

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. In accordance with the existing literature, our results support a positive association between education and social interaction. Furthermore, 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.

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

JEL Classification: J24, Z12

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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), 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.’ (Glaeser *et al.*, 2002, p. F455).

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. To be specific, we analyze the relationship between social interaction and educational attainment at the individual level using British cohort data from the *National Child Development Study (NCDS)*. Furthermore, 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. Social interaction outside the family may lead to parents being able to access the support and assistance of other individuals and, hence, may benefit parents in bringing up their children (Coleman, 1988, and Furstenberg and Hughes, 1995) and thereby

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

enhance the academic development of their children. Fan (2007) 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. To be specific, 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 and 42. 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 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.³ Prior to analyzing the relationship between the social interaction of the parent and their child's academic development, we explore the relationship between the parent's level of education and the extent to which they engage in social interaction. We compare two commonly used measures of educational attainment: an index of the highest qualification obtained and years of schooling.⁴ Table 1 presents the distribution of the number of types of clubs by educational attainment when the respondent is aged 33. The summary statistics suggest that club membership is positively associated with education.

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 maths, 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 also been used to measure the educational development of children in the U.S., see, for example, James-Burdumy (2005).

³ It should be acknowledged, however, that in accordance with Glaeser *et al.* (2002), the 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.

⁴ The educational attainment index is defined on a six point scale indicating: no educational qualifications; 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.

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.

Children start the test at a point, which is appropriate for their age and establish a 'basal' ('ceiling') by achieving a certain number of consecutive correct (incorrect) answers. The maths test comprises multiple choice questions, which 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. Higher scores in the tests 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. Children are presented with pictures and are asked to indicate which picture matches the word spoken by the interviewer. This test has been regarded as an aptitude test for verbal ability and an achievement test for vocabulary. The sample size for PIATs is 2,271 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, maths 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.⁶ Hence, since the dependent variable is essentially a non negative integer count, we adopt a Poisson regression model, which

⁶ In Section 3.3, where we explore the robustness of our findings, we normalize the test scores and adopt OLS. Our findings are robust to this alternative functional form.

specifies that each value of the dependent variable, y_i , is drawn from a Poisson distribution with parameter I_i , which is related to the regressors \mathbf{x}_i :

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

(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 p in equation (1). In terms of the additional explanatory variables, we include: the age of the child; 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; 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; and the highest educational qualification of the parent of the child. Finally, we include whether the parent has reported that he/she has experienced reading or maths problems since leaving school. Summary statistics of the explanatory variables included in equation (1) are presented in Table 2.

3. Results

3.1 Social Interaction and the Educational Attainment of the Parent

Prior to exploring the relationship between the social interaction of the parent and their child's education, we explore the relationship between the parent's level of education and the extent

to which they engage in social interaction. We compare two commonly used measures of educational attainment: an index of the highest qualification obtained and years of schooling. Table 3 presents findings pertaining to the relationship between club membership and the education of the parent. We employ a standard ordinary least squares (OLS) approach for years of schooling and, following Dearden *et al.* (2002), we adopt an ordered probit specification when analyzing the index of highest educational attainment. Clearly, the greater the number of clubs an individual is a member of, the higher is their level of educational attainment. In the case of the highest educational attainment index, a one standard deviation increase in the extent of club membership is associated with a decrease in the probability of having no education by 9.87%.⁷ Similarly, club membership is positively associated with the number of years of schooling. Our educational attainment equation follows a standard specification: see Dearden *et al.* (2002); Ermisch and Francesconi (2001); and Harmon and Walker (2000), controlling for school resources, family background and ability (Table 3A).⁸ In Table 3B, we explore whether education influences club membership. Regardless of how education is measured, there is a positive influence on club membership. As such, irrespective of the direction of causality, in accordance with existing literature, our findings support a positive association between education and club membership, i.e. our proxy for social interaction.

3.2 Parental Social Interaction and Children's Academic Test Scores

We now consider whether there is a 'spillover' effect where a parent's social interaction is related to the academic ability of their children. Table 4 presents the results of estimating equation (1), where the dependent variable denotes the test score of the children of the *NCDS*

⁷ This is calculated based on the mean sample characteristics of respondents. For example, the 9.87% effect is calculated by multiplying the marginal effect, -0.1001, by the standard deviation of the number of clubs, 0.9858.

⁸ See Brown and Taylor (2007) for results relating to the full specification.

respondents in reading, mathematics or vocabulary.⁹ It is apparent that the number of clubs that the parent belongs to is positively related to the test scores attained by the children.¹⁰ A one standard deviation increase in the number of clubs the parent belongs to is associated with increases in the reading, maths and vocabulary scores of 1.6%, 1.5% and 3.4% respectively.^{11,12}

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, in Table 5, we re-estimate equation (1) 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). In particular, we are interested in whether the influence of the social interaction of the parent remains once we control for the child's social capital. Our findings suggest that shy children are likely to have lower maths and reading test scores, whilst being a bully is negatively associated with all test scores. The number of friends the child has is inversely associated with maths and reading test scores, yet positively associated with the vocabulary test score. The sizes of the effects are, however, relatively moderate. The child's

⁹ 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.

¹⁰ 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.

¹¹ 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.

¹² It is unlikely that the social interaction of the parent is capturing their own education since the set of explanatory variables in equation (1) controls for the educational attainment of the parent. Parental club membership has a similar impact on the child's test scores when parental education is predicted from the specification in Table 3A.

club membership has a strong influence on their maths and reading test scores – both in terms of magnitude, with influences of 20% and 19% respectively, and statistical significance suggesting that even at a young age there is a positive association between education and social interaction. Noticeably, parental club membership is still positively related to the children’s test scores.¹³

One 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, in Table 6 Panel A 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.

It is apparent from Table 6 Panel A 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

¹³ 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. These results are available from the authors upon request.

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.¹⁴

Again, as found in Table 5, the child's club membership has a strong positive relationship with the test scores. Moreover, the effects from parental social interaction still remain once the controls for intra-family interaction are included. A one standard deviation increase in parental club membership is associated with increases in the children's reading, maths and vocabulary test scores of 1.2%, 1.1% and 2.0% respectively – hence the effects are only moderately influenced by controlling for the child's social capital and family interaction. 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.

In order to further check for robustness, in Table 6 Panel B, we replace the number of clubs of which the parent is a member with its predicted value based on the set of control variables used to model the club membership of the parent in Table 3B. The set of over-identifying instruments includes the number of cigarettes smoked, past club membership, *BSAG* personality traits of the parent,¹⁵ economic status, whether the respondent's spouse is

¹⁴ This finding might also reflect an age affect 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.

¹⁵ The *BSAG* personality scores refer to the Bristol Social-Adjustment Guide, which was designed to describe an individual's behavior and attitudes in particular settings. 'Syndrome' scores were used in the *NCDS* to give a quantitative assessment of behavior defined from the following syndromes: Unforthcomingness; Withdrawal; Depression; Anxiety for acceptance by adults; Hostility towards adults; 'Writing off' of adults and adult standards; Anxiety for acceptance by children; Hostility towards children; Restlessness; 'Inconsequential'

unemployed, hours worked and regional controls.¹⁶ The positive association between parental social activity and the child's test scores remains after replacing the club membership of the parent with its predicted value, with the magnitude of the influence being slightly exacerbated.¹⁷

3.3 Robustness

In this final sub-section, we explore the robustness of our findings in four ways. Firstly, we explore whether our findings reflect unobserved family effects. Secondly, we explore whether our findings are robust to amending the measure of social interaction. Thirdly, we consider the timing of the measurement of social interaction and the test scores in order to explore causality issues. Finally, we investigate whether our key findings are robust to specifying an alternative functional form: namely OLS estimation with standardized test scores.

Social Interaction and Family Fixed Effects

One could argue that the results relating parental social interaction and their offspring's academic test scores may be driven by unobserved family effects, which are correlated with social interaction. Consequently, as a robustness check we control for families that have more than one child taking the tests by allowing for clustering within groups, which controls for intra-family correlations (Table 7 Panel A). The analysis is based upon the same explanatory variables employed in Table 5. The parental social interaction effects are largely unchanged indicating a statistically significant positive relationship between parental club membership and the child's test scores.

behavior; Miscellaneous symptoms and Miscellaneous nervous symptoms. We use the combined total score to each of these 'syndromes' where a higher numerical score signifies greater behavioral problems.

¹⁶ To test for the validity of the instruments we consider the joint significance of the over-identifying variables in the club membership equation. We find that these variables are jointly significant at the 1% level supporting the use of these instruments. Secondly, the residuals from the test score equation are regressed on the over-identifying instruments. Our findings suggest an insignificant relationship between the residuals and the over-identifying variables thereby further endorsing the validity of this set of instruments.

¹⁷ The controls employed in Table 6 Panel A are also included in the model presented in Table 6 Panel B.

An alternative approach, which allows for both potential family fixed effects and child fixed effects to be eradicated, is to follow the children of the *NCDS* respondents sampled in 1991 through to 2000, i.e. when the parent (i.e. *NCDS* respondent) is aged 42. Unfortunately, the only available proxy for the education of the respondents' children in 2000 is the age that the child left full time education. There are 841 children of the *NCDS* respondents who can be matched across time (i.e. 1991 to 2000) and who had completed full time education by 2000. For 1991, we created a dummy variable, which equals one if the child had above average PIAT and PPVT-R scores. Similarly, for 2000, a binary dummy variable signifies whether the age that the child left full time education was above the average. We then difference the two indicators across time in order to obtain a proxy for the change in the children's education between 1991 and 2000.¹⁸ The change in education is estimated via an ordered probit model where changes in the education of the child relative to the average are defined as: 0 = decreased; 1 = no change; and 2 = increased. With respect to the explanatory variables, there is also information relating to parental social interaction in 2000. In 1991 and 2000, the types of club membership are consistently defined as: religious organizations; trade union/staff associations; an environmental charity/voluntary group; other charity/voluntary group; and any other type of club. The correlation between parental club membership at age 33 and age 42 is 0.4343. We define the change in parental social interaction as: $\Delta SOC_t^{parent} = SOC_{1991}^{parent} - SOC_{2000}^{parent}$. Restricting the measure of club membership to be identical across time and differencing enables us to model: $\Delta E_t^{child} = g(\Delta SOC_t^{parent})$, i.e. the

¹⁸ To be specific, y denotes the test score in 1991 (age left full time education in 2000) of the child and \bar{y} is average education across children in 1991 (2000). The binary indicators are defined as: $e_{1991}^{child} = 1$ if $y_{1991} > \bar{y}_{1991}$, 0 otherwise, and $e_{2000}^{child} = 1$ if $y_{2000} > \bar{y}_{2000}$, 0 otherwise. Differencing the indicators yields: $\Delta E_t^{child} = e_{1991}^{child} - e_{2000}^{child}$.

relationship between the change in the education of the child over time and the change in the parents' social interaction over time.

From the results presented in Table 7 Panel B, it is evident that the change in the number of clubs the parent is a member of is positively associated with the probability that the child has experienced an increase in education relative to the mean. This is in the region of 1.96% based upon a one standard deviation increase in the change in parental club membership over time. These robustness checks suggest that the relationship between parental social interaction and their offspring's education is not a consequence of unobserved family fixed effects.

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. So 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, attends religious meetings or attends 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).¹⁹ These measures have been used in the previous literature to proxy social capital, see Glaeser *et al.* (2002). Table 8 presents the correlations between the different

¹⁹ The intensity measures and the trust measure are positively related to the educational attainment of the parent in accordance with the results presented in Tables 3A and 3B. These results are omitted for brevity but are available on request. See Brown and Taylor (2007) for a detailed analysis of the determinants of the frequency of attending religious and political meetings.

proxies of social capital where there is generally a positive and statistically significant relationship between the alternative measures.

In Table 9, we replace parental club membership with each of the alternative measures of the parents' social capital whilst controlling for the child's social capital and family interaction. Introducing each measure individually, Panels A through to E generally show 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 – 2.9%, 2.8% and 6.3% respectively.²⁰ 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 (2007). Finally, each of the alternative measures of social interaction are entered simultaneously in Panel F. 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 coefficient as well as statistical significance for the maths and reading tests, whilst trust dominates for the PPVT-R test.

Timing and Causality Issues

It is generally difficult to justify a causal interpretation in applied econometrics without finding plausible sources of identifying variation. Hence, our findings of a positive relationship between parent's social capital and the children's test scores do not necessarily imply a causal relationship.²¹ So far, we have explored the relationship between the parents'

²⁰ The functional form of equation (1) is $E(y|x_1, x_2, \mathbf{L}, x_k) = \exp(f_1, f_2, \mathbf{L}, f_k)$ and taking logs gives the approximation $\% \Delta E(y|x) \approx 100 \times f_j$ for a change in a binary variable x_j .

²¹ The existing literature, which has focused upon intergenerational transfers of parental education and economic outcomes of their offspring, e.g. 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.

social capital 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 suggests evidence of a causal relationship. Furthermore, when the respondents (i.e. the parents) 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 measures of social interaction and social capital, the *NCDS* includes information on the number of types of clubs that the parent was an active 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 this measure 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 additional 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 used in Table 9, specifically the frequency with which individuals undertake sport and/or attend religious meetings.²²

In Table 10, we replace parental club membership at age 33 with proxies of the parents’ social interaction at age 23, each measured prior to the children taking the PIAT and PPVT-R tests, whilst also controlling for the child’s social capital and family interaction.²³

²² The correlation between sporting (religious) activities at the ages of 23 and 33 is 0.2266 (0.5925).

²³ The child’s test score, y , is modeled as follows: $y_{t=1991}^{child} = f(SOC)_{t=1981}^{parent}$.

The results presented in Table 10 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 1.1% and 0.9% respectively. Such influences are similar in magnitude to those based upon club membership at age 33. Introducing each alternative measure of social interaction individually, Panels B through to F generally support a positive association between parental social capital and the child's test scores.²⁴ 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 1.1% and 1.6% respectively. The results presented in Table 10 are consistent with a causal interpretation of the relationship between parent's social capital and the child's test scores.^{25,26}

Functional Form

In order to further explore the robustness of our findings, we analyze an alternative functional form. With each of the tests, children start at a point, which is appropriate for their age and establish a 'basal' ('ceiling') by achieving a certain number of consecutive correct (incorrect) answers. Hence, children are asked different sets of questions depending on their initial answer. Rather than using the 'raw' test score, which reflects the number of correct answers a child provides, one can employ standardized scores, see Fryer and Levitt (2004). Hence, we explore the robustness of our results by normalizing the test scores to have a mean of zero and a standard deviation of unity and re-estimate equation (1) by Ordinary Least Squares (OLS), see Zavodny (2006). Our focus is on the relationship between parental social interaction and the children's test scores using the full set of measures of social interaction defined above and

²⁴ The only exception is the frequency at which parents socialize with friends which does not significantly influence any of the test scores.

²⁵ 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 to have children. In addition, we have replaced the number of clubs the parent is a member of in 1981 or 1991 with a similar proxy of social interaction for when the parent is aged 42. For this later time period, club membership has no significant influence upon the test scores of the child in 1991, which is consistent with a causal relationship.

²⁶ The causality argument is less sanguine however if there are unobserved fixed effects that are correlated with parent's social interaction and also correlated with the child's test score.

controlling for intra-family interaction and the social capital of the child. To be specific, we replicate the analysis of Tables 9 and 10 based on the alternative functional form and standardized test scores.

Table 11 Panel A presents the results relating to the relationship between parental social interaction at 33 and their offspring's test scores. We also investigate the relationship between the parent's social capital at age 23 (i.e. 1981) and the test scores of children taken in 1991. These results are summarized in Table 11 Panel B. In rows 1 to 3 of Table 11 Panels A and B, the parental social interaction variables are based on the measures of social capital in 1981 and 1991, i.e. ages 23 and 33, which are identical, namely: the number of clubs the parent is a member of; the frequency at which the parent undertakes sport; and the frequency at which the parent attends religious meetings. Our principle measure of parental social interaction, the number of clubs that the parent is a member of, is positively associated with the children's test scores and this relationship is arguably of a causal nature since club membership in 1981 also influences the PIAT reading and PPVT-R test scores. Indeed, evaluated at the mean, a one standard deviation increase in parental club membership at age 23 is associated with a 0.026 (0.046) standard deviation increase above the mean in the PIAT reading (PPVT-R) test score. There is also evidence that parental social interaction in sport and religion influences children's reading and vocabulary test scores (see rows 2 to 3 in Table 11 Panels A and B). The remaining rows of Table 11 (rows 4 to 6) focus on additional measures of social interaction, which are not comparable across time. In general, there is evidence of a positive association between social interaction and the reading and vocabulary test scores of children.

4. Conclusion

We have investigated the relationship between educational attainment and engagement in formal social activities. Our empirical findings are in accordance with the existing literature

supporting a positive relationship between education and social interaction. In addition, our results 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, maths and vocabulary tests. This result is robust to controlling for intra-family social interaction and the social interaction of the child. In addition, our empirical findings support a causal relationship, which is largely insensitive to functional form and normalizing the test scores.

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: Distribution of Club Membership by Education (Sample = *NCDS* Respondents, i.e. Parents)

Number of Clubs	FREQUENCY (%)						
	<i>ALL INDIVIDUALS</i>	No Education	GCSE C	A Level	Diploma	Nursing/Teaching	Degree
0	54.47%	44.33%	70.74%	18.52%	25.71%	21.31%	9.09%
1	26.09%	37.45%	16.76%	48.15%	27.86%	32.79%	29.75%
2	12.86%	12.96%	8.74%	18.52%	30.00%	27.87%	30.58%
3	4.89%	4.66%	2.75%	11.11%	11.43%	13.11%	18.18%
4	1.40%	0.51%	0.87%	3.70%	5.00%	4.92%	8.26%
5	0.29%	0.10%	0.14%	0.00%	0.00%	0.00%	4.13%

Table 2: 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
Number of schools child has attended	1.1220	1.0784
Single parent family	0.1474	0.3545
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 3A: The Effect of Parental Club Membership on the Educational Attainment of the Parent (Sample = *NCDS* Respondents, i.e. Parent of the Child)

	DEPENDENT VARIABLE = Highest Educational Attainment at 33 (ORDERED PROBIT MODEL)			DEPENDENT VARIABLE = Years of Schooling (OLS)	
	COEFFICIENT	T STATISTIC	M.E. (<i>probability no education</i>)	COEFFICIENT	T STATISTIC
Number of clubs	0.2754	(8.00)	-0.1001	0.3307	(8.03)
(Pseudo) R Squared	0.1940			0.3184	
Wald χ^2 (42)	752.63 $p=[0.000]$			40.13 $p=[0.000]$	
F (42, 2,678)					
Observations	2,721				

Notes: (i) Controls are: gender; class size at 11 and 16; school type; single sex school at 16; the school lacked library facilities, sports facilities, science facilities and/or any other facilities when aged 16; mother and father's occupation when growing up; age mother and father left full time education; presence of older and younger siblings; parental interest in the child when aged 7; frequency mother and father used library facilities when child was aged 11; frequency mother and father read to the child when growing up; child had a room to do homework when aged 11; free school meals when aged 11; mother speaks English; mother and/or father dead when growing up; family difficulties due to divorce or separation, unemployment, alcohol and/or finances when growing up; maths and reading test scores when aged 11; spent time in school before compulsory school joining age. (ii) M.E. is the marginal effect showing the probability of having no education.

Table 3B: The Effect of the Parent's Education on the Club Membership of the Parent (Sample = *NCDS* Respondents, i.e. Parent of the Child)

	DEPENDENT VARIABLE = Number of clubs currently a member of when aged 33: ORDERED PROBIT					
	COEFFICIENT	T STATISTIC	M.E. (<i>probability no clubs</i>)	COEFFICIENT	T STATISTIC	M.E. (<i>probability no clubs</i>)
Years of schooling	0.1252	(7.54)	-0.0456			
GCSE				0.1107	(1.61)	-0.0403
A Levels				0.3365	(1.64)	-0.1291
Diploma				0.5663	(5.08)	-0.2197
Teaching/Nursing				0.6878	(4.58)	-0.2678
Degree				0.8021	(6.12)	-0.3111
Pseudo R Squared	0.2717			0.2736		
Wald χ^2 (g)	8,453.64 $p=[0.000]$			7,107 $p=[0.000]$		
Observations	2,721					

Notes: (i) Controls measured when individuals are aged 33: gender; employment status; unemployed spouse; number of hours worked; ethnicity; total income; home owned outright; marital status; household size; disabled; health over previous 12 months; number of children; bullied at school; number of cigarettes smoked per day; occupational status of parents when growing up; personality traits; a member of a club when aged 21 (i.e. past club membership); and 160 regional dummies. (ii) When measuring educational attainment by years of schooling $g=128$, whilst when employing educational dummies $g=132$. (iii) M.E. is the marginal effect of the parent not being a member of any clubs.

Table 4: Parental Social Interaction 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	2.7623	(133.70)	2.6878	(125.00)	3.7284	(196.79)
Child's age	0.0993	(61.46)	0.0957	(57.12)	0.0409	(24.13)
Child male	-0.0286	(4.08)	0.0104	(1.44)	0.0305	(4.49)
Whether child has siblings	-0.0118	(0.95)	0.0276	(2.12)	0.0504	(4.12)
Number of children present during test	0.0399	(9.61)	0.0312	(7.02)	0.0101	(2.45)
Number of books child has of his/her own	0.0371	(16.62)	0.0313	(13.53)	0.0261	(12.15)
Whether single parent household	-0.0321	(3.50)	-0.0002	(0.02)	-0.0394	(4.04)
<i>Highest educational attainment of parent</i>						
GCSE	0.1026	(13.33)	0.0837	(10.50)	0.0986	(12.99)
A Levels	0.1307	(4.29)	0.1120	(3.52)	0.2610	(9.48)
Diploma	0.0627	(4.10)	0.0725	(4.62)	0.1079	(8.01)
Teaching/Nursing	0.0317	(1.45)	0.0687	(3.09)	0.0891	(4.59)
Degree	0.0522	(2.86)	0.0553	(2.93)	0.1648	(11.77)
Number of clubs parent member of at 33	0.0164	(4.72)	0.0152	(4.23)	0.0347	(10.48)
Pseudo R Squared	0.1204		0.1135		0.0658	
Log Likelihood $c^2(17)$	6,652.61 $p=[0.000]$		5,246.73 $p=[0.000]$		2,015.31 $p=[0.000]$	
Observations	2,721		2,721		2,958	

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

Table 5: Children's Academic Test Scores, Parental Social Interaction and the Social Capital of Child (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	3.0377	(137.16)	2.9498	(128.07)	3.6166	(172.52)
Bullies other children	-0.0541	(4.27)	-0.0048	(0.38)	-0.0291	(2.58)
Number of friends	-0.0028	(2.13)	-0.0039	(2.91)	0.0049	(3.94)
Index of shyness with children	-0.1657	(4.70)	-0.1509	(2.34)	0.0157	(3.68)
Index of shyness with adults	-0.0189	(2.38)	-0.0158	(1.99)	0.0197	(4.01)
Child belongs to club: sports; music; art etc.	0.2052	(7.90)	0.1871	(4.56)	0.0063	(0.85)
Number of clubs parent member of at 33	0.0129	(3.54)	0.0135	(3.58)	0.0273	(7.90)
Pseudo R Squared	0.2083		0.1964		0.0678	
Log Likelihood $\chi^2(22)$	11,510.61 $p=[0.000]$		9,076.34 $p=[0.000]$		2,076.22 $p=[0.000]$	
Observations	2,721				2,958	

Notes: 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 (Panel A only); 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; whether the parent has maths and/or reading problems; and the highest educational qualification of the parent.

Table 6: Children's Academic Test Scores, Parental Social Interaction and Intra-Family Interaction (Sample = Children of the *NCDS* Respondents)

PANEL A	DEPENDENT VARIABLES					
	PIAT READING TEST SCORE		PIAT MATHS TEST SCORE		PPVT-R TEST SCORE	
	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC
Intercept	3.1155	(128.59)	3.0171	(119.94)	3.5572	(151.89)
Number of clubs parent is a member of at 33 <i>Social capital of the child</i>	0.0121	(3.20)	0.0113	(2.89)	0.0201	(4.72)
Bullies other children	-0.0776	(6.11)	-0.0289	(2.27)	-0.0258	(2.26)
Number of friends	-0.0026	(1.96)	-0.0045	(3.21)	0.0026	(1.96)
Index of shyness with children	-0.1454	(2.33)	-0.1317	(9.18)	0.0134	(3.75)
Index of shyness with adults	-0.0168	(2.11)	-0.0145	(1.81)	0.0187	(3.12)
Child belongs to club: sports; music; art etc. <i>Intra-family interaction</i>	0.1654	(20.09)	0.1416	(16.63)	-0.0081	(0.92)
Number of hours child watches TV Alone	-0.0059	(8.16)	-0.0031	(4.27)	-0.0028	(3.75)
Child watches TV with parents	-0.1348	(14.12)	-0.1314	(3.32)	0.0312	(3.12)
How frequently child eats meal with parents	-0.0089	(3.32)	-0.0089	(3.20)	-0.0001	(0.38)
Frequency child visits shops with parents	-0.0268	(3.60)	-0.0255	(3.32)	0.0314	(5.41)
Frequency child taken on outings by parents	-0.0285	(6.32)	-0.0261	(5.62)	0.0319	(8.06)
Frequency family meets with relatives	0.0332	(5.75)	0.0291	(3.30)	-0.0010	(0.44)
Time child spends with father	0.0408	(12.67)	0.0474	(14.25)	0.0068	(1.95)
Pseudo R Squared	0.2214		0.2100		0.0711	
Log Likelihood $c^2(30)$	12,236.02 $p=[0.000]$		9,703.13 $p=[0.000]$		2,177.98 $p=[0.000]$	
PANEL B	PIAT READING TEST SCORE		PIAT MATHS TEST SCORE		PPVT-R TEST SCORE	
	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC
Predicted Club Membership of Parent	0.0290	(4.24)	0.0286	(4.04)	0.0304	(4.60)
Pseudo R Squared	0.2215		0.2101		0.0707	
Log Likelihood $c^2(30)$	12,243.74 $p=[0.000]$		9,711.10 $p=[0.000]$		2,167.58 $p=[0.000]$	
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; 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; whether the parent has maths and/or reading problems; and the highest educational qualification of the parent. (ii) In Panel B club membership is predicted using the controls listed in Table 3B.

Table 7: Children’s Academic Test Scores, Parental Social Interaction and Family Fixed Effects (Sample = Children of the *NCDS* Respondents)

PANEL A: CLUSTERING WITHIN GROUPS	PIAT READING TEST SCORE		PIAT MATHS TEST SCORE		PPVT-R TEST SCORE			
	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC	COEFFICIENT	T STATISTIC		
Number of clubs parent is a member of at 33	0.0134	(2.01)	0.0136	(2.05)	0.0279	(5.46)		
Log Likelihood $c^2(21)$	9,627.14 $p=[0.000]$		7,026.28 $p=[0.000]$		1,625.22 $p=[0.000]$			
Observations	2,721				2,958			
PANEL B: RELATIONSHIP OVER TIME	CHANGE IN EDUCATION ΔE_t^{child}							
	COEF	T STAT	DECREASED M.E	T STAT	NO CHANGE M.E	T STAT	INCREASED M.E.	T STAT
Change in number of clubs parent is s member of ΔSOC_t^{parent}	0.1471	(2.21)	-0.0315	(2.21)	0.0019	(0.63)	0.0296	(2.18)
Log Likelihood $c^2(12)$	32.59 $p=[0.001]$							
Pseudo R Squared	0.0228							
Observations	841							

Notes: (i) In Panel A, the controls are as in Table 5. (ii) In Panel B, changes in education are ranked: 0=decreased; 1=no change; and 2=increased. (iii) M.E. denotes marginal effect. (iv) Additional controls in Panel B include: the number of children in the household in 1991; the number of books the child owned in 1991; the number of schools the child had attended by 1991; logarithm of household income in 1991; whether the family owned their own home in 1991; the highest educational attainment of the parent in 1991; and single parent household in 1991.

Table 8: Correlation between Measures of Parents' Social Capital (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=[0.0000]</i>	1				
Frequency parent attends religious meetings	0.6214 <i>p=[0.0000]</i>	0.2366 <i>p=[0.0000]</i>	1			
Frequency parent attends political meetings	0.3598 <i>p=[0.0000]</i>	0.0258 <i>p=[0.0000]</i>	0.6259 <i>p=[0.0000]</i>	1		
Parent can trust most people	0.1504 <i>p=[0.0000]</i>	0.1155 <i>p=[0.0000]</i>	0.1455 <i>p=[0.0000]</i>	0.0828 <i>p=[0.0000]</i>	1	
Number of friends/neighbors for advice	0.0409 <i>p=[0.0000]</i>	0.0796 <i>p=[0.0000]</i>	0.0601 <i>p=[0.0000]</i>	-0.0020 <i>p=[0.9297]</i>	0.0621 <i>p=[0.0000]</i>	1

Table 9: Children's Academic Test Scores and Alternative Measures of Parental Social Capital (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	0.0038	(2.87)	0.0102	(4.84)	0.0052	(2.58)
PANEL B						
Frequency parent attends religious meetings	0.0045	(1.20)	0.0005	(0.12)	0.0169	(4.92)
PANEL C						
Frequency parent attends political meetings	-0.0002	(0.06)	-0.0034	(0.79)	0.0161	(4.23)
PANEL D						
Parent can trust most people	0.0288	(4.40)	0.0275	(4.08)	0.0624	(9.74)
PANEL E						
Number of friends/neighbors for advice	0.0221	(4.84)	0.0164	(3.46)	0.0086	(1.96)
PANEL F						
Frequency parent undertakes sport	0.0023	(1.12)	0.0100	(4.61)	0.0041	(1.98)
Frequency parent attends religious meetings	0.0056	(1.20)	0.0021	(0.45)	0.0105	(2.38)
Frequency parent attends political meetings	-0.0053	(1.02)	-0.0059	(1.11)	0.0081	(1.66)
Parent can trust most people	0.0082	(1.04)	0.0109	(1.34)	0.0380	(4.99)
Number of friends/neighbors for advice	0.0134	(2.48)	0.0115	(2.05)	0.0009	(0.17)
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; 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; 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 and measures of family interaction, as in Table 6. (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 10: Children's Academic Test Scores, Parental Social Interaction and Causality (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						
Number of clubs parent member of	0.0129	(2.81)	-0.0045	(1.20)	0.0110	(3.43)
PANEL B						
Frequency parent undertakes sport	-0.0009	(0.36)	0.0052	(2.05)	0.0058	(2.59)
PANEL C						
Frequency parent attends religious meetings	0.0155	(3.36)	0.0014	(0.29)	0.0219	(5.39)
PANEL D						
Frequency parent undertakes voluntary work	0.0021	(0.47)	0.0073	(2.60)	0.0047	(2.16)
PANEL E						
Frequency parent goes to the cinema	-0.0009	(0.02)	0.0161	(2.61)	0.0233	(5.02)
PANEL F						
Frequency parent meets friends	-0.0008	(0.30)	0.0017	(0.62)	-0.0009	(0.36)
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; 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; 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 and measures of family interaction, as in Table 6. (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.

Table 11: Children's Academic Test Scores and Functional Form (Sample = Children of the *NCDS* Respondents)

	DEPENDENT VARIABLES					
	PIAT READING TEST SCORE		PIAT MATHS TEST SCORE		PPVT-R TEST SCORE	
	COEF	T STAT	COEF	T STAT	COEF	T STAT
PANEL A: <u>Parental Social Interaction at 33</u>						
(1) Number of clubs parent member of	0.0494	(2.88)	0.0233	(2.46)	0.0826	(3.91)
(2) Frequency parent undertakes sport	0.0223	(2.45)	0.0201	(2.36)	0.0273	(2.53)
(3) Frequency parent attends religious meetings	0.0332	(2.17)	0.0018	(0.12)	0.0638	(3.26)
(4) Frequency parent attends political meetings	0.0618	(2.69)	0.0182	(0.98)	0.0826	(3.91)
(5) Parent can trust most people	0.0686	(2.14)	0.0544	(1.96)	0.1792	(5.06)
(6) Number of friends/neighbors for advice	0.0534	(2.29)	0.0305	(1.34)	0.0273	(1.11)
PANEL B: <u>Parental Social Interaction at 23</u>						
(1) Number of clubs parent member of	0.0303	(2.02)	-0.0059	(0.41)	0.0533	(2.86)
(2) Frequency parent undertakes sport	0.0121	(2.14)	-0.0088	(0.90)	0.0272	(2.06)
(3) Frequency parent attends religious meetings	0.0405	(2.19)	0.0028	(0.15)	0.0748	(3.14)
(4) Frequency parent undertakes voluntary work	0.0212	(2.12)	0.0168	(0.83)	0.0229	(0.91)
(5) Frequency parent goes to the cinema	0.0174	(1.80)	-0.0234	(1.19)	0.1035	(3.82)
(6) Frequency parent meets friends	0.0253	(2.11)	0.0047	(0.42)	0.0170	(2.18)
Observations	2,721				2,958	

Notes: (i) Each of the test scores have been normalized to have a mean of zero and a standard deviation of unity. (ii) 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; 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; whether the parent has maths and/or reading problems; and the highest educational qualification of the parent. (iii) We also include the social capital of the child and measures of family interaction, as in Table 6. (iv) T statistics are based upon white robust standard errors.