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Changes in the relationship between social housing tenure and child outcomes over time: Comparing the Millennium and British Cohort Studies

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Abstract

This paper is the first to investigate how tenure inequalities in child outcomes have changed over time. I compare the differences in the cognitive, non-cognitive and health outcomes of children in social housing with children in non-social housing, and evaluate whether these tenure differences have changed between the 1970 BCS cohort and the 2000 MCS cohort. I find that in both cohorts, children in social housing exhibit worse outcomes across all three dimensions than children in non-social housing. For cognitive and health outcomes, however, the tenure difference has narrowed between the two cohorts, while for non-cognitive outcomes, the tenure difference has widened. These results suggest that children in social housing tenure have experienced both a relative improvement in their cognitive and health outcomes over time, and a relative worsening in their non-cognitive outcomes over time, compared with children in non-social housing.

JEL codes: I3
Keywords: Social Housing Tenure; Child Outcomes; Cohort Studies

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1 Introduction

The 2011 Census, published at the end of 2012, shows that almost a fifth of all households (4,100,000) reside in social housing across England and Wales, with London, and other large, metropolitan cities exhibiting the greatest concentrations of social rented accommodation. Al-though the proportion of people in social housing has remained fairly stable since the turn of the century the demand for social housing continues to grow. Local authority waiting lists for social housing have increased by 80% since 2001, from 1 million to over 1.8 million households by the end of 2012. With the protracted nature of the most recent recession, more stringent conditions associated with the welfare receipt[1], and the decline in the number of housing starts[2], the overdemand for social housing seems set to continue, and the role of social housing as the preserve of the most disadvantaged in society looks likely to intensify.

Perhaps unsurprisingly then, children in social housing tend to exhibit worse outcomes than children residing in either owner occupied or private rented accommodation. Work by Lupton et al. [16] shows that children in social housing, born in 2000, are likely to display poorer child wellbeing, namely, cognitive outcomes at age 5. This suggests the existence of 'tenure-inequality' with respect to child cognitive outcomes, and suggests potential tenure-inequalities in other dimensions of child development. From a policy perspective, a pertinent question relating to this evidence is how have tenure-inequalities in child development changed over time? Identifying changes in tenure-inequalities in child outcomes over time provides a measure by which to evaluate the effectiveness of the governmental approach over time, to reducing inequality of opportunity, and of life chances more broadly.

This paper looks at how the gap in child development between children in social housing and non-social housing has changed between the British Cohort Study, 1970 (BCS) and the Millennium Cohort Study, 2000 (MCS). Previous research closest to addressing this question informally compares the tenure gap over time in the adult outcomes of individuals who had resided in either social housing or non-social housing during childhood. Feinstein et al. [11] use the 1946, 1958 and 1970 UK cohort studies to calculate the odds ratios for indicators of disadvantage in adult-hood for those who experienced either social housing, private rental or neither of these forms of housing in childhood. Lupton et al. [15] perform OLS regression using the same UK cohort studies of social housing tenure in childhood on a broad range of adult health, qualification and employment outcomes. The results of both studies suggest that tenure-inequality in adult outcomes for children raised in social housing may have increased between 1946 and 1970, with greater odds ratios, and larger statistical associations, found for the 1970 cohort in the Feinstein

[1]As of April 1, 2013.
[2]Department for Communities and Local Government figures show housing starts by Housing Associations fell by 28% between mid-2011 and mid-2012.

et al and Lupton et al papers, respectively. However, neither paper can make this inference with certainty, as the cross-cohort difference in the gaps in the adult outcomes associated with tenure in childhood is not formally tested.

This paper provides three novel contributions to the literature addressing changing tenure-inequalities in outcomes. Firstly, I investigate the change in the tenure gap in child development over time, rather than adult outcomes associated with childhood tenure in social housing. Secondly, unlike previous research, I formally test the difference in the tenure gap over time to provide a statistically robust description of the change in tenure-inequality over time, with respect to the child outcome in question. Lastly, I consider three separate dimensions of child development. In addition to a child cognitive outcome similar to that used by Lupton et al, 2011, I look at child outcomes relating to non-cognitive development and health, and by carrying out symmetrical analysis across the child outcomes I can compare changes in the the tenure gap between child outcomes.

The returns over the life-cycle to early childhood skills has been widely established. Cognitive and non-cognitive skills in childhood have been shown to have important effects both on schooling attainment and decisions, and later labour market outcomes[3] and there is also strong evidence for the existence of complementarities between cognitive skills and non-cognitive traits[4]. Similarly, childhood health has been shown to be strongly associated with a wide range of adult outcomes, including educational attainment, income and labour market outcomes, health and socio-economic status[5]. No research to my knowledge has estimated the tenure gap in early child-hood non-cognitive traits or health outcomes. Given the lasting importance of all three child outcomes on life chances, and the existence of reinforcing associations between the outcomes, particularly for non-cognitive and cognitive outcomes, an understanding of how tenure-inequality with respect to these outcomes has changed over time may provide a valuable perspective on the wider challenge of mitigating social exclusion and improving intra- and inter-generational social mobility.

I do not attempt to identify a causal relationship between social housing tenure and child out-comes, however, I do investigate which characteristics help to explain the tenure gaps found in child outcomes. Broadly, there are three dimensions of social housing relative to non-social housing which may explain tenure gaps in child outcomes; compositional disadvantage, housing quality and neighbourhood/area quality. The first of these relates to the socio-economic and household characteristics of the social housing group relative to the non-social housing group.

[3]Heckman et al. [12], Carneiro et al. [4], Borghans et al. [2].
[4]Cunha et al. [8], Brunello and Schlotter [3], Carneiro et al. [4]. [5]Case et al. [6], Case and Paxson [5], Currie [9], Smith [19].

To the extent that social housing is a proxy for aspects of compositional disadvantage, tenure gaps in outcomes will be explained by measures of such disadvantage. To explore this, based on the literature I condition on a broad set of child, parent and family characteristics and examine whether they help explain the estimated tenure gap in the child outcomes. The second dimension, housing quality, may mediate the tenure gap in outcomes to the extent that housing quality varies across tenures in ways which are non-trivial in determining childhood development. Similarly, tenure gaps in outcomes may result from tenure differences in the quality of the neighbourhood or area which are relevant in the determination of child outcomes. However, I run the analysis on a pooled sample combining the BCS and MCS cohorts, meaning that any covariates included in one cohort must have a counterpart in the other cohort which has an equivalent interpretation. This does not present a problem for the set of composition covariates included which are well matched across cohorts, but general indicators of housing quality and local neighbourhood characteristics are not present in both cohorts. The only exception to this is a measure of over-crowding, which is available in both the BCS and MCS. In the appendix of the paper I present the main results with the inclusion of the overcrowding measure as a measure for housing quality.

It is important to note that conditioning on covariates is very much a secondary aspect of this paper. This is due to the fact that two distinct, but pooled, cohorts are being studied. Lupton et al, 2011, as aforementioned, perform a similar analysis on the Millennium Cohort Study only, and by including a diverse range of covariates their estimate of the remaining tenure effect can be interpreted as the association between social housing tenure and child cognitive outcomes which is not mediated by the included covariates. The remaining tenure effect cannot, as the authors make clear, be considered causal, due to the analysis being OLS and thus potentially suffering from endogeneity. However, in this paper, the analysis is, effectively, being conducted on both cohorts. Thus any differences in unobserved heterogeneity associated with the included covariates between the two cohorts, irrespective of an identical set of covariates being used across both cohorts, would render the interpretation of the cohort-specific tenure effects incompatible with each other[6].

2 **Methodology**

I estimate two parameters. The first is the association between social housing tenure at age 5, compared with all other forms of housing tenure[7], and child outcomes at age 5. I do not attempt to identify a causal impact of tenure on child outcomes but rather an association which, crucially, can be plausibly considered comparable across the two cohorts. The second parameter

[6]These methodological issues and the equivalence requirement mentioned in the preceding paragraph are discussed in more detail in sections 2.4 and 5.3.

[7]Private renting and owner occupied.

of interest, the key parameter of the paper, measures whether the association between social housing tenure and child outcomes has changed over time. I pool the BCS and MCS samples and formally test the statistical significance of this second parameter.

2.1 Social Housing and Child Outcomes

Consider the following linear regression model;

$$y_i = \beta_0 + \beta_1 SH_i + u_i, u_i \sim N(0, \delta^2); \quad (1)$$

where y_i is the child outcome and SH_i is an binary indicator for social housing tenure, equal to '1' if child *i* is observed in social housing, and '0' otherwise. This model could be estimated separately for the two sets of data;

$$MCS : y_i^M = \beta_0^M + \beta_1^M SH_i + u_i^M, u_i^M \sim N(0, \delta_M^2); \quad (2)$$

$$BCS : y_i^B = \beta_0^B + \beta_1^B SH_i + u_i^B, u_i^B \sim N(0, \delta_B^2); \quad (3)$$

where the superscripts *M* and *B* refer to the MCS and BCS cohorts, respectively[8]. Pooling the samples provides the following equation;

$$y_i = \beta_0^B + \beta_1 SH_i + (\beta_0^B - \beta_0^M) D_i^B + u_i, u_i \sim N(0, \delta^2); \quad (4)$$

where D^B is an indicator variable for observations from the BCS. Before estimating this I allow for the within-county correlation of errors by clustering at the county level. I estimate the fol-lowing equation using the pooled sample;

$$y_i = \beta_0^B + \beta_1 SH_i + (\beta_0^B - \beta_0^M) D_i^B + u_g, u_g \sim N(0, \delta^2); \quad (5)$$

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[8] It is possible to test whether $_1{}^B - {}_1{}^M = 0$ as each parameter has a distribution given by its standard error and the two samples are independent. One could t-test the difference, given by $({}^B - {}^M)/\sqrt{((se({}^B))^2 + (se({}^M))^2)}$ (Clogg et al. [7], Paternoster et al. [18]) which follows a z-distribution. However when I estimate equations (2) and (3) for the MCS and BCS, respectively, the residual variance, given by the RMSE, turns out to be the same. In this scenario, the standard errors from the pooled regression are more efficient.

[9] I end up with 44, fairly balanced clusters and assume no inter-group correlation of errors. Kezdi [14], shows that around 50 clusters with roughly equal sizes is usually close enough to infinity for accurate standard errors and inference.

where *g* represents the number of clusters, defined in the data as counties[9]. Equation (5) contains the first parameter of interest for my analysis, β_1, (P1) which represents the raw relationship between social housing tenure and the outcome of interest for the pooled sample, and an average effect of social housing across the two cohorts.

2.2 Social Housing Effects Over Time

To investigate how P1, i.e. the social housing tenure effect, differs between the BCS and MCS, the social housing indicator, SH_i, is interacted with the indicator for observations from the BCS, D^B;

$$y_i = \beta_0^B + \beta_1^M SH_i + (\beta_0^B - \beta_0^M)D_i^B + (\beta_1^B - \beta_1^M)D_i^B SH_i + u_g, u_g \sim N(0, \delta^2); \quad (6)$$

This provides the key parameter of the paper, $\beta_1{}^B - \beta_1{}^M$ (P2), representing the difference between the corresponding parameters in equations (3) and (2), i.e. the difference in the effect of social housing tenure on child outcomes between the two cohorts. Note also that $\beta_1{}^M$ in equation (6) is not equivalent to β_1 in equation (5). With the inclusion of the $D_i^B SH_i$ interaction, $\beta_1{}^M$ in equation (6) captures only the effect of social housing tenure within the MCS sample, and thus will be identical to that derived in equation (2).

2.3 Observed Heterogeneity

In a second specification I condition on observable heterogeneity in the estimation of both P1 and P2 by including a vector of covariates pertaining to child, parent and family characteristics, denoted C_i. Beginning with the P1 model and corresponding to equation (5), the inclusion of covariates gives;

$$y_i = \beta_0^M + \beta_1 SH_i + \beta_2 C_i + (\beta_0^B - \beta_0^M)D_i^B + u_g; \quad (7)$$

What remains of P1 (β_1) will represent a more reliable association between social housing tenure and child outcomes, and the extent to which, if any, P1 differs between equations (5) and (7) will be suggestive of the role of C_i in determining P1, that is, the extent to which the tenure effect on child outcomes is explained by the covariates included.

I condition on the identical set of covariates when estimating the key parameter, P2, by including the vector C_i in equation (6), giving;

$$y_i = \beta_0^M + \beta_1^M SH_i + \beta_2 C_i + (\beta_0^B - \beta_0^M)D_i^B + (\beta_1^B - \beta_1^M)D_i^B SH_i + u_g; \quad (8)$$

P2 ($\beta_1{}^B - \beta_1{}^M$) based on this equation will represent the difference in the tenure effect over the two cohorts which can not be attributed to differences in the covariates included.

Correspondingly, differences in P2 between equations (6) and (8) will be suggestive of a mediating role of C_i in determining how the tenure effect has changed between the two cohorts.

It is plausible that the child outcome returns to the composition covariates vary by cohort and/or tenure, and that this heterogeneity of impact may be important in estimating both P1 and particularly P2. One method of addressing this would be to model cohort- and tenure-specific effects of the covariates by including cohort- and tenure-covariate interactions, thereby allowing the covariate effects to vary by cohort and tenure, respectively. However this would not be appropriate here as by including tenure-covariate interactions there would no longer be a single social housing effect, as the social housing effect would be different for the sub-groups of the interaction. P1 and P2 thus would depend on which groups of the covariates were chosen as the reference cases which would merely constitute a reparameterisation. This implies that P1 and P2 would not be comparable in models with and without interactions. For this reason I do not explicitly model cohort- and tenure-specific effects of the covariates in the P1 and P2 models outlined above, but in Section 5.2 I investigate whether there is heterogeneity in the effects of the composition covariates by cohort and tenure, and the extent to which this helps determine P2.

2.4 Unobserved Heterogeneity

In the absence of unobserved heterogeneity, equation (8) allows the interpretation of P2 as the change in the tenure effect between the two cohorts which is not attributable to changes in the included covariates. This interpretation is not necessarily valid, however, in the presence of unobserved heterogeneity. In addition, further restrictions have been placed on the choice of covariates used in this paper by the pooled nature of the data. Pooling the MCS and BCS data and estimating a tenure effect on child outcomes requires outcome and control variables in the two cohorts to be directly equivalent. I.e. the child outcome measures, the social housing indicator and the covariates are defined within each cohort in such a way that they are directly comparable across cohorts. This equivalency requirement means that if there are covariates present in one cohort and not the other (or if covariates can not be proxied in a satisfactorily comparable way across cohorts), those covariates cannot be included in this analysis. Characteristics pertaining to local neighbourhood effects and housing quality for example, which have been used previously in the literature as covariates and/or variables with potential explanatory power[10] are omitted from my analysis for these reasons[11].

[10] Lupton et al. [16].

[11] With the exception of overcrowding which is available in both cohorts, and which I use as a proxy for housing quality, the results of which are in the Appendix.

However the presence of unobserved heterogeneity is not necessarily problematic for the interpretation of the estimated change in the tenure effect over time (P2). Any omitted variables characterising the unobserved heterogeneity will render the P2 estimate and subsequent inferences inappropriate if; (i) they are correlated with social housing tenure and the child outcome for at least one of the two cohorts, conditional on the covariates and (ii) this correlation is time-variant. If condition (i) is not met, and the omitted variables are not correlated with tenure and child outcomes in either the MCS or BCS, they can not possibly be associated with the tenure effect for either cohort, leaving P2 unchanged. If condition (ii) is not met and the omitted variables are correlated with tenure and child outcomes, conditional on the covariates, but the correlation is equivalent in both cohorts, P1 would be affected, but equally so for both the MCS and BCS leaving P2 again unchanged. I explore the extent to which unobserved heterogeneity presents issues in the interpretation of the results in section 5.3.

3 **Data**

The data used for this analysis are the Millennium Cohort Study (MCS) and the British Cohort Study (BCS). The MCS tracks the development of 19,000 children born in the UK in 2000 and 2001. Interviews were conducted when the child was 9 months, and then at 3, 5, 7 and 11 years old. The MCS is a rich, nationally representative data set. Information collected includes child behaviour and development, child and parent health, parents' employment and education, income and poverty, housing and neighbourhood. The BCS is the precursor to the MCS and provides a very similar range of information, but is less exhaustive in some areas. The BCS had an initial birth sample of 17,000 children born in the UK all within a single week in 1970. The initial sweep was taken when the child was born, followed by interviews at 5, 10, 16, 26, 30, 34 and 42 years.

3.1 Outcome Measures

For the child outcomes I use measures of three areas of child development, observed at child age 5; Cognitive, Non-cognitive and Health. The cognitive measure used from the MCS is the pattern construction test. Here the children are asked to copy and construct two- and three-dimensional objects with coloured tiles and cubes. The BCS equivalent of this test comes in the form of a copy-design test, where children were asked to copy and draw two-dimensional objects on paper. These tests have been shown to be associated with later child cognitive and educational performance as well as adult outcomes such as wages[12]. The MCS and BCS test scores are standardised within cohort, before being pooled.

[12]Feinstein and Duckworth [10]

The non-cognitive measure for both the MCS and BCS is the Rutter Behaviour Scale at age 5, an established metric to measure signs of behavioural difficulties in children. The full Rutter scale consists of 26 questions. While the questions in the MCS are not identical to those in the BCS, many of the same behavioural traits are addressed by the Rutter questions in both the MCS and BCS. I utilise those traits which are equivalently represented in the MCS and BCS Rutter questions to create the non-cognitive outcome used in the analysis. Rutter questions per-taining to the following behavioural traits are used; “Restless/Overactive”, “Fidgety/Squirmy”, “Fights”, “Bullied”, “Worrisome”, “Solitary”, “Frustrated”, “Unhappy/Tearful”, “Steals”, “Nervous/Clingy”, “Disobedient”, “Fearful”, “Lies”. Each of the questions is answered by the parent with one of “not true”, “somewhat true” or “certainly true”. I constructed a raw score from these responses and as with the cognitive measure, standardise the scores within cohort.

Finally, I construct an equivalent health measure for the MCS and BCS. I use information on hospital admissions since the birth of the child to create a binary outcome variable equal to ‘1’ if the child had ever been admitted to hospital and ‘0’ if not. This is a crude health measure, and invariably will not capture variation in all dimensions of child health, but it is the most appropriate measure available in both cohorts.

The Outcomes panel of Table 1 shows the summary of the raw (non-standardised) non-cognitive, cognitive and health outcome measures by cohort (MCS and BCS) and tenure (Social Housing and Non-Social Housing). The Difference column provides the within cohort mean difference between the two groups, non-social housing minus social housing, in each of the three outcomes with the significance level corresponding to the result of a t-test on the equality of means. Within each cohort, the non-cognitive, cognitive and health outcomes, as defined, of children in social housing are statistically significantly worse on average than their non-social housing counterparts.

3.2 Housing Tenure

The constructed social housing indicator variable is binary, based on a housing tenure question at child age 5. In the MCS, the variable is equal to ‘1’ if the mother responded with either “rent from local authority” or “rent from housing authority”, and ‘0’ if the response is “own outright/mortgage” or “rent privately”. Housing associations are registered social landlords performing an identical task to local authorities in owning and providing social housing on a non-profit basis. The BCS birth cohort and the child outcomes used for the analysis predate the formation of housing associations[13] and thus the corresponding social housing indicator takes the value of ‘1’ if the mother responded “rented from council”, and ‘0’ if the response is “own outright/being bought” or “rent privately”. Based on this indicator, it can be seen that the proportion of children in social housing has reduced from 34% in the BCS to 24% in the MCS.

[13]Housing associations were formed in 1988.

3.3 Covariates

To investigate the role of the composition of families in social housing in my analysis, I use a broad set of socio-economic, parent, family and child controls, defined to be equivalent between the MCS and BCS. I employ the following measures; whether the mother has qualifications[14], whether the child has no siblings, whether the child has 3 or more siblings, whether the mother was younger than 24 at first birth, whether the mother was older than 34 at first birth, whether the mother is a lone parent, whether the child is non-white and whether the child is a girl. I also condition on family income. The measures for family income in the MCS and BCS are not compatible in their raw form. The MCS provides a continuous family income measure while the BCS provides bands of income ranges. I construct equivalent bands of income for the MCS sample, where the cut-off values for each group are based on the proportion of individuals in each corresponding group in the BCS categorical income measure. Thus the categorical income measure for the MCS has cut-off values which are nominally unimportant, but the manner in which they distribute the MCS sample is identical to the BCS[15].

The Covariates panel in Table 1 provides a comparison of the socio-economic, parent, family and child characteristics across tenures and cohorts. Again, the Difference column presents a t-test on the equality of the means of the two housing groups. Compared with mothers not in social housing, it can be seen that the mothers in social housing across both cohorts were more likely to be less educated, have three or more siblings, be young, a lone parent and have lower income. However, MCS mothers in social housing were slightly more likely to have no siblings and to be non-white compared with the non-social housing mothers in the MCS, whereas the reverse is true for the BCS. Similarly, MCS mothers in social housing were less likely to be above the age of 34 at the birth of their first child than non-social housing mothers in the MCS, which is again the reverse of the BCS. All within cohort differences between the social housing and non-social housing are statistically significant. Important also for the analysis in this paper are the the direct differences between the two groups of social housing mothers. MCS mothers in social housing were over three times more likely to have attained qualifications than the BCS mothers in social housing. MCS cohort children were more likely to have no siblings and less likely to have 3 or more siblings. A half of social housing mothers in the MCS were lone parents compared with a fifth in the BCS. Social housing mothers in the MCS were also much less likely to be older mothers, and much more likely to be non-white. As will become clear, these changes in the characteristics of social renters, relative to non-social renters, between the BCS and MCS are significant in understanding changes in the tenure gap over time.

[14] I also conduct the analysis using a more detailed measure of mothers qualifications, indicating one of four levels of qualification ranging from no qualifications to degree. The results were substantively identical to those when using the binary measure for mothers qualifications, thus I report results based on the binary measure.

[15] For robustness I create an alternative income measure for the pooled sample by standardising the respective income measures for the banded BCS and continuous MCS, within cohort, before combining them in the pooled data. The results of the analysis are unaffected and thus I report the results based on the banded income measure.

3.3.1 Missing Information

From Table 1 it is clear that there is missing covariate information within the sample. Missing observations are replaced with the sample means of the covariate and missing dummy indicators are included. However it is important to note that the relative distribution of missing covariate information across tenures will not be identical across cohorts. Thus the extent to which tenure differences in missing information account for the tenure effect will potentially vary across cohorts, and correspondingly, this variation across cohorts may help to explain any changes in the tenure effects in the child outcomes over time. This is explored in greater detail in section 5.2.

3.4 Sample

Of the 18,435 cohort members in the BCS with non-missing housing tenure information, 12,302, 12,329, and 12,432 have non-missing information for their non-cognitive, cognitive and health outcomes, respectively. Similarly, of the 19,360 cohort members in the MCS with non-missing housing tenure information, 14,435, 14,628, and 14,940 have non-missing information for their non-cognitive, cognitive and health outcomes, respectively. Thus, there are 26,737, 26,957 and 27,372 cohort members, respectively, in the estimation sample for the non-cognitive, cognitive, and health outcomes in the pooled MCS and BCS data.

4 **Results**

The non-cognitive and cognitive measures are standardised, meaning the coefficients from the OLS regressions for these two outcomes represent standard deviations. The health measure is a binary indicator and so I present Probit regression results, providing marginal effects of each variable included in the model. It is important to note that the non-cognitive and cognitive outcome measures are increasing in performance, i.e. a higher score in either of the two outcomes represents better performance in that dimension. In contrast, the binary health measure, defined as an indicator for hospital admission, is increasing in poor health, i.e. a '1' represents relatively poor health and a '0' relatively good health. I first examine the relationship between social housing tenure and child outcomes (P1) as an average effect across cohorts, and then the change in the relationship between the two cohorts (P2).

4.1 Social Housing and Child Outcomes (P1)

Table 2 presents two specifications for the P1 model for each child outcome, Raw and Cov, corresponding to equations (5) and (7), respectively, with the latter specification introducing the

composition covariates. Beginning with the Raw specification, it can be seen that for both non-cognitive and cognitive outcomes, social housing tenure is associated with a penalty of just over 0.4 standard deviations. For the health outcome, children in social housing are approximately 4% more likely to have been admitted into hospital by the age of 5 than those in either private-rented or owned places of residence. The Cov specification introduces the socio-economic, family, parental and child covariates, denoted as Composition in the Controls panel at the bottom of the table. This reduces the association between social housing tenure and non-cognitive, cognitive and health outcomes, by 44%, 43% and 44%, respectively, suggesting that almost half of the association observed between social housing tenure and the child outcomes in question is explained by observable tenure-differences in these composition characteristics.

4.2 Social Housing Over Time (P2)

The P2 model captures the change in the effect of social housing tenure on child outcomes be-tween the two cohorts where P2 is the coefficient on 'Social Housing*BCS', i.e. the interaction between the social housing tenure indicator and the indicator for the observation being drawn from the BCS. Again two specifications are estimated, Raw and Cov, corresponding to equations

(6) and (8), respectively. For clarity, note that P2 represents the difference in the tenure effect, P1, between the BCS and MCS, defined as ($\beta_1^B - \beta_1^M$). Given that P1 is negative for both non-cognitive and cognitive outcomes, a positive P2 represents a relative worsening in the outcome between the two cohorts, while a negative P2 suggests an improvement. For the health outcome, which is equal to '1' if the child has been admitted to hospital in their lifetime, a positive P2 coefficient for the health outcome implies a relative improvement in the health outcome for those in social housing, while a negative P2 implies a relative worsening.

Beginning with non-cognitive outcomes, the Raw specification for the P2 model gives rise to a highly statistically significant P2 coefficient of approximately 0.16 s.d, implying that the tenure gap in the BCS is smaller than in the MCS. This suggests that relative to children in non-social housing, children in social housing performed better in non-cognitive tests in the BCS than in the MCS. That is, children in social housing have experienced a worsening in their non-cognitive development between the BCS and MCS, relative to children not in social housing. In contrast, the P2 coefficient in the Raw specification for cognitive outcomes is approximately -0.08 s.d implying that the relative cognitive outcomes of children in social housing have improved between the BCS and MCS. Similarly, the relative health of children in social housing has also improved over time with a Raw specification P2 coefficient of approximately 0.03, suggesting that both cohorts exhibit higher rates of hospital admittance for children in social housing compared with children not in social housing, but this differential has reduced by almost 3% between the two cohorts.

For non-cognitive outcomes, the very small and statically insignificant P2 coefficient in the Cov specification shows that the inclusion of the composition characteristics eliminates the difference in the social housing effect between the BCS and MCS. This result suggests that the worsening of the relative non-cognitive outcomes of children in social housing between the BCS and MCS is largely explained by changes in the composition of families in social housing between the the two cohorts, relative to families in non-social housing. For the cognitive outcome P2 increases from -0.8 to -0.14, implying a greater relative improvement between the two cohorts when the composition variables are conditioned on. This implies that the gap in cognitive outcomes has narrowed, as shown in the Raw specification, despite changes in the relative composition of families in social housing, such that when these changes in composition are accounted for, the relative improvement in cognitive outcomes is larger, as shown in the Cov specification. For health outcomes the P2 coefficient increases to over 4% in the Cov specification from just under 3% suggesting that after controlling for their characteristics, families in social housing in the MCS are even less likely to have admitted the cohort member into hospital by the age of 5 compared with the BCS, again suggesting that the relative improvement in health outcomes has occurred despite the changes in the relative composition of families in social housing.

5 **Discussion**

5.1 Key Findings: Changes in Social Housing Tenure Effect Over Time and Differences Across Outcomes

Children at age 5 in social housing exhibit worse non-cognitive and cognitive development than children living in either private rented or owned housing, by approximately 0.43 and 0.42 standard deviations, respectively. In the BCS and MCS respectively, the mean (standard deviation) of the raw non-cognitive scores are approximately 41.53 (4.18) and 37.54 (3.54). Thus a non-cognitive cost of 0.43 standard deviations associated with social housing tenure equates to approximately 4.3% and 4.1% of the non-cognitive average scores in the BCS and MCS, respectively. Similarly, the mean and standard deviation of the raw cognitive scores are approximately 4.73 (1.98) and 50.33 (9.71) in the BCS and MCS respectively. A cognitive cost of 0.42 standard deviations equates to approximately 17.5% and 8.1% of the cognitive average scores in the BCS and MCS, respectively. Although the 17.5% figure is somewhat inflated by the smaller integer range and thus relatively large standard deviation of the cognitive outcome variable in the BCS, the MCS figure of 8.1% nevertheless suggests that the the tenure effect has a greater impact on raw cognitive scores than non-cognitive scores. The P1 coefficient for the health outcome suggests that children in social housing are also approximately 4% more likely to have been admitted to hospital than children not in social housing. Given 25.5% and 12.7% of children on average were admitted to hospital before the age of 5 in the BCS and MCS respectively, this represents 15.6%and 31.4% of the likelihood of being admitted to hospital.

Lupton et al. [16], represents the only other study in the literature which estimates the association between social housing tenure in childhood and child outcomes[16]. Lupton et al show that although children in both social and private rented housing perform worse in cognitive tests than children in owner occupied housing, the association is stronger for those in social housing. They find a raw social housing tenure effect of approximately 4.2 points, compared with children in owner occupied housing. Given the mean pattern construction score for the sample was 50.6 points, this effect represents 8.3% of the mean. This is very similar to the 8.1% found in this paper for cognitive scores in the MCS.

The new findings here are the differences in the social housing tenure effect between the two cohorts, and how these differ across child outcomes. For cognitive and health outcomes, the tenure effect has narrowed. That is, relative to their counterparts in private rented and owner occupied housing, children born in social housing in 2000 have better cognitive and health out-comes at age 5 than those born in 1970. The 0.076 standard deviation reduction in the tenure effect between the two cohorts for cognitive outcomes corresponds to approximately a 17% reduction based on the tenure effect in the BCS. In contrast, the raw gap in non-cognitive outcomes between children in social housing and those in private rented or owner occupied housing has widened between the two cohorts, with the 0.16 standard deviation widening of the gap corresponding to a 45% increase in the tenure effect over time. In other words, tenure-inequality with respect to cognitive and health outcomes has reduced while tenure-inequality with respect to non-cognitive outcomes has increased, over the same time period.

5.2 What Drives the Change in the Tenure Effect Over Time

The introduction of the socio-economic, family, parental and child characteristics affect the estimates of the change in the tenure effect between the two cohorts for all three outcomes. The results suggest that children in social housing in the MCS belong to families, which by the indicators used in this paper, experience greater levels of disadvantage with respect to the three child outcomes. When this increase in the relative disadvantage of families in social housing between

[16]There are a number of differences in the identification methods between the two studies, however, which complicate direct comparisons in the estimated tenure effects. Firstly, the Lupton et al study explores tenure effects on cognitive outcomes in the MCS only. Non-cognitive and health outcomes are not considered. Secondly, Lupton et al distinguish between private rented and owner occupied housing. The tenure variable in this paper is binary, where those in private rented and owner occupied housing are grouped together. It is worth noting, however, that within the MCS sample used in this paper, only 9% of the cohort members were in private rented housing, compared with 66% in owner occupied housing (which is almost identical to the Lupton et al working sample using the MCS). Thus the extent to which combining the private rented and owner occupied housing will impact the social housing tenure effect will be relatively small.

the two cohorts is controlled for, the relative worsening of the non-cognitive outcomes of children in social housing between the two cohorts is eliminated. For the cognitive and health outcomes, accounting for the increase between the two cohorts in the relative disadvantage of families in social housing acts to increase the relative improvement in the cognitive and health outcomes of children in social housing.

Changes in the relative composition of families in social housing between the two cohorts can be characterised as changes in the distribution of, and/or the returns associated with, the com-position covariates, across tenure and cohort. Thus, to explore the role of these composition covariates in the estimate of the change in the tenure effect between the two cohorts, I con-sider the comparative influence of changes in the relative tenure distribution of the composition covariates between the two cohorts and changes in the relative tenure returns associated with the composition covariates. I utilise a three-fold Blinder-Oaxaca decomposition[17], which divides the mean difference in the child outcome into an "endowments" effect and a "coefficient" effect corresponding to the distribution and returns, respectively, associated with those composition covariates, as well as an "interaction" effect describing the additional influence of the combination of the endowment and coefficient effects.

The mean (raw) difference in the child outcome (*Y*) between the non-social housing group (*N*) and the social housing group (*S*) is given by;

$$R = E(Y_N) - E(Y_S); \tag{9}$$

where *E*(*Y*) respresents the expected value of the child outcome in question. Based on the following linear model;

$$Y_h = X_h' \beta_h + u_h; \tag{10}$$

where *X* is the vector of composition covariates and $h \in (N; S)$, the mean difference in the child outcome can be characterised as the difference in the linear prediction of the covariates at their respective tenure-specific means. Assuming $E(u_h) = 0$, this is given by;

[17]Blinder [1] Oaxaca [17]. The following description of the methodology based on Jann [13].

$$R = E(Y_N) - E(Y_S) = E(X_N)'\beta_N - E(X_S)'\beta_S; \quad (11)$$

This can be rearranged to give the following;

$$R = [E(X_N) - E(X_S)]'\beta_S + E(X_S)'(\beta_N - \beta_S) + [E(X_N) - E(X_S)]'(\beta_N - \beta_S); \quad (12)$$

This decomposition of the raw tenure difference in the child outcome is divided into three com-ponents;

$$R = E + C + I; \quad (13)$$

The first component, $E = [E(X_N) - E(X_S)]' \beta_S$, represents the "endowment effect". This rep-resents the part of the mean difference attributable to differences in the covariates between the two tenures from the perspective of those in social housing. The endowment component estimates the expected change in the mean child outcome for those in social housing, if they had the covariate levels of those in non-social housing, $[E(X_N) - E(X_S)]'$, but retained the social housing group coefficients associated with those covariates, β_S. Indicators for missing covariate information are included in the set of covariates, capturing the effect of tenure differences in the distribution of missing covariate information, given non-missing outcome information, on the tenure gap. The second component, $C = E(X_S)' (\beta_N - \beta_S)$, is the "coefficient effect", measuring the influence of differences in the coefficients, or returns, associated with the covariates. This is similarly interpreted as measuring the expected change in the mean child outcome for those in social housing if they experienced the coefficients on the covariates experienced by the non-social housing group, $(\beta_N - \beta_S)$, but retained the social housing group level of endowments, $E(X_S)'$. Again, indicators for missing covariate information are included in the covariates, this time capturing the effect of tenure differences in the coefficients associated with the indicators of missing covariate information, given non-missing outcome information, on the tenure gap. It is important to note that either housing group, N or S, could exhibit 'better' coefficients for the given set of covariates in two ways; by exhibiting larger coefficients, or greater returns, to endowments which are positively associated with the child outcome, and/or by exhibiting smaller coefficients, or lower returns, to endowments which are negatively associated with the child outcome. The coefficient component also includes the contribution of tenure differences in the intercept between the two housing groups. The final component, $I = [E(X_N) - E(X_S)]' (\beta_N - \beta_S)$, represents the "interaction effect", which accounts for the contribution of simulataneous differences in both endowments and coefficients between the two groups.

I decompose the child outcome gap for each cohort, such that;

$$R^c = E^c + C^c + I^c; \quad (14)$$

where $c \in (B; M)$, with B and M indicating the BCS and MCS cohorts, respectively.

Subtracting the BCS decomposition from the MCS decomposition and rearranging decomposes the change in the tenure gap between the two cohorts attributable to differences in the relative endowment, coefficient and interaction effects between the two cohorts, such that;

$$R^M - R^B = (E^M - E^B) + (C^M - C^B) + (I^M - I^B) \quad (15)$$

($R^M - R^B$) can be considered the cohort differential in the social housing tenure gap, identical the Raw specification estimate of P2 in Table 2. ($E^M - E^B$), ($C^M - C^B$) and ($I^M - I^B$) rep-resent the contribution of the cohort differentials in the endowment, coefficient and interaction components, respectively, to the cohort differential in the overall social housing tenure gap in the child outcome.

Tables 3 and 4 present the three-fold decomposition, separately for each cohort, of the mean differential in non-cognitive and cognitive outcomes, respectively, between children in social housing and non-social housing. For each table, the top row of the first two columns under Cohort provides the raw social housing tenure gap in outcomes for MCS and BCS. The Difference column presents the cohort differential in the raw tenure gap, equivalent to the Raw specification estimates of P2 in Table 2. For each of the cohort columns the main social housing effect is decomposed into the three components, endowments, coefficients and interaction, as described by equation (13), such that the contributions of the three components, given by their respective Total rows, sum to the total social housing tenure effect. Each of the three decomposition components is disaggregated further to separately capture the role of the composition covariates and missing information on those covariates, while the coefficients component, as aforementioned, also includes the contribution of differences in the constant between the two housing groups. Change in the endowments, coefficients and interaction contributions between cohorts is captured by the final Difference column (MCS - BCS) which provides the cohort differentials for each of the three components of the decomposition. As in equation (15) the cohort differentials for the three components of the decomposition sum to the cohort differential in the social housing effect.

Beginning with non-cognitive outcomes in Table 3, the cohort differential in the social housing tenure effect for non-cognitive outcomes, presented in the Difference column, is 0.162 s.d (corresponding to the Raw specification P2 estimate for the non-cognitive outcome in Table 2). Comparing the total endowment contribution in the MCS and BCS, it can be seen that children in social housing in the MCS experience a greater total increase in their non-cognitive outcomes with the endowments of their non-social housing counterparts (0.271 s.d), than would children in social housing in the BCS (0.123 s.d). This cohort differential in the endowment component is captured by the 0.148 difference in the final column, which represents a statistically significant increase in the total endowments effect from the BCS to the MCS. However, this increase in the total endowment effect between the two cohorts is almost entirely driven by an increase in the missing covariate information effect (Missing row) rather than the non-missing covariate effect (Covariates row). With respect to the latter, providing children in social housing with the expected covariate levels of those in non-social housing increases the expected non-cognitive outcomes by roughly the same in both cohorts, 0.139 s.d and 0.133 s.d in the MCS and BCS respectively. However, whereas the composition of missing information on the covariates is com-parable across tenures in the BCS (-0.009 s.d), in the MCS, giving the social housing group the ‘endowment’, or distribution, of missing covariate information of the non-social housing group increases the expected non-cognitive outcome by 0.133 s.d. This is reflected in the final column, which shows that between

the two cohorts, the cohort differential in the endowment effect with respect to the covariates is negligible, 0.006 s.d and statistically insignificant, while the cohort differential in the endowment effect with respect to the distribution of missing information is positive, 0.142 s.d and statistically significant. From Table 1 it can be derived that for both the MCS and BCS, the social housing group exhibit more missing covariate information, for each of the covariates, than the non-social housing group. Thus, the decomposition estimates suggest that in the BCS, missing information on at least some of the covariates is not negatively associated with outcomes, i.e. those children with missing covariate data do not exhibit poorer non-cognitive outcomes. However in the MCS missing covariate information is negatively associated with outcomes, such that providing the social housing group with the smaller endowment of missing covariate information of the non-social housing group, improves the expected non-cognitive outcomes of those in social housing.

The difference in the total endowment effect between cohorts suggests that the MCS children in social housing experience greater levels of non-cognitive 'endowment' disadvantage relative to their non-social housing counterparts, but that this is characterised not by less favourable levels of the covariates, but rather less favourable levels of the latent characteristics which are both positively associated with the likelihood of providing missing covariate information and negatively associated with non-cognitive outcomes. This greater level of relative endowment disadvantage, however, is counteracted by the cohort differential in the coefficent effect, -0.054 s.d, which is entirely driven by the cohort differential in the covariates coefficient effect between the two cohorts. Although insignificant, in the MCS the expected non-cognitive outcomes of children in social housing, with the covariate coefficients of the non-social housing group, decrease, by -0.137 s.d, implying that the social housing group experience 'better' returns to the composition covariates such that were they to exhibit the returns experienced by the non-social housing group, the expected non-cognitive outcomes would be worse. Again, it is worth noting that better coefficients could imply greater returns to endowments which are positively associated with the child outcome and/or lower returns to endowments which are negatively associated with the child outcome[18]. The coefficient effect with respect to the covariates in the BCS, however, is positive, albeit small and also insignificant. Consequently, the cohort differential in the coefficient effect with respect to the covariates, at -0.20 s.d and statistically significant, acts to widen the relative non-cognitive tenure gap between the two cohorts. This suggests that although the social housing children in the MCS experience greater levels of non-cognitive endowment inequalities, they in fact enjoy more favourable returns to those endowments compared with their non-social housing counterparts, relative to the BCS. This is plausible insofar as one might expect greater positive returns to more scarce endowments.

[18]I explore specific covariate coefficient effects for both the non-cognitive and cognitive outcomes in Section 5.3

However this large improvement in the covariate coefficients of the social housing group relative to the non-social housing group is tempered by the relative increase in both the Constant and Missing components of the coefficients effect. Providing the social housing group with the intercept, conditional on the covariates, of the non-social housing group increases the non-cognitive outcomes of children in social housing in the MCS to a greater extent than for the BCS, 0.300 s.d compared with 0.207 s.d. This implies that, with respect to non-cognitive outcomes, there is greater unobserved heterogeneity in the MCS between the two tenures than in the BCS. Providing the BCS social housing group with the missing covariate coefficients of the non-social housing group has no impact on the expected non-cognitive outcomes, again confirming that in the BCS, the children and families in the social housing and non-social housing groups with missing covariate information are broadly similar in their outcomes and latent characteristics composition. This is not true for the MCS, where the social housing group exhibit better out-comes with the missing covariate coefficients of the non-social housing group, with the subsequent cohort difference in the missing coefficient effect equal to 0.052 s.d. The cohort differential in the interaction coefficient is insignificant implying that cohort differences in the interaction of the endowment and coefficient effects do not significantly contribute to the cohort differential in the non-cognitive tenure gap.

From Table 4, the cohort differential in the social housing tenure effect for cognitive outcomes is -0.076 (corresponding to the Raw specification P2 estimate for the cognitive outcome in Table 2). The decompositions of the tenure gaps in the cognitive outcomes in both the BCS and MCS suggest that changes in the endowment and coefficient effects between the two cohorts contribute to the change in the tenure effect between the two cohorts in a very different way to that observed for non-cognitive outcomes. The change in the total endowment effect between the two cohorts is negative and significant at -0.052 s.d, compared with 0.148 s.d found for non-cognitive outcomes in Table 3. This total endowments effect is driven by the cohort differential in the contribution of the covariates component of the endowment effect, equal to -0.119 s.d. suggesting that children in social housing in the MCS, with respect to their cognitive outcomes rather than non-cognitive outcomes, exhibit greater endowments, and lower levels of covariate disadvantage, than their BCS counterparts. The cohort differential in the missing endowment contribution is positive and significant, although smaller than was the case for non-cognitive outcomes, at 0.066, and tempers the overall reduction in the total endowment contribution.

The contribution of the coefficient effect with respect to the covariates is also very different for the cohort differential in the cognitive tenure gap with that observed for the non-cognitive gap. Providing the social housing group in the MCS with the cognitive returns to the covariates experienced by the non-social housing group raises the expected cognitive outcomes for the social housing group by 0.171 s.d although the increase is not significant.

The difference between the MCS and BCS in the coefficient effects with respect to the covariates, however, is positive and significant, at 0.184 s.d. The overall difference in the total coefficients effect between the two cohorts is, however, negative and significant, at -0.111 s.d, and this is due to the large cohort differential in the intercept. For the MCS, in contrast to non-cognitive outcomes, providing the social housing group with the intercept of the non-social housing group from the cognitive out-come regression has no impact on the cognitive outcomes of children in social housing. However doing so in the BCS would increase the cognitive outcomes of social housing children by 0.252 s.d. This implies that, with respect to cognitive outcomes, unobserved heterogeneity between the social housing and non-social housing groups is present and significant in the BCS sample but is much less of a factor in the MCS. In other words, the composition covariates better capture the variance in cognitive outcomes in the MCS, and this cohort differential of -0.237 s.d acts to help explain the narrowing of the cognitive tenure gap between the cohorts. This is in stark contrast to that found for non-cognitive outcomes.

In summary, for non-cognitive outcomes, comparing the decompositions for the MCS and BCS suggests an increase in the relative endowment disadvantage, but a decrease in the relative co-efficient disadvantage. In contrast, for cognitive outcomes there appears to be a decrease in the relative endowment disadvantage and an increase in the relative covariate coefficent disadvantage (despite the total coefficient effect being negative due to the cohort differential in the role of the intercept). Further, the contrast in the total endowment effect and covariate coefficient effect between cognitive and non-cognitive outcomes is stark. The covariate endowment effect for the BCS is slightly larger for cognitive outcomes than for non-cognitive outcomes while the reverse is true for the MCS. Given that the within cohort covariate distribution by tenure, is almost identical across outcomes due to the working samples within each cohort being almost identical for both cognitive and non-cognitive outcomes, this reversal over time of the relative contribution of endowments for non-cognitive and cognitive outcomes must be almost entirely due the changes in the non-cognitive and cognitive returns to the covariates between the two cohorts. Thus, effectively the same set of endowments of those in non-social housing in the MCS would provide a cognitive return equal to approximately half of the corresponding non-cognitive return.

In addition to the cognitive and non-cognitive returns to the covariates diverging over time, from a comparison of the non-cognitive and cognitive covariate coefficient effects in the MCS, it is clear that this divergence over time has (i) varied by tenure, and (ii) the variation by tenure has been in opposite directions for the two outcomes. In the BCS, the covariate coefficient effects are small for both cognitive and non-cognitive outcomes. In contrast in the MCS the non-cognitive returns to the covariates are in fact higher for those in social housing, giving rise to the negative covariate coefficient effect, while the cognitive returns to the covariates are lower for those in social housing, giving rise to the positive covariate coefficient effect.

5.3 Unobserved Heterogeneity

As stated in section 2.4, the interpretation of the Raw specification P2 is the change over time in the mean difference in the child outcome between the social housing and non-social housing groups. This interpretation is robust to any form of unobserved heterogeneity. The P2 estimates in Table 2 and the Blinder-Oaxaca decomposition indicate that the role of the composition covariates, however, has changed between the two cohorts and also, crucially, between tenures in the following two dimensions;

1. The distribution of endowments (composition covariates); and

2. The 'returns' to the endowments.

This in turn suggests that indeed, the within-cohort differences in unobserved heterogeneity across tenures, is not constant across cohorts, which is supported by the evidence from the Blinder-Oaxaca decomposition. Both the change in the endowment composition of the social housing group and the change in the returns to the endowments of the social housing group, relative to the non-social housing group, could plausibly be associated with a set of omitted variables, Z, such that $cov(Z, SH, y \mid X) \neq 0$, where SH, y and X are the social housing tenure indicator, the child outcome and the set of composition covariates, respectively, where this covariance varies across cohorts. P1, the remaining within-cohort tenure effect, would be unambiguously upward biased for both cohorts, while the net effect on P2 would depend on the cohort specific P1 effects.

An alternative source of the unobserved heterogeneity that would be driven by points 1 and 2 above, is simultaneity. It is plausible that social housing tenure itself has a causal impact on both the endowment distribution and the returns to endowments experienced by those in social housing, and that this relationship has changed between the cohorts. In contrast to the presence of omitted variables, reverse causality would bias P1 downwards for each cohort, as the causal impact of social housing tenure on the distribution of and returns to endowments would be a component of the social housing tenure effect. Again however, the effect on P2 would depend on the cohort specific P1 effects.

Regardless of whether the changing role of the covariates across the two cohorts is as a re-sult of omitted variables or simultaneity, it is clear that the estimate of the change in the tenure effect over time, conditional on the included covariates, cannot be considered robust to changes in unobserved heterogeneity between the two cohorts. The Blinder-Oaxaca decomposition suggests that any omitted variables or reverse causality affecting the relative returns to endowments for those in social housing would have to account for the stark differences across outcomes in the direction of the change in the returns between the cohorts.

In the case of omitted variables, the set, *Z*, would have to contain a subset which have improved the relative non-cognitive returns over time to the covariates used in this paper for those in social housing (corresponding to the negative cohort differential in the covariate coefficient effect in Table 3, -0.20 s.d) and a subset which have worsened the relative cognitive returns over time for those in social housing (corresponding to the positive cohort differential in the covariate coefficient effect in Table 4, 0.184 s.d), and/or a subset which simultaneously exhibit both of these effects. Similarly, in the presence of simultaneity, social housing tenure would have to causally both improve and worsen, respectively, the relative non-cognitive and cognitive returns over time to the same set of covariates.

To look at this in more detail, Table 5 further disaggregates the covariate coefficient effects for both cohorts for non-cognitive and cognitive outcomes, respectively. The covariate coefficient effect for each cohort, by outcome, is shown in the first row (from Tables 3 and 4), and the contribution of each of the individual covariate coefficients is shown underneath, with the sum of the individual covariate coefficient effects equal to the main covariate coefficient effect in the top row. As shown in Tables 3 and 4, the covariate coefficient effect has weakened between the two cohorts for non-cognitive outcomes, and strengthened between the two cohorts for cognitive outcomes, where the starting point, the BCS, exhibits comparable covariate coefficient effects for both non-cognitive and cognitive outcomes. Comparing the coefficient effects for the individual covariates between the non-cognitive and cognitive Difference columns, shows that this is being driven almost entirely by the change in the relative returns to income between the two cohorts. For non-cognitive outcomes, providing the social housing group with the returns to income experienced by the non-social housing group increases the expected non-cognitive outcomes in the BCS, and has no expected change in the MCS, with the subsequent change in this coefficient effect being negative, at -0.067 s.d. In contrast, the opposite is true for cognitive outcomes, with no income coefficient effect in the BCS, but a very large, positive income coefficient effect for the MCS, resulting in a very large positive change in the coefficient effect, equal to 0.251 s.d. In other words, the non-cognitive returns to family income for the social housing group, relative to the non-social housing group, have remained statistically the same between the two cohorts, as the cognitive returns to family income have significantly worsened for the social housing group compared with the non-social housing group.

There are two points of interest with respect to this finding. It is firstly perhaps counter-intuitive to find *lower* cognitive returns to income for social renters, as is found in the MCS. As shown in Table 1, families in social housing tend to be exhibit lower income than those in non-social housing. Thus one might expect the marginal return to an increase in income to be greater for those with lower income, though for the MCS sample this is not the case. Secondly, this MCS tenure differential in the cognitive returns associated with family income is clearly not exhibited with respect to non-cognitive outcomes.

Thus the unobserved heterogeneity, whether characterised by omitted variables or simultaneity (or both), must account for the divergent path of the relative non-cognitive and cognitive returns to family income for those in social housing in the MCS and as a result, the divergent path between cohorts.

6 **Conclusion**

Children in social housing exhibit poorer developmental outcomes than children in non-social housing. This paper shows that this 'penalty' associated with social housing has become smaller between 1975 and 2005[19] for child cognitive and health outcomes, but has increased for non-cognitive outcomes. This represents an important finding with respect to policy. There are two implications; (i) the set of factors determining tenure-inequalities in child cognitive and health outcomes is not the same as that which determines tenure-inequalities in non-cognitive outcomes and (ii) the common set of factors determining tenure-inequalities in all three outcomes has different effects on cognitive and health outcomes as it does on non-cognitive outcomes. The role of each of these mechanisms needs to be understood if effective social housing policy and policy pertaining to social mobility more broadly is to be implemented.

A secondary aspect of the paper attempts to explore the mechanisms mediating the changes in tenure-inequalities in child outcomes between the two cohorts. However, the methods used cannot address the differential impact of unobserved heterogeneity across the two cohorts that is associated with the characteristics conditioned upon, and so no firm assertions are made regarding the role of these covariates or the robustness of the conditional tenure effect. What can be said, however, is that the tenure differences in the characteristics, or 'endowments', of the children and their families, and how these have changed over time, do not account for tenure-inequalities in cognitive and non-cognitive outcomes equivalently. Similarly, tenure differences in the 'return' to the endowments, and how these have changed over time, do not appear to be associated with tenure-inequalties in cognitive and non-cognitive outcomes equivalently, and this is particularly true with respect to the changing returns to income for those in social housing. Further research is clearly needed to explore this in the required detail.

[19]Five year old children born in 1970 and 2000, respectively.

7 Appendix

As discussed in the Introduction, the only indicator for housing quality which is equivalent and compatible across cohorts is a measure of overcrowding. Table 6 is the analogue of Table 2, but where instead of including the composition covariates in the Cov specification, I include the single overcrowding measure. It can be seen from the P1 model estimates in the Cov specification that overcrowding does appear to have a modest effect on the tenure gap in non-cognitive and cognitive outcomes, reducing the estimated tenure gap by 8% and 17% respectively, from the Raw specification. However, overcrowding does not explain the cohort differentials in the tenure gap for any of the three outcomes, with the P2 estimates remaining very stable across the Raw and Cov specifications. This suggests that changes in the relative overcrowding of social renting households between the two cohorts does not help explain the relative improvement in the cognitive and health outcomes or the relative worsening in the non-cognitive outcomes, of children in social housing between the two cohorts.

8. **Tables**

Table 1: Comparison of child outcomes, and parent and family characteristics between children in social housing and non-social housing, for the MCS and BCS.

	MCS					BCS				
	Social Housing		Non-Social Housing		Difference	Social Housing		Non-Social Housing		Difference
	Mean	Obs	Mean	Obs		Mean	Obs	Mean	Obs	
Outcomes										
Non-cognitive	36.15	3503	37.98	10932	1.83***	40.55	4173	42.03	8129	1.48***
Cognitive	47.44	3589	51.26	11039	3.82***	4.13	4184	5.03	8145	0.9***
Health [0, 1]	0.14	3726	0.12	11214	-0.02***	0.29	4231	0.23	8201	-0.06***
Composition Covariates										
Moth quals [0, 1]	0.73	2115	0.91	9411	0.17***	0.22	3756	0.55	7788	0.33***
No siblings [0, 1]	0.19	3729	0.16	11217	-0.04***	0.09	4011	0.11	8198	0.03***
3 or more siblings [0, 1]	0.21	3729	0.11	11217	-0.10***	0.26	4011	0.11	8198	-0.15***
Moth ¡24 [0, 1]	0.53	3476	0.19	10912	-0.34***	0.18	2692	0.09	5029	-0.09***
Moth ¿34 [0, 1]	0.07	3476	0.17	10912	0.09***	0.36	2692	0.34	5029	-0.02*
Lone parent [0, 1]	0.45	3729	0.11	11217	-0.34***	0.09	4011	0.03	8201	-0.06***
Non-white [0, 1]	0.19	3469	0.12	10891	-0.06***	0.04	3889	0.07	8119	0.03***
Fam income (age10)	3.58	1291	4.29	7683	0.70***	3.52	3024	4.08	6495	0.76***
Gender [0, 1]	0.49	3480	0.49	10916	-0.01	0.47	4033	0.49	8201	0.01

[1] The Difference column provides the mean difference between the two groups (Non-social Housing - Social Housing) with the significance level corresponding to the result of a t-test on the equality of means.
[2] * significant at 10%, ** significant at 5% and *** significant at 1%.

Table 2: OLS estimate of the social housing tenure effect on child outcomes (P1) and the change in the social housing tenure effect on child outcomes between the BCS and MCS (P2).

Model	P1		P2	
Specification	Raw	Cov	Raw	Cov
Non-cognitive				
Social Housing (P1)	-0.434	-0.243		
	[0.019]***	[0.024]***		
Social Housing*BCS (P2)			0.162	0.005
			[0.027]***	[0.033]
R-squared	0.038	0.089	0.039	0.089
Obs	26737	26737	26737	26737
Cognitive				
Social Housing (P1)	-0.418	-0.238		
	[0.013]***	[0.019]***		
Social Housing*BCS (P2)			-0.076	-0.141
			[0.027]***	[0.021]***
R-squared	0.035	0.073	0.036	0.074
Obs	26957	26957	26957	26957
Health				
Social Housing (P1)	0.039	0.022		
	[0.004]***	[0.006]***		
Social Housing*BCS (P2)			0.029	0.043
			[0.008]***	[0.009]***
R-squared	(0.030)	(0.039)	(0.031)	(0.039)
Obs	27372	27372	27372	27372
Controls				
Composition		x		x

[1] Social Housing (P1) represents a binary variable equal to '1' if the child, aged 5, resides in social housing, and '0' if the child resides in a non-social housing.
[2] Social Housing*BCS (P2) represents a binary variable equal to '1' if the child, aged 5, resides in social housing and is observed in the BCS, and '0' otherwise.
[3] The social housing binary indicator is included in the both specifications of the P2 model, as described in equations (6) and (8), but no longer has the interpretation of P1 due to the inclusion of P2. Thus I do not present the coefficient on the binary social housing indicator.
[4] The non-cognitive and cognitive measures are standardised within cohort, with to mean zero and a standard deviation of one. the health measure is binary.
[5] * significant at 10%, ** significant at 5% and *** significant at 1%.

Table 3: Three-fold Blinder-Oaxaca Decomposition: Non-cognitive Outcome

	Cohort		
Non-cognitive Outcome	MCS	BCS	Difference
Social Housing Effect	0.517 [0.025]***	0.355 [0.021]***	0.162***
Endowments			
Covariates	0.139 [0.017]***	0.133 [0.013]***	0.006
Missing	0.133 [0.013]***	-0.009 [0.006]	0.142***
Total	0.271 [0.016]***	0.123 [0.013]***	0.148***
Coefficients			
Covariates	-0.137 [0.151]	0.063 [0.059]	-0.20*
Constant	0.300 [0.150]**	0.207 [0.067]***	0.093
Missing	0.053 [0.035]	0.001 [0.016]	0.052*
Total	0.216 [0.027]***	0.270 [0.022]***	-0.054*
Interaction			
Covariates	0.053 [0.029]*	-0.025 [0.014]*	0.078
Missing	-0.023 [0.020]	-0.003 [0.005]	-0.02
Total	0.029 [0.034]	-0.029 [0.017]*	0.058

[1] The Difference column calculated as the MCS - BCS for each left-hand side row.
[2] The statistical significance of the value in the Difference column is calculated as $({}^{M} {}^{B})/{}^{p}((se({}^{M}))^2 + (se({}^{B}))^2)$, where ^{M} and ^{B} represent the social housing tenure effects for the MCS and BCS, respectively and *se* denotes standard error (Clogg et al, 1995, Brame et al, 1998).
[3] * significant at 10%, ** significant at 5% and *** significant at 1%.

Table 4: Three-fold Blinder-Oaxaca Decomposition: Cognitive Outcome

Cognitive Outcome	MCS	BCS	Difference
Social Housing Effect	0.379 [0.019]***	0.455 [0.019]***	-0.076***
Endowments			
Covariates	0.066 [0.031]**	0.185 [0.017]***	-0.119***
Missing	0.065 [0.007]***	-0.001 [0.003]	0.066***
Total	0.131 [0.029]***	0.183 [0.018]***	-0.052**
Coefficients			
Covariates	0.171 [0.129]	-0.013 [0.051]	0.184*
Constant	0.015 [0.129]	0.252 [0.059]***	-0.237**
Missing	-0.024 [0.019]	0.034 [0.017]	-0.058**
Total	0.163 [0.026]***	0.273 [0.019]***	-0.111***
Interaction			
Covariates	0.069 [0.031]**	0.001 [0.019]	0.068*
Missing	0.016 [0.021]	-0.001 [0.003]	0.017
Total	0.086 [0.044]*	-0.001 [0.018]	0.086

[1] The Difference column calculated as the MCS - BCS for each left-hand side row.
[2] The statistical significance of the value in the Difference column is calculated as $({}^{M} {}^{B})/{}^{p}((se({}^{M}))^2 + (se({}^{B}))^2)$, where ^{M} and ^{B} represent the social housing tenure effects for the MCS and BCS, respectively and *se* denotes standard error (Clogg et al, 1995, Brame et al, 1998).
[3] * significant at 10%, ** significant at 5% and *** significant at 1%.

Table 5: Three-fold Blinder-Oaxaca Decomposition: Detailed Comparison of the Change in the Covariate Coefficient Effects Over Time For Non-cognitive and Cognitive Outcomes.

	Non-cognitive			Cognitive		
	MCS	BCS	Difference	MCS	BCS	Difference
Covariate Coefficient Effect	-0.137 [0.151]	0.063 [0.059]	-0.20	0.171 [0.129]	-0.013 [0.051]	0.184*
Covariates						
Moth Quals	-0.006 [0.041]	-0.012 [0.007]	0.006	0.017 [0.054]	0.005 [0.011]	0.012
No Siblings	-0.028 [0.008]***	-0.011 [0.005]	-0.017***	-0.003 [0.009]	-0.007 [0.008]	0.004
3 or more Siblings	0.005 [0.006]	0.015 [0.011]	0.01	0.008 [0.016]	-0.005 [0.009]	0.013
Young Moth	-0.023 [0.019]	0.007 [0.012]	-0.03	-0.038 [0.013]***	-0.006 [0.011]	-0.032***
Old Moth	-0.001 [0.004]	-0.012 [0.009]	0.011	0.002 [0.005]	0.026 [0.012]**	-0.024
Lone Parent	-0.037 [0.038]	0.010 [0.009]	-0.047	-0.021 [0.016]	-0.001 [0.005]	-0.02
Non White	-0.024 [0.014]	-0.003 [0.004]	-0.021*	-0.020 [0.013]	-0.009 [0.003]***	-0.011
Family Income	0.002 [0.094]	0.069 [0.053]	-0.067	0.254 [0.125]**	0.003 [0.044]	0.251***
Gender	-0.025 [0.018]	-0.013 [0.013]	-0.012	-0.029 [0.027]	-0.019 [0.014]	-0.01

1 The Difference columns calculated, separately for the Non-cognitive and Cognitive outcome, as the MCS - BCS for each left-hand side row.

2 The statistical significance of the value in the Difference columns is calculated, separately for the Non-cognitive and Cognitive outcome, as (^{M} ^{B})/^{p}((*se*(^{M}))^2 + (*se*(^{B}))^2), where ^{M} and ^{B} represent the social housing tenure effects for the MCS and BCS, respectively and *se* denotes standard error (Clogg et al, 1995, Brame et al, 1998).

3 * significant at 10%, ** significant at 5% and *** significant at 1%.

Table 6: OLS estimate of P1 and P2 with the inclusion of housing quality measure (Over-crowding).

Covariate	Housing Quality			
Model	P1		P2	
Specification	Raw	Cov	Raw	Cov
Non-cognitive				
Social Housing (P1)	-0.434	-0.401		
	[0.019]***	[0.013]***		
Social Housing*BCS (P2)			0.162	0.178
			[0.027]***	[0.027]***
R Sq/(Pseudo R Sq)	0.038	0.043	0.039	0.042
Obs	26737	26737	26737	26737
Cognitive				
Social Housing (P1)	-0.418	-0.346		
	[0.013]***	[0.014]***		
Social Housing*BCS (P2)			-0.076	-0.054
			[0.027]***	[0.026]**
R Sq/(Pseudo R Sq)	0.035	0.044	0.036	0.05
Obs	26957	26957	26957	26957
Health				
Social Housing (P1)	0.039	0.036		
	[0.004]***	[0.005]***		
Social Housing*BCS (P2)			0.029	0.029
			[0.008]***	[0.011***
R Sq/(Pseudo R Sq)	(0.030)	(0.034)	(0.031)	-0.031
Obs	27372	27372	27372	27372
Controls				
Overcrowding		x		x

[1] Social Housing (P1) represents a binary variable equal to '1' if the child, aged 5, resides in social housing, and '0' if the child resides in a non-social housing.

[2] Social Housing*BCS (P2) represents a binary variable equal to '1' if the child, aged 5, resides in social housing and is observed in the BCS, and '0' otherwise.

[3] The social housing binary indicator is included in the both specifications of the P2 model, as described in equations (6) and (8), but no longer has the interpretation of P1 due to the inclusion of P2. Thus I do not present the coefficient on the binary social housing indicator.

[4] The non-cognitive and cognitive measures are standardised within cohort, with to mean zero and a standard deviation of one. the health measure is binary.

[5] * significant at 10%, ** significant at 5% and *** significant at 1%.

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