes	Yes
Ethnicity-controls	No	Yes	Yes	Yes
School fixed effects	No	No	Yes	No
Output Area fixed effects (after move)	No	No	No	Yes

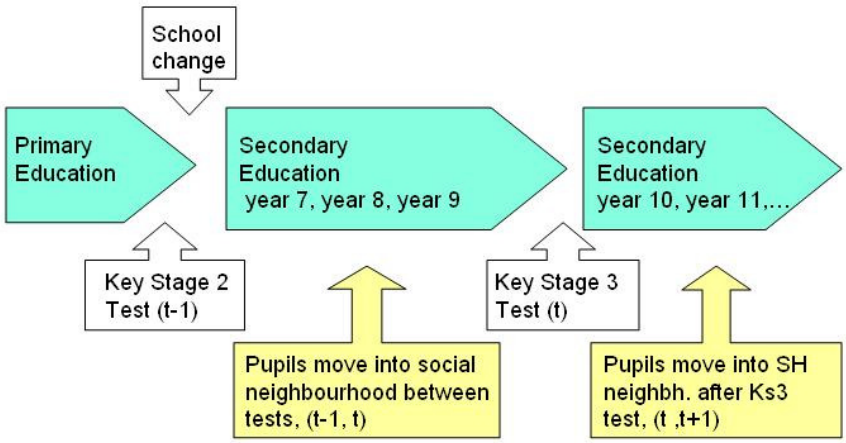
Notes: Neighbourhoods classified as Social housing if at least 80% of residents in social rented sector. SH movers who moved only once. Only pupils who always lived in Local Authority with more than 5% of population on Social Housing waiting list. Over 596k obs., errors clustered at neighbourhood level. Standard errors in brackets. ** sig. at 1%.

Table 7: Robustness checks

	Effect of moving into SH n'hood
20% vs 80% threshold	0.400 (1.231)
Excluding y9-10 movers	-0.532 (0.857)
Only first cohort	-0.392 (1.059)
Only movers	-0.013 (1.063)

Notes: All regressions include Output Area (neighbourhood) fixed effects, like table 6 (d). Standard errors in brackets.

Figure 1: The English School System and identification



Group/dummy	$d(SH\text{-}Move)_{i,\ t-1,t}$	$d(SH\text{-}Move)_{i,\ t-1,t+1}$	$d(Move)_{i,\ t-1,t}$	$d(Move)_{i,\ t-1,t+1}$
Never moved	0	0	0	0
Moved				1
Moved before test			1	1
Moved into SH n'hood		1		1
Moved before test into SH n'hood	1	1	1	1

Figure 2: Percentage of population on social housing waiting lists 2007

Notes: Data Sources: Department for Communities and Local Government, "shapefile" from UKBORDERS. Using a spatial match in ARC-GIS I identified all Census 2001 Output Areas with their centre in a local authority with less than 5% of the population on a waiting list and excluded pupils living in, moving from or moving to one of these OAs from the analysis. Waiting list correlation with 2002 is r>0.86**.

Figure 3: Balancing of pupils who moved into SH neighbourhoods

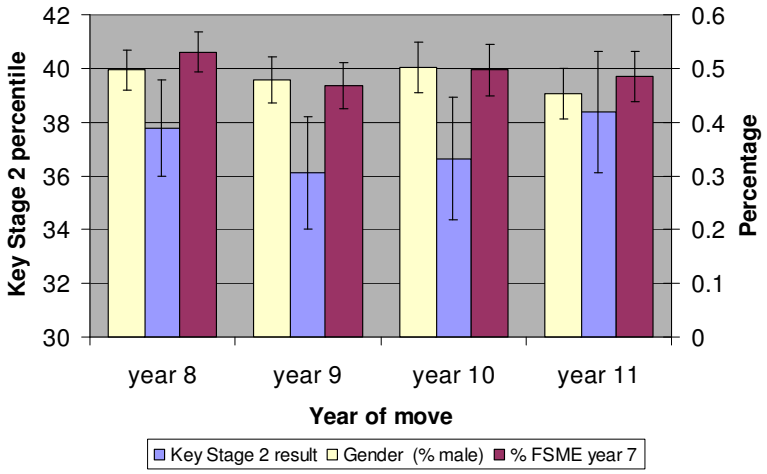


Figure 4: Change in neighbourhood quality for SH-movers

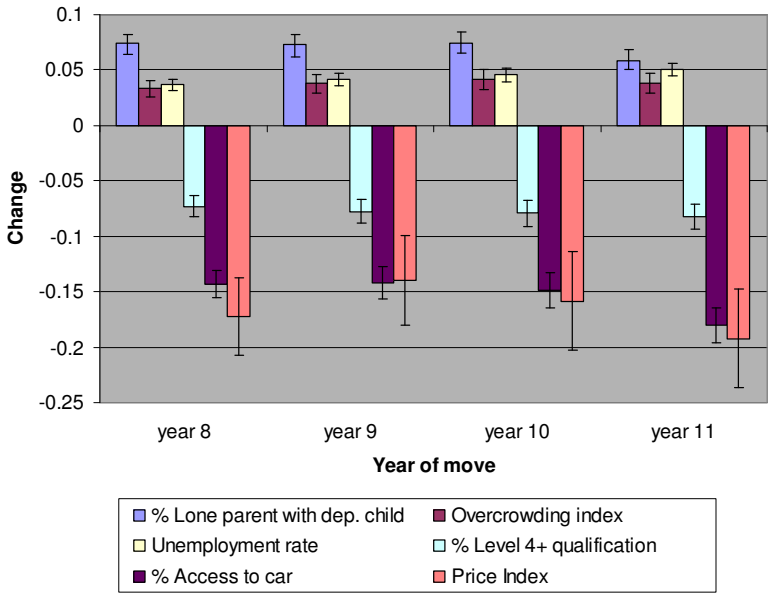
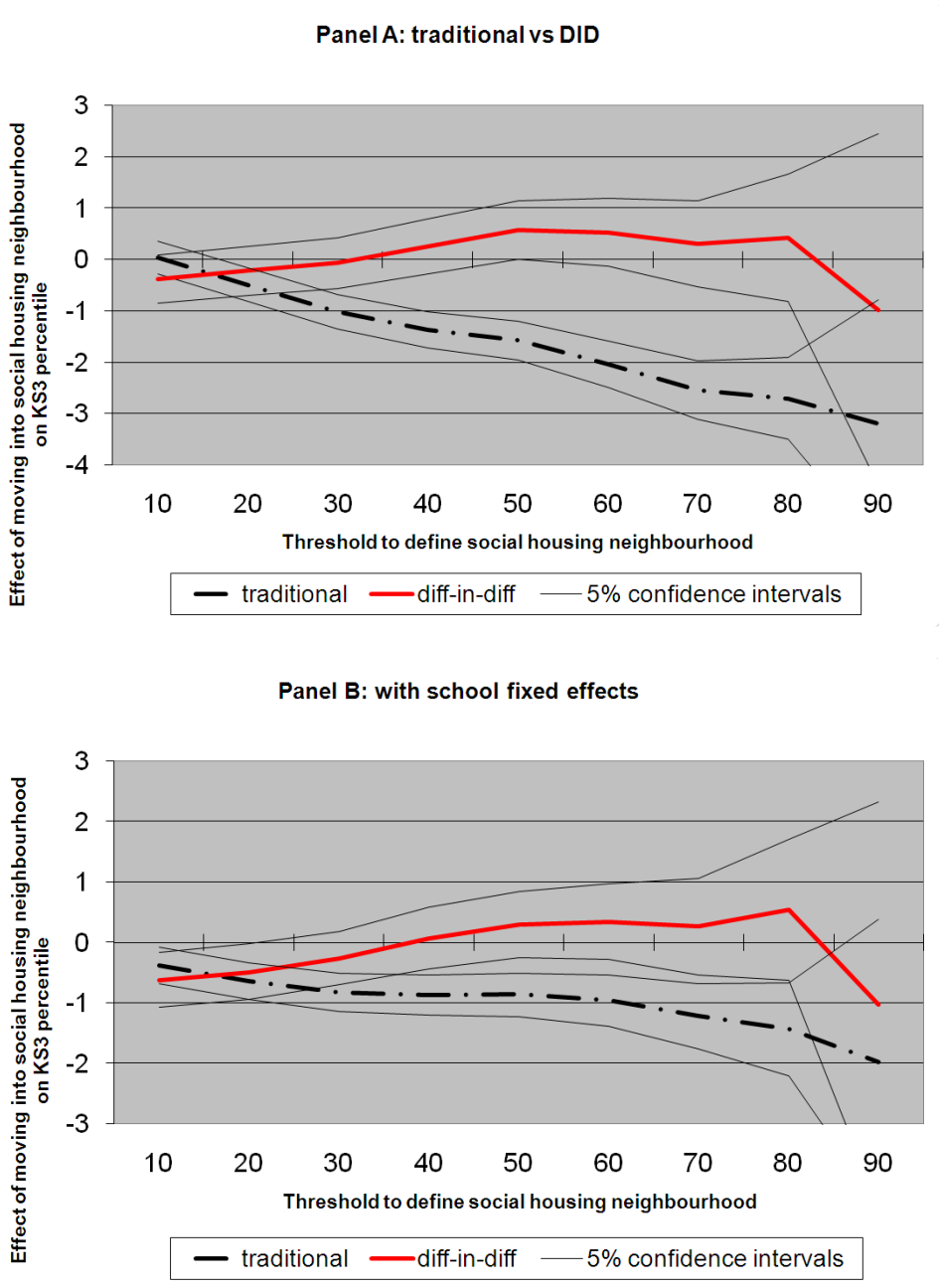


Figure 5: Changing the threshold definition of social housing neighbourhoods



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