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Social Interaction and Children's Academic Test Scores: Evidence from the National Child Development Study

Sarah Brown and Karl Taylor*

*Department of Economics
University of Sheffield
9 Mappin Street
Sheffield
S1 4DT
United Kingdom*

Abstract: We explore the relationship between educational attainment and social interaction using individual level data from the British *National Child Development Study*. To be specific, we analyze whether an intergenerational aspect to this relationship exists by examining the relationship between the educational attainment of children and the degree of formal social activity undertaken by their parents. Our results suggest that children's scores in reading, mathematics and vocabulary tests are positively associated with the extent of their parents' formal social interaction, and this relationship is robust to alternative definitions of social interaction.

Key Words: Education; Human Capital; Social Capital; Social Interaction

JEL Classification: J24, Z12

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*Corresponding author. Tel.: +44 114 222 3420; fax: +44 114 222 3458.
E-mail address: k.b.taylor@sheffield.ac.uk

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1. Introduction and Background

Over the last decade, there has been increasing interest in the economics literature in social interaction and social capital and their implications for socio-economic outcomes such as educational attainment and employment status. For example, the literature on the economics of religion has analyzed the determinants of the decision to participate in religious activities, such as church attendance, thereby focusing on participation in one particular formal social activity.¹ Given that social skills and personality characteristics in general are an important part of human capital (see Bowles et al. 2001), it is not surprising that the relationship between social interaction and education has attracted interest in the economics literature.

Educational attainment plays an important role in determining the opportunity cost of engaging in any non-work activity, such as church attendance. For highly educated individuals who typically receive relatively high earnings, time spent out of the labor market attracts a relatively large opportunity cost. A positive association between education and the opportunity cost of time devoted to formal social activities implies an inverse relationship between social activities and educational attainment. Sacerdote and Glaeser (2001) argue, however, that if education increases the returns from social activities, then one might predict a positive association between education and formal social activities. In general, empirical evidence supports a positive relationship between church attendance and educational attainment (see Brown and Taylor 2007, Iannaccone 1998, and Sacerdote and Glaeser 2001). Furthermore, Glaeser et al. (2002, p. F455), who report evidence supporting a positive correlation between education and social interaction proxied by membership in organizations including religious organizations, argue that this relationship is not only well known in the social capital literature, but is also ‘one of the most robust empirical regularities in the social capital literature’.

¹ See Iannaccone (1998) for an excellent comprehensive survey of the literature on the economics of religion.

In addition to determining the opportunity cost of engaging in formal social activities, education is clearly related to social involvement with education playing a key role in the development of social skills (see Putnam 2000). A socialization function of education exists in that skills such as reading and writing play a crucial role in developing communication skills. Sacerdote and Glaeser (2001) argue that schools teach children basic social skills and how to interact with one another. Furthermore, they argue that the positive relationship between education and social interaction is the result of treatment and selection whereby the socialization function of schooling represents the treatment and selection reflects the fact that education requires the same skills as participation in many other formal social activities such as the ability to listen and communicate. Their empirical findings suggest that education is positively associated with a range of formal social activities such as being a member of a trade union, political club or sports club as well as social religious activity.²

This paper builds on this literature and explores the implications of engaging in a range of activities involving social interaction. We analyze the relationship between social interaction and educational attainment using British cohort data from the *National Child Development Study (NCDS)*. To be specific, we explore the relationship between a parent's level of social interaction and their child's academic development. Given that family background is an important determinant of educational attainment (see Ermisch and Francesconi 2001), one might predict that the level of formal social activity (i.e. social interaction) undertaken by an individual may influence the academic development of their children. Furthermore, as Coleman (1988, p. S109) remarks, in a seminal contribution to the social capital literature, 'there is one effect of social capital that is especially important: its effect on the creation of human capital in the next generation.'

² Interestingly, Sacerdote and Glaeser (2001) find that education is not correlated with non social religious activity such as praying.

A number of potential channels exist whereby parental social capital may influence the educational attainment of their offspring. In particular, Coleman (1988) discusses the effect of social capital within the family and within the community outside the family. The latter can lead to the opportunity for parents to discuss their children's behavior and progress with others, thereby leading to parents being able to access the support and assistance of other individuals. The additional social capital to which such social networks potentially lead to, may be beneficial for parents in bringing up their children (Coleman, 1988). Consequently, as argued by Furstenberg and Hughes (1995, p. 582), who find that social capital is related to the socio-economic achievement of a sample of teenage mothers and their children, 'parenting is thus shared by the community'.

Furthermore, the social capital of parents is potentially enhanced if they are members of a community that is characterized by common values. If such values emphasize the importance of factors that are conducive to educational attainment, for example, a good work ethic, then parents who belong to such a community may instill these values in their children, which may enhance their human capital accordingly. For example, Fan (2008) explores the relationship between religious participation (a particular type of social capital) and children's education within an overlapping generations theoretical framework, which predicts a close relationship between children's education and religious participation. In this framework, parental religious participation is assumed to have a positive impact on the level of effort and motivation their children exert in their studies thereby enhancing their human capital accumulation. Such arguments highlight an additional mechanism through which parental social capital potentially influences the academic development of their children.

Thus, it is apparent that intergenerational aspects to social capital may exist. Similarly, the economics literature has firmly established an intergenerational link between parent's and children's educational attainment (see, for example, Oreopoulos et al., 2006), which is not

surprising given the important role that parents play in the decisions regarding the human capital investments of their children. It is apparent therefore that an intergenerational link between social capital may exist whereby a parent's involvement in formal social activity may be positively associated with their children's involvement in formal social activity, which in turn may be conducive to human capital accumulation.³

To be specific, in this paper, we explore whether the children of parents who report relatively high levels of social interaction report relatively high levels of academic achievement, an area, which, to our knowledge, has been the subject of limited empirical scrutiny within the economics literature.

2. Data and Methodology

For the purposes of this study, we exploit the rich data available from the British *NCDS*, which is a British cohort study with a target sample of all children born in Great Britain during a given week (March 3rd to March 9th) in 1958. This panel study provides a wealth of information relating to the family background of the respondent in addition to having the advantage of tracing the respondent over a relatively long time horizon for a sample of individuals of the same age. The survey follows the same individuals at ages 7, 11, 16, 23, 33, 42 and 46. In the survey conducted at age 33, measures of the academic skills of the respondents' children are available, thereby enabling us to link parents' (i.e. the *NCDS* respondents) formal social activities with the educational attainment of their offspring. Our choice of data set reflects the fact that the *NCDS* encompasses the key components required for our analysis, namely information pertaining to the parent's level of social interaction and detailed information on their children's academic skills in reading, writing and arithmetic.

Following Glaeser et al. (2002), our principle measure of the parent's involvement in formal social activities, a proxy for their social capital, *SOC*, is defined as the number of

³ We are particularly grateful to an anonymous reference for highlighting this point.

types of clubs that the individual is currently an active member of. The different types of clubs include a political party, an environmental charity/voluntary group, other charity/voluntary group, women's groups, townswomen's guild or women's institute, parents/school organizations, tenants/residents association, trade union/staff associations, and religious organizations.⁴

For a sub-sample of *NCDS* respondents aged 33, the respondents' children participated in a variety of tests exploring various aspects of their development; the Peabody Individual Achievement Tests (PIATs) in math, reading recognition and comprehension and the Peabody Picture Vocabulary Test – Revised (PPVT-R).⁵ The PIATs, which have been extensively validated, measure the academic achievement of children aged 5 and over and are the most widely used brief assessments of academic achievement with high test-retest reliability and concurrent validity (*National Longitudinal Survey of Youth*, 1997 User Guide). Both the PIATs and PPVT-R tests have been used to measure the educational development of children in the U.S. (see, for example, James-Burdumy 2005).

Children start the test at a point that is appropriate for their age and establish a 'basal' ('ceiling') by achieving a certain number of consecutive correct (incorrect) answers. The math test comprises multiple choice questions that increase in terms of difficulty, starting with questions focusing on, for example, recognizing numerals and progressing to topics such as geometry. The reading recognition test consists of multiple choice questions and starts with letters and progresses to words, whilst the reading comprehension test is based on the meaning of sentences (*NCDS Sweep V User Guide Part 1*). Higher scores in the tests

⁴ It should be acknowledged, however, that in accordance with Glaeser et al. (2002), the club membership variable captures the number of types of clubs rather than the number of clubs an individual belongs to. In addition, we have no information on the size of the club (i.e. the extent of the social network that an individual belongs to). Finally, our measure does not include participation in groups associated with hobbies (such as book or garden clubs). Given that membership of such clubs may represent consumption activities (Glaeser et al., 2002), their omission from our measure may not be too problematic.

⁵ The sub-sample comprises one third of the sample of cohort members chosen at random who had one or more natural or adopted children currently living with them at the interview date.

represent higher levels of achievement. The PPVT-R is a widely used and extensively validated test of hearing vocabulary knowledge for children aged four and over based on pictorial representation. The children are shown pictures and are asked to indicate which picture coincides with the word stated by the interviewer. Hence, the test assesses both verbal ability and vocabulary (*NCDS Sweep V User Guide Part 1*). The sample size for the PIATs is 2,721 children, whilst the sample size for the PPVT-R is 2,958 children.

Given that the dependent variable is a test score (either from the reading, math or vocabulary test) based on the number of correct responses, the dependent variable assumes discrete values but is not a categorical variable. Using Ordinary Least Squares (OLS) to model test scores is potentially problematic in the presence of excessive zeros. In particular, each of the test scores we analyze from the *NCDS* has approximately a six percent zero response rate, where those children with zeros actually took the tests but did not get any correct answers. Although these percentages are quite small, OLS regression models do not predict the tails of the distributions accurately. Hence, since the dependent variable is essentially a non-negative integer count, we adopt a Poisson regression model that specifies that each value of the dependent variable, y_i , is drawn from a Poisson distribution with parameter λ_i , which is related to the regressors \mathbf{x}_i :

$$\text{Prob}(Y_i = y_i) = \frac{e^{-\lambda_i} \lambda_i^{y_i}}{y_i!}, \quad y_i = 0, 1, 2, \dots, m, \quad E[y_i | \mathbf{x}_i, SOC_i] = \lambda_i = \exp^{\mathbf{x}_i \phi + \pi SOC_i} \quad (1)$$

(see Greene, 2003). The PIAT test scores in maths and reading have means (standard deviations) of 36 (19) and 38 (22) with maximum values of 84, whilst the PPVT-R has a mean (standard deviation) of 37 (13), with a maximum value of 104. We aim to explore the relationship between the level of social interaction of the parent, SOC , as proxied by club membership, and a child's scores in the PIATs and the PPVT-R. Hence, our focus is on the sign and significance of π in equation (1). In terms of the additional explanatory variables,

we include the age of the child,⁶ the gender of the child, a dummy variable which takes the value of one if the child has experienced over one year of a limiting health problem, a dummy variable which takes the value of one if the child has siblings, a dummy variable for whether the child is the oldest non adult within the household, an index of the number of books the child has (0=none, 1=between 1 and 9, 2=between 10 and 19, 3=between 20 and 49, 4=at least 50), and the number of children present when the child took the test. In terms of family background, we control for the logarithm of household income; whether the family owns their own home; whether the child comes from a single parent household; the age of the second parent; and the highest educational qualification of the parent of the child.⁷ Finally, in the initial baseline specification, we include whether the parent has reported that he/she has experienced reading or math problems since leaving school. To explore the robustness of the results, we include additional covariates including controls for the social interaction of the child, specifically their interaction with other children (i.e. bullying, number of friends and how shy they are with other children) as well as controls for social interaction with their parents, for example, watching TV, eating meals, going on outings together, and spending time with the father. Summary statistics for the explanatory variables included in equation (1) are presented in Table 1.

⁶ It should be noted that the age of the child is directly related to the age of the parent (i.e. all the respondents are born in 1958), as such for older children the parent must have been relatively young when the child was born, which potentially may cause opposing influences upon the academic performance of the child.

⁷ Educational dummy variables are defined for each of the following qualifications: the equivalent to the General Certificate of Secondary Education (GCSE) grade C or above; Advanced (A) level; diploma level, nursing or teaching qualifications; and, finally, degree level qualifications. GCSEs are taken after 11 years of formal compulsory education and approximate to the US honors high school curriculum. A levels are public examinations taken by 18 year olds over a two-year period, usually studying a set syllabus in one to four subjects. This qualification is the major determinant of eligibility for entry to higher education in the UK. No education is the reference category.

3. Results

3.1 Parental Social Interaction and Children's Academic Test Scores

We explore the relationship between the parent's formal social interaction and the academic ability of their children. Table 2 presents the results of estimating equation (1), where the dependent variable denotes the test score of the children of the *NCDS* respondents in reading, mathematics or vocabulary.⁸ It is apparent that the number of clubs that the parent belongs to is positively related to the test scores attained by the children.⁹ A one standard deviation increase in the number of clubs the parent belongs to is associated with increases in the reading, math and vocabulary scores of 1.6%, 1.5% and 3.4% respectively.¹⁰ These effects are relatively large in comparison to the influence from other covariates on the test scores. For example whether the child is in a single parent household only influences the reading test score, decreasing it by just under 4%, whilst male children have higher math and vocabulary scores than females in the region of 2.9% and 1.3% respectively. The effects related to the number of books that the child has of his/her own are relatively large: a one standard deviation increase in the number of books is associated with increases in the reading, math and vocabulary test scores by 6.3%, 6.9% and 2.9% respectively.^{11,12}

⁸ The sample size is smaller for the PIAT maths and reading tests since children aged over 5 take such tests whilst the PPVT-R test is administered to children aged four and above. The following results are not affected by restricting the sample to children aged 5 plus for the PPVT-R test score estimation, yielding the same sample size as for the PIATs.

⁹ When analyzing social interaction, a natural question arises as to whether parents engage in more or less social interaction than non-parents. It may be the case that parenthood leads to less time for social activities or conversely that it may open up opportunities for more social interaction. The mean value of the social interaction proxy for parents is 0.8087 as compared to 1.0076 for non-parents although the difference is not statistically significant. Furthermore, if we regress the social interaction index for all *NCDS* respondents on the number of children or being a parent, we find that such characteristics have insignificant effects. A related issue concerns whether individuals change the extent to which they engage in social interaction once they have children. The mean level of social interaction in 1991 for respondents whose children participated in the tests in 1991, but were not born in 1981, is 0.7972 whilst the mean value of the social interaction proxy for this group of respondents in 1981 was 0.9788.

¹⁰ This is calculated based on the mean sample characteristics of respondents. For example, the 1.6% effect is found by multiplying the coefficient, 0.0164, by the standard deviation of the number of clubs, 0.9858.

¹¹ Interestingly, the highest educational attainment of the parent does not have a monotonic influence upon the child's test scores. This finding is robust to changes in the specification. We have also experimented with using years of completed education as an alternative measure of parental education attainment, consistent with James-Burdumy (2005), and find that the influence of the parents' years of schooling has a positive influence on each

Arguably, the social interaction of the parent could be capturing the social capital of the child (i.e. an omitted variable problem may exist). Consequently, we investigate whether the findings are robust to including proxies for the social capital of the child. Specifically, we control for whether the child bullies other children, how many friends the child has, how shy the child is with other children or adults, and whether the child belongs to a club such as sports, music, art or cubs (junior scouts).

Another shortcoming of the analysis so far relates to the omission of controls for intra-family interaction. Furstenberg and Hughes (1995) distinguish between intra-family based social capital and community based social capital. With respect to intra-family based social capital, one might predict that the amount of time spent in shared family activities would be positively associated with a child's academic development. Alternatively, club membership may be correlated with omitted family interaction variables which influence the child's academic ability. Hence, we include controls for the number of hours the child watches television (TV) alone; whether the child watches TV with his/her parents; the frequency with which the child eats with both parents; the frequency with which the child visits the shops with his/her parents; the frequency with which the child is taken on outings by his/her parents and/or relatives, such as for a picnic, to the park, museum and/or theatre; how often the family meets relatives; and an index of how much time the child spends with his/her father.

Given that one of the potential routes via which parental social interaction may have an intergenerational effect is through the creation of networks and community membership,

of the child test scores, whilst the effect of parental social interaction is unchanged in terms of magnitude and significance.

¹² The deviance statistic is insignificant, suggesting that over-dispersion is not a problem in the test score models. Our results are robust to estimating a negative binomial specification which is less restrictive than the Poisson model since the assumption of equi-dispersion is relaxed. In addition, rather than using the 'raw' test score, which reflects the number of correct answers a child provides, an alternative specification would be to employ standardized test scores (see Fryer and Levitt 2004). We have explored the robustness of our results by normalizing the test scores to have a mean of zero and a standard deviation of one, and we have re-estimated equation (1) via Ordinary Least Squares (see Zavodny 2006). In general, the findings are robust to specifying this alternative functional form.

then it is possible that the measure of parental social capital is simply capturing a regional effect. Hence, we also control for the region in which the parent lives to ascertain whether this impacts upon the intergenerational effects of social capital. In particular, in the following analysis, we aim to determine whether the positive and statistically significant influence of the social interaction of the parent upon his/her offspring's test scores, as found in Table 2, remains once we control for the child's social capital, family based social capital and region of residence.

The results of including additional controls for the child's social capital, intra-family social interaction and region are presented in Table 3. With respect to the effect of the child's social capital proxies, our findings suggest that shy children are likely to have lower math and reading test scores, whilst being a bully is negatively associated with all test scores, consistent with Brown and Taylor (2008) who find that bullying influences the educational attainment of the *NCDS* respondents. Interestingly, the number of friends the child has is inversely associated with the math test score. The sizes of the effects are, however, relatively moderate. The exception is that child's club membership has a strong impact on the maths and reading test scores both in terms of magnitude, with influences of 14% and 16% respectively, and statistical significance, suggesting that, even at a young age, there is a positive association between academic performance and social interaction.

The findings related to family interaction suggest that watching TV alone is inversely associated with a child's test scores as is, perhaps surprisingly, the frequency at which the child is taken on outings by parents or relatives. Noticeably, there are some differences in the direction of the relationship between some of the child's social capital proxies and the family interaction controls and the PPVT-R and PIAT test scores. This may reflect differences between the tests in that, in contrast to the PIATS, the PPVT-R is a pictorial based vocabulary recognition test. For example, the frequency at which the child is taken on outings/shops by

his/her parents and whether the child watches TV with his/her parents are positively related to the PPVT-R test but negatively related to the PIAT test scores. One might argue that this type of interaction is associated with increased visual awareness, which may explain the positive association with the PPVT-R test.¹³ Despite the additional controls for the social capital of the child and intra-family interaction, it is noticeable that parental club membership remains positively related to the children's test scores.¹⁴ A one standard deviation increase in parental club membership is associated with increases in the child's reading, math and vocabulary test scores by 1%, 1.1% and 1.5% respectively – hence the effects are only moderately influenced by controlling for the child's social capital, intra-family interaction and region of residence.¹⁵ Our findings suggest that, across the different models, the positive relationship between parental social interaction and children's reading, writing, mathematics and vocabulary test scores is highly robust.¹⁶

¹³ This finding might also reflect an age effect in that older children may not spend as much time with their parents. Indeed, interacting the age of the child with whether they watch TV or go on outings/to the shops with their parents reveals that watching TV or going on outings/to the shops with parents has a positive impact on both the PIAT and PPVT-R test scores which declines with age.

¹⁴ We have also investigated whether the influence of parental social interaction varies with the gender of the child. If the proxies of parental social capital are interacted with the child's gender there is a significant differential impact for the PPVT-R test only, where the effect is moderated for males. Splitting the sample by gender reveals that the social capital of parents is positively related to the test scores regardless of the child's gender with the effect being larger for females. We have also explored whether the results differ according to the gender of the parent. Interestingly, for both the PIAT maths and reading tests the social interaction of the father has the largest association with the child's test score, whilst the converse is true for the PPVT-R vocabulary test. Full results are available upon request.

¹⁵ As stated in Section I, an intergenerational link may exist between social capital whereby parental involvement in formal social activity might be positively associated with the social interaction of their offspring, and this in turn may be conducive to the child's educational development. To explore the implications of this for our results, we interact the parent's club membership with his/her child's club membership. The coefficients on the club membership of the parent and child are still significant and the magnitude of the effects across the test scores is largely unchanged. Interestingly, the interactive term is insignificant for the PIAT math and the PPVT-R test and has a small negative effect on the reading test score of the child.

¹⁶ It may be the case that educational attainment is positively associated with increased social capital, i.e. better educated parents have better social interaction skills. Assuming that an intergenerational transmission mechanism exists for education (see, e.g., Oreopoulos et al. 2006), this could also explain the positive association between parental social interaction and his/her child's test scores. However, it is unlikely that the social interaction of the parent is merely capturing their own education since the set of explanatory variables in equation (1) includes the educational attainment of the parent.

3.2 Type of Parental Club Membership

Our primary measure of parental social capital (i.e. the number of types of club membership), allows us to explore whether the type of club influences the child's test score performance. Hence, in Table 4 Panels A to F, we replace the number of types of club membership with a binary dummy variable indicating whether the parent is a member of a particular club. The results are interesting in that whether the parent is a member of a trade union or staff association has no influence at the 5 per cent level of statistical significance upon his/her offspring's academic test scores, whilst being a member of a religious organization (political party) only influences the PPVT-R (math) test score in a positive fashion. All other club types influence two or more of the children's test scores. The most noticeable effects are from whether the parent is a member of a parent or school organization, having approximately a 4.1% (5%) effect on the reading (PPVT-R) test score. This is consistent with the interpretation that social capital outside of the family may provide an opportunity for parents to access support and assistance from other individuals or that being part of a community, which shares common values conducive to human capital accumulation, might enhance a child's educational development. Similarly, membership of women's groups has a 6.6% (5.6%) impact on the reading (PPVT-R) test scores.¹⁷ In the final panel of Table 4, we enter each club type simultaneously and find that the largest impact upon each of the test scores is generally from parental involvement in the child's school. Consequently, it is clear that whilst the number of clubs that the parent is a member of is positively related to the child's test score, the specific type of parental social interaction is important both in terms of statistical significance and the magnitude of the effect.

¹⁷ The functional form of equation (1) is $E(y|x_1, x_2, \dots, x_k) = \exp(\phi_1, \phi_2, \dots, \phi_k)$, and taking logs gives the approximation $\% \Delta E(y|x) \approx 100 \times \phi_j$ for a change in a binary variable x_j .

3.3 *Alternative Measures of Social Capital*

As pointed out by Durlauf (2002), the definition of social capital ranges from a form of social networks to trust and trustworthiness and, hence, encapsulates many concepts. Thus, in this section, we explore whether our key findings are robust to amendments to the measure of social interaction. Thus far, our measure of parental social interaction has been based on club membership. In contrast to Glaeser et al. (2002), we are able to control for the intensity of participation in clubs since the *NCDS* includes information on the frequency at which the parent undertakes sporting activities and attends religious meetings or political meetings. We also have information on the number of friends/neighbors the respondent can turn to for advice. In addition, respondents in the *NCDS* are asked whether they can trust most people, thereby allowing us to proxy social capital via a measure of trust, similar to that used by Glaeser et al. (2000). These measures have been used in the previous literature to proxy social capital (see Glaeser et al. 2002). Table 5 presents the correlations between the different proxies of social capital where there is generally a positive and statistically significant relationship between the alternative measures.

In Table 6, we replace parental club membership with each of the alternative measures of the parent's social capital whilst controlling for the child's social capital, family interaction and region. Introducing each measure individually, Panels A through to E generally reveal a positive association between parent's social capital and the child's test scores. For example, the offspring of parents who are generally trusting of other people have higher reading, maths and vocabulary scores, 1.9%, 2.8% and 4.9% respectively. Exceptions are the frequency with which the parent attends religious and political meetings, which only influence the child's vocabulary test scores. The positive association between parental religious activity and children's educational attainment is consistent with the theoretical predictions of Fan (2008). Finally, Panel F shows a specification where each of the alternative measures of social

interaction are entered simultaneously. The number of friends/neighbors the respondent can turn to for advice dominates the effects of the intensity measures in terms of the magnitude of the estimated coefficients as well as statistical significance for the PIAT reading test; the frequency that the respondent undertakes sport has the largest impact upon the PIAT math test score whilst trust dominates for the PPVT-R vocabulary test. Hence, replacing our measure of parental social interaction (i.e. the club membership index) with alternative proxies of social interaction still reveals a positive association between parent social capital and the children's test scores.

3.4 Timing and Measurement of Social Interaction

It is generally difficult to justify a causal interpretation in applied econometrics without finding plausible sources of identifying variation. Hence, our finding of a positive relationship between the parent's social interaction and the children's test scores does not necessarily imply a causal relationship.¹⁸ Thus far, we have explored the relationship between the parent's social interaction when the parents are aged 33 and the scores of the children from tests taken whilst the parents are aged 33. In order to shed some light on causality, we investigate whether measures of the parent's social capital at age 23 influence the test scores of the children attained when the parents are aged 33. Differences in the timing of the measurement of the test scores and the measurement of parental social interaction suggest that any significant correlation from such a specification arguably is in accordance with a causal relationship in that the potential for reverse causality is somewhat diminished. To be specific, the test scores attained by the children in 1991 cannot influence the social interaction undertaken by their parents in 1981. Furthermore, when the respondents (i.e. the parents)

¹⁸ The existing literature, which has focused upon intergenerational transfers of parental education and economic outcomes of their offspring (e.g. the education of the child) has typically used data with either information on twins or natural/adoptive child samples to infer causality (see Sacerdote 2002). Unfortunately, our sample of children does not allow us to identify twins, and the number of adopted children is less than 1% of the sample, rendering such a strategy infeasible.

were aged 23, the majority of the *NCDS* respondents' children (approximately 95%) were not born – the mean age of the respondents' children in 1991 being 8 years old.

With respect to the measures of social interaction and social capital, the *NCDS* includes information on the number of types of clubs that the parent was a member of at age 23. The different types of clubs include voluntary groups, trade union/staff associations, religious organizations, sports clubs, and youth clubs. The correlation between the number of types of club membership at age 23 and the number of types of club membership at age 33 is 0.5136 and is statistically significant at the one per cent level despite the fact that the definitions differ slightly. In addition, there are a number of measures of the intensity of social interaction at age 23. To be specific, there is information on how often they undertake sport, attend religious meetings, undertake voluntary work, go to the cinema, or meet friends. For two of the measures of social capital, the questions are identical to those analyzed in Table 6, specifically the frequency with which individuals undertake sport and/or attend religious meetings.¹⁹

In Table 7, we replace parental club membership at age 33 with parental club membership at age 23 (i.e. parental club membership prior to when their children took the PIAT and PPVT-R tests in 1991). We also specify the same controls as in Table 3 including the children's social capital and family interaction. Hence, the child's test score, y , is modeled as follows: $y_{t=1991}^{child} = f(SOC)_{t=1981}^{parent}$. The results presented in Table 7 Panel A indicate that a one standard deviation increase in parental club membership at age 23 is associated with statistically significant increases in the children's reading and vocabulary test scores of 1.3% and 1.1%, respectively. Such influences are similar in magnitude to those based upon parental club membership at age 33.

¹⁹ The correlation between sporting (religious) activities at the ages of 23 and 33 is 0.2266 (0.5925).

The number of clubs that the parent was a member of at age 23 may reflect social capital accumulated relatively early in adulthood.²⁰ Hence, simultaneously including club membership at age 23 and at age 33 may potentially control for this early measure of social capital and control for social capital at a later stage of the individual's lifecycle. As such, it is interesting to explore which measure of social interaction has the largest influence on the children's academic test scores. We investigate this in Table 7 Panel B where the parent's club membership at 33 has a positive and statistically significant effect on the children's test scores; furthermore this effect dominates the effect from club membership at age 23, which is insignificant. In Table 7 Panel C, we extend this line of analysis and include the social interaction at age 23 as well as the change in the parent's social interaction over time by taking the difference in the club membership indexes between ages 23 and 33 (i.e. 1981 to 1991). Hence, this specification allows for the possibility that the change in parental social interaction over time might influence the children's academic test scores, whilst also controlling for social interaction at age 23, the early measure of social capital. Interestingly, the parent's social interaction at age 23 has a positive and significant effect on each test score as does the change in social interaction over time. These findings are consistent with a causal interpretation with our proxy of the change in social interaction between ages 23 and 33, capturing an effect over and above that related to the parent's early social capital measured at age 23.

We also have information pertaining to club membership when the *NCDS* respondent is aged 42. In Table 7 Panels D through to F, we replicate Panels A to C by focusing on the impact of parental club membership at age 33 (Panel D replicates the findings of Table 3), club membership when aged 33 and 42, club membership at age 33 and the change in club membership between 33 and 42 (i.e. 1991 to 1999). The results reveal that the age 33 effect is

²⁰ The alternative measures of social interaction available at age 23 are analyzed in Table 8 and discussed below.

robust to including either the level of social capital when aged 42 (see Panel E) or the change in club membership between 33 and 42 (Panel F). The latter result suggests that there is no persistent unobserved effect over time.

In Table 8, we focus upon the alternative measures of social interaction at age 23 (Panels A to E). Generally, we find support for a positive association between parental social interaction and the child's test scores. For example, a one standard deviation increase in the frequency at which the parent attends religious meetings in 1981 is associated with increases in the reading and PPVT-R test scores of 1% and 1.4%, respectively. Similarly, the frequency that the parent undertakes sporting activities and/or meets with their friends both have positive and statistically significant effects on the PPVT-R test score, where a one standard deviation increase in sporting activity (meeting friends) is associated with 0.7% (1.4%) higher test score.

To summarize, the results presented in Table 7 Panels A to C and Table 8 are arguably consistent with a causal interpretation of the relationship between a parent's social interaction and his/her children's academic test scores given the difference in the timing between these variables. However, such causality arguments are generally less sanguine if there are unobserved fixed effects that are correlated with the parent's social interaction and also correlated with the child's test score.²¹ The finding that the age 42 measure of parental social interaction is generally insignificant, both in the level and the change over time specifications, suggests that there is no persistent unobserved effect over time.

²¹ The results are robust to restricting the sample to those children born after 1981, although this does raise sample selection issues relating to the respondent's decision and ability to have children. Unfortunately, we are unable to employ a fixed effects estimator. Although there may be multiple children within the household who have taken the tests, we only have information upon one parent's social interaction (i.e. the *NCDS* respondent).

4. Conclusion

We have investigated the relationship between educational attainment and engagement in formal social activities. Our empirical findings indicate a hitherto neglected influence of social interaction. To be specific, our empirical results suggest that a lack of social interaction may have adverse intergenerational effects in terms of educational attainment. The offspring of individuals who engage in relatively low levels of social interaction attain relatively low scores in reading, mathematics, and vocabulary tests. This result is robust to controlling for intra-family social interaction and the social interaction of the child.

The mean age of the children in our sample is eight years, and empirical evidence suggests that children learn quickly at an early age with early learning being important for learning later in life (see, for example, Cunha et al., 2006). As such, one might predict that the children with relatively low test scores are likely to attain relatively low levels of educational attainment later on in life. Finally, as pointed out by Sacerdote and Glaeser (2001), the positive association between education and social interaction indicates an important role for social involvement. We provide further support for this argument and, furthermore, indicate that there are potentially additional intergenerational benefits from social involvement.

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Table 1: Summary Statistics (Sample = Children of the *NCDS* Respondents; $n = 2,721$)

variable	mean	s.d.
PIAT reading test score	38.1544	21.9551
PIAT maths test score	35.7600	18.6010
PPVT-R test score	36.7350	13.0489
Number of types of clubs parent is a member of at age 33	0.7354	0.9858
Frequency parent undertakes sport at age 33	1.6222	1.8127
Frequency parent attends religious meetings at age 33	0.5408	0.9509
Frequency parent attends political meetings at age 33	0.3344	0.7905
The parent can trust most people	0.6022	0.4895
Number of friends/neighbors parent can turn to for advice	0.4517	0.6860
Age of child	8.1389	2.4854
Gender of child	0.3466	0.4759
The child has a limiting health problem	0.0889	0.2847
The child has siblings	0.9313	0.2530
The child is the eldest sibling	0.3193	0.4663
Number of schools child has attended	1.1220	1.0784
Single parent family	0.1474	0.3545
Age of second parent	31.4603	19.2843
The parent has a reading problem	0.0606	0.2387
The parent has a maths problem	0.0213	0.1445
Number of children present when taking test	0.4282	0.7144
Number of books child has of his/her own	1.4767	1.6573
Log household income of parents	0.0169	2.0647
Highest educational qualification of the parent at 33: GCSE	0.5105	0.4999
Highest educational qualification of the parent at 33: A Levels	0.0099	0.0991
Highest educational qualification of the parent at 33: Diploma	0.0515	0.2209
Highest educational qualification of the parent at 33: Teaching/Nursing	0.0224	0.1481
Highest educational qualification of the parent at 33: Degree	0.0426	0.2021
Child bullies other children	0.0632	0.2609
Number of friends the child has	3.0838	2.9784
Index of shyness of the child with children	0.6068	1.3183
Index of shyness of the child with adults	0.4583	1.0977
Child belongs to club: sports; music; art; junior scouts	0.3352	0.4721
Number of hours child watches TV alone	3.6174	5.1664
Child watches TV with parents	0.2576	0.4374
How frequently the child eats meal with parents	2.3852	1.9571
Frequency the child visits shops with parents	0.1069	0.5423
Frequency child is taken on outings by parents	0.9169	0.9921
Frequency family meets with relatives	1.9842	2.2315
Time child spends with father	1.3455	1.5470

Table 2: Parental Social Interaction (Aged 33) and Children's Academic Test Scores (Sample = Children of the NCDS Respondents)

	DEPENDENT VARIABLES					
	PIAT READING TEST SCORE		PIAT MATHS TEST SCORE		PPVT-R TEST SCORE	
	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC
Intercept	2.7493	(98.36)	2.6017	(89.52)	3.6602	(33.28)
Child's age	0.1053	(62.82)	0.1027	(59.09)	-0.0401	(22.57)
Child male	-0.0116	(1.61)	0.0286	(3.84)	0.0126	(1.82)
Whether child has siblings	-0.0127	(2.99)	0.0119	(2.75)	-0.0130	(3.07)
Whether eldest child	-0.0227	(6.78)	-0.0252	(8.81)	0.0669	(8.58)
Number of children present during test	0.0241	(4.87)	0.0202	(3.95)	-0.0097	(2.89)
Number of books child has of his/her own	0.0415	(16.81)	0.0383	(14.99)	0.0174	(7.57)
Whether single parent household	-0.0377	(3.60)	-0.0114	(1.05)	-0.0074	(0.66)
Age of second parent	-0.0001	(0.30)	0.0005	(1.71)	0.0005	(1.72)
<i>Highest educational attainment of parent</i>						
GCSE	0.0832	(10.04)	0.0676	(7.86)	0.1183	(14.64)
A Levels	0.1249	(4.10)	0.1142	(3.59)	0.2385	(8.66)
Diploma	0.0501	(3.24)	0.0669	(4.22)	0.1059	(7.76)
Teaching/Nursing	0.0387	(1.77)	0.0765	(3.44)	0.0831	(4.26)
Degree	0.0591	(3.21)	0.0587	(2.93)	0.1673	(11.85)
Number of clubs parent member of at 33	0.0128	(3.42)	0.0140	(3.64)	0.0178	(5.04)
Pseudo R Squared	0.1832		0.1791		0.0775	
Log Likelihood $\chi^2(20)$	8,029.00 $p=[0.000]$		6,533.55 $p=[0.000]$		1,942.46 $p=[0.000]$	
Observations	2,721				2,958	

Notes: Additional controls in test score models: logarithm of household income; whether the family owns its own home; a dummy indicator of whether the child has experienced health problems; and whether the parent has maths and/or reading problems.

Table 3: Children’s Academic Test Scores, Parental Social Interaction (Aged 33) – Additional Controls (Sample = Children of the NCDS Respondents)

	DEPENDENT VARIABLES					
	PIAT READING TEST SCORE		PIAT MATHS TEST SCORE		PPVT-R TEST SCORE	
	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC
Intercept	3.0853	(100.03)	2.9063	(90.81)	3.5901	(117.39)
Number of clubs parent is a member of at 33	0.0101	(2.63)	0.0110	(2.80)	0.0151	(4.18)
<i>Social capital of the child</i>						
Bullies other children	-0.0802	(6.27)	-0.0289	(2.27)	-0.0369	(3.21)
Number of friends	-0.0015	(1.09)	-0.0032	(2.26)	-0.0010	(0.64)
Index of shyness with children	-0.1393	(2.28)	-0.1228	(7.79)	0.0118	(2.69)
Index of shyness with adults	-0.0136	(1.69)	-0.0114	(1.42)	0.0135	(2.74)
Child belongs to club: sports; music; art etc.	0.1624	(19.53)	0.1409	(16.38)	-0.0137	(1.54)
<i>Intra-family interaction</i>						
Number of hours child watches TV Alone	-0.0056	(7.78)	-0.0031	(4.25)	-0.0030	(3.98)
Child watches TV with parents	-0.1217	(12.41)	-0.1099	(10.85)	0.0277	(2.73)
How frequently child eats meal with parents	-0.0107	(3.73)	-0.0106	(3.56)	-0.0071	(2.57)
Frequency child visits shops with parents	-0.0008	(0.11)	0.0018	(0.22)	0.0279	(4.59)
Frequency child taken on outings by parents	-0.0281	(6.08)	-0.0216	(4.54)	0.0166	(4.07)
Frequency family meets with relatives	0.0305	(14.28)	0.0283	(12.74)	-0.0064	(2.72)
Time child spends with father	0.0376	(11.57)	0.0431	(12.86)	0.0072	(2.06)
Pseudo R Squared	0.2841		0.2734		0.0841	
Log Likelihood χ^2 (192)	12,452.32 $p=[0.000]$		9,973.05 $p=[0.000]$		2,107.22 $p=[0.000]$	
Observations	2,721				2,958	

Notes: (i) Additional controls in test score models: child’s age; child’s gender; a dummy indicator of whether the child has experienced health problems; whether the child has siblings; whether child is the eldest sibling; the number of books the child owns; the number of children present when the child took the test; logarithm of household income; whether the family owns its own home; single parent household; the age of the second parent; whether the parent has math and/or reading problems; the highest educational qualification of the parent; and 160 regional dummy variables.

Table 4: Children’s Academic Test Scores, Parental Social Interaction – Type of Club Attended at Age 33 (Sample = Children of the *NCDS* Respondents)

	DEPENDENT VARIABLES					
	PIAT READING TEST SCORE		PIAT MATHS TEST SCORE		PPVT-R TEST SCORE	
	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC
PANEL A						
Political Party Membership	-0.0054	(0.18)	0.0705	(2.42)	-0.0055	(0.20)
PANEL B						
Charity or Voluntary Work	0.0127	(2.04)	0.0219	(2.74)	-0.0070	(0.61)
PANEL C						
Women’s Groups	0.0664	(3.09)	0.0147	(0.65)	0.0555	(2.94)
PANEL D						
Religious Organization	-0.0083	(1.07)	-0.0022	(0.28)	0.0185	(2.52)
PANEL E						
Parents or School Organization	0.0412	(4.45)	0.0295	(3.07)	0.0502	(5.84)
PANEL F						
Trade Union or Staff Association	0.0122	(1.39)	0.0156	(1.72)	0.0139	(1.65)
PANEL G						
Political Party Membership	-0.0121	(0.41)	0.0615	(2.08)	-0.0002	(0.01)
Charity or Voluntary Work	0.0066	(0.53)	0.0134	(2.04)	-0.0151	(1.30)
Women’s Groups	0.0593	(2.72)	0.0092	(0.40)	0.0395	(2.07)
Religious Organization	0.0150	(1.90)	-0.0062	(0.76)	0.0120	(1.61)
Parents or School Organization	0.0403	(4.23)	0.0288	(2.91)	0.0472	(5.36)
Trade Union or Staff Association	0.0142	(1.60)	0.0147	(1.61)	-0.0107	(1.26)
Observations	2,721				2,958	

Notes: (i) Additional controls in test score models: child’s age; child’s gender; a dummy indicator of whether the child has experienced health problems; whether the child has siblings; whether child is the eldest sibling; the number of books the child owns; the number of children present when the child took the test; logarithm of household income; whether the family owns its own home; single parent household; the age of the second parent; whether the parent has math and/or reading problems; the highest educational qualification of the parent; and 160 regional controls.

Table 5: Correlation between Alternative Measures of Parents' Social Capital at Age 33 (Sample = *NCDS* Respondents, i.e. Parents of the Children)

	NUMBER OF CLUBS PARENT IS A MEMBER OF	FREQUENCY PARENT UNDERTAKES SPORT	FREQUENCY PARENT ATTENDS RELIGIOUS MEETINGS	FREQUENCY PARENT ATTENDS POLITICAL MEETINGS	PARENT CAN TRUST MOST PEOPLE	NUMBER OF FRIENDS/NEIGHBORS FOR ADVICE
Number of clubs parent is a member of	1					
Frequency parent undertakes sport	0.3421 <i>p</i> =[0.0000]	1				
Frequency parent attends religious meetings	0.6214 <i>p</i> =[0.0000]	0.2366 <i>p</i> =[0.0000]	1			
Frequency parent attends political meetings	0.3598 <i>p</i> =[0.0000]	0.0258 <i>p</i> =[0.0000]	0.6259 <i>p</i> =[0.0000]	1		
Parent can trust most people	0.1504 <i>p</i> =[0.0000]	0.1155 <i>p</i> =[0.0000]	0.1455 <i>p</i> =[0.0000]	0.0828 <i>p</i> =[0.0000]	1	
Number of friends/neighbors for advice	0.0409 <i>p</i> =[0.0000]	0.0796 <i>p</i> =[0.0000]	0.0601 <i>p</i> =[0.0000]	-0.0020 <i>p</i> =[0.9297]	0.0621 <i>p</i> =[0.0000]	1

Table 6: Children's Academic Test Scores and Alternative Measures of Parental Social Capital at Age 33 (Sample = Children of the *NCDS* Respondents)

	DEPENDENT VARIABLES					
	PIAT READING TEST SCORE		PIAT MATHS TEST SCORE		PPVT-R TEST SCORE	
	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC
PANEL A						
Frequency parent undertakes sport	0.0040	(2.93)	0.0117	(5.52)	0.0052	(2.35)
PANEL B						
Frequency parent attends religious meetings	0.0021	(0.56)	-0.0005	(0.08)	0.0137	(3.97)
PANEL C						
Frequency parent attends political meetings	-0.0014	(0.33)	-0.0040	(0.92)	0.0159	(4.15)
PANEL D						
Parent can trust most people	0.0188	(4.40)	0.0275	(4.08)	0.0491	(6.96)
PANEL E						
Number of friends/neighbors for advice	0.0195	(2.83)	0.0123	(2.45)	0.0010	(0.21)
PANEL F						
Frequency parent undertakes sport	0.0038	(1.84)	0.0116	(5.47)	-0.0001	(0.03)
Frequency parent attends religious meetings	0.0037	(0.80)	0.0013	(0.26)	0.0057	(1.78)
Frequency parent attends political meetings	-0.0040	(0.77)	-0.0059	(1.09)	0.0108	(2.22)
Parent can trust most people	-0.0025	(0.35)	0.0024	(0.31)	0.0472	(6.67)
Number of friends/neighbors for advice	0.0118	(2.35)	0.0083	(2.59)	-0.0004	(0.09)
Observations	2,721				2,958	

Notes: (i) Additional controls in test score models: child's age; child's gender; a dummy indicator of whether the child has experienced health problems; whether the child has siblings; whether child is the eldest sibling; the number of books the child owns; the number of children present when the child took the test; logarithm of household income; whether the family owns its own home; single parent household; the age of the second parent; whether the parent has math and/or reading problems; and the highest educational qualification of the parent. (ii) We also include the social capital of the child, measures of family interaction and 160 regional dummy variables, as in Table 3. (iii) The frequency of undertaking sporting activities goes from: 0=never, through to 5=every day. Similarly, the frequency of attending religious and/or political meetings goes from: 0=never, through to 3=at least once a week. The index of friends/neighbors the respondent can turn to for advice goes from 0 to 4.

Table 7: Children's Academic Test Scores, Parental Social Interaction over Time (Sample = Children of the *NCDS* Respondents)

	DEPENDENT VARIABLES					
	PIAT READING TEST SCORE		PIAT MATHS TEST SCORE		PPVT-R TEST SCORE	
	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC
PANEL A						
Number of clubs parent member of at 23	0.0129	(2.81)	0.0004	(0.11)	0.0110	(3.43)
PANEL B						
Number of clubs parent member of at 23	0.0029	(0.77)	-0.0031	(0.78)	0.0010	(0.29)
Number of clubs parent member of at 33	0.0091	(2.28)	0.0120	(2.90)	0.0148	(3.90)
PANEL C						
Number of clubs parent member of at 23	0.0120	(2.61)	0.0089	(2.88)	0.0158	(3.69)
Change in number of clubs 23 to 33	0.0091	(2.28)	0.0120	(2.90)	0.0148	(3.90)
PANEL D						
Number of clubs parent member of at 33	0.0101	(2.63)	0.0110	(2.80)	0.0151	(4.18)
PANEL E						
Number of clubs parent member of at 33	0.0113	(2.68)	0.0092	(2.11)	0.0120	(5.03)
Number of clubs parent member of at 42	-0.0032	(0.70)	0.0048	(1.02)	0.0064	(1.62)
PANEL F						
Number of clubs parent member of at 33	0.0081	(2.72)	0.0140	(2.87)	0.0175	(6.30)
Change in number of clubs 33 to 42	0.0032	(0.70)	-0.0048	(1.02)	-0.0110	(5.03)
Observations	2,721				2,958	

Notes: (i) Additional controls in test score models: child's age; child's gender; a dummy indicator of whether the child has experienced health problems; whether the child has siblings; whether child is the eldest sibling; the number of books the child owns; the number of children present when the child took the test; logarithm of household income; whether the family owns its own home; single parent household; the age of the second parent; whether the parent has math and/or reading problems; and the highest educational qualification of the parent. (ii) We also include the social capital of the child, measures of family interaction and 160 regional dummy variables, as in Table 3.

Table 8: Children’s Academic Test Scores and Parental Social Interaction over Time – Measured Prior to Tests (Sample = Children of the *NCDS* Respondents)

<u>PARENT SOCIAL ACTIVITY AGED 23</u>	DEPENDENT VARIABLES					
	PIAT READING TEST SCORE		PIAT MATHS TEST SCORE		PPVT-R TEST SCORE	
	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC
PANEL A						
Frequency parent undertakes sport	0.0018	(0.72)	-0.0024	(0.92)	0.0043	(2.90)
PANEL B						
Frequency parent attends religious meetings	0.0135	(2.92)	0.0011	(0.22)	0.0177	(4.33)
PANEL C						
Frequency parent undertakes voluntary work	0.0027	(0.61)	0.0079	(2.73)	0.0041	(2.01)
PANEL D						
Frequency parent goes to the cinema	-0.0012	(0.02)	0.0131	(2.12)	0.0161	(3.43)
PANEL E						
Frequency parent meets friends	0.0004	(0.14)	0.0034	(1.18)	0.0090	(3.39)
Observations	2,721				2,958	

Notes: (i) Additional controls in test score models: child’s age; child’s gender; a dummy indicator of whether the child has experienced health problems; whether the child has siblings; whether child is the eldest sibling; the number of books the child owns; the number of children present when the child took the test; logarithm of household income; whether the family owns their own home; single parent household; the age of the second parent; whether the parent has maths and/or reading problems; and the highest educational qualification of the parent. (ii) We also include the social capital of the child, measures of family interaction and 160 regional dummy variables, as in Table 3. (iii) The frequency of undertaking sporting activities, undertaking voluntary work, going to the cinema and meeting friends each goes from: 0=never, through to 5=five times per week. Similarly, the frequency of attending religious meetings goes from: 0=never, through to 3=at least once a week.