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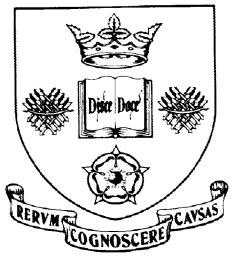

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Intergenerational Analysis of Social Interaction

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Intergenerational Analysis of Social Interaction*

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Abstract

We explore the relationship between the social interaction of parents and their offspring from a theoretical and an empirical perspective. Our theoretical framework establishes possible explanations for the intergenerational transfer of social interaction whereby the social interaction of the parent may influence that of their offspring and vice versa. The empirical evidence, based on four data sets covering Great Britain and the U.S., is supportive of our theoretical priors. We find robust evidence of intergenerational links between the social interaction of parents and their offspring supporting the existence of positive bi-directional intergenerational effects in social interaction.

Keywords: Social Interaction; Intergenerational Transfer
JEL Classification: D19; H24; H41; H31

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1 Introduction

Over the last two decades there has been increasing interest in the economics literature in the implications of social interaction and social capital for socio-economic outcomes such as educational attainment and employment. 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 socio-economic outcomes such as education has attracted growing interest in the economics literature. In general, empirical evidence supports a positive relationship between social interaction and educational attainment, see, for example, 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, state 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).

It is apparent that intergenerational aspects to the accumulation of social capital may exist as in the case of human capital accumulation. A vast literature exists exploring the determinants and implications of human capital, with recent interest in intergenerational aspects such as the link between the human capital of parents and their children. A number of explanations have been put forward to explain the existence of a positive intergenerational relationship in educational attainment. Firstly, it could be due to genetic transmission of ability, i.e. more able parents have more able children. Secondly, it could reflect a direct transfer of knowledge from parent to child, whereby parents with higher levels of education are more able to help their children with their learning. Alternatively, it may be due to economic factors such as income and wealth, with such resources providing access to, for example, books and private tutoring. In practice, however, it is likely that a combination of these factors is responsible for the observed positive relationship between parents' and children's human capital (see, for example, Cunha and Heckman, 2007; Blanden *et al.*, 2007).

In contrast to the human capital literature, the relationship between parents' and children's social interaction is relatively unexplored in the economics literature. One might conjecture that if a child is brought up by parents who are socially active, then this may become the norm for the child. Indeed, in the context of the more general concept of social capital, Putnam (2000) remarks that "the parents' social capital ... confers benefits on their offspring, just as children benefit from their parents' financial and human capital," (Putnam, 2000, p. 299). Similarly, Brown and Taylor (2009) argue that an intergenerational link between social interaction may exist whereby parental social interaction may be positively associated with their children's involvement in formal social activity, which in turn may be conducive to human capital accumulation.

In general, the existing research in this area is drawn from the sociological literature and has focused on social capital rather than social interaction. For example, Duncan *et al.* (2005) analyse the relationship between 17 characteristics of mothers and their children using U.S. data, where the characteristics of parents and offspring are both measured during adolescence. One of seven domains explored relates to social activities such as church attendance. They highlight four mechanisms which may explain correlations between such characteristics of mothers and their offspring, namely: socio-economic re-

sources; parenting practices; genetic inheritance, and role modelling, whereby the latter two explanations find relatively more support. In a similar vein, Vesel (2006) explores whether social capital is transmitted from parents to children using survey data relating to the Czech Republic. The empirical analysis, which is based on establishing correlations rather than causal relationships, suggests weak intergenerational transmission of social capital. Similar findings are reported by Jennings and Stoker (2004) relating to the intergenerational transmission of social trust. In contrast, Beck and Jennings (1982) report a strong correlation between parents' and children's civic participation in the U.S.

In the economics literature, Guiso *et al.* (2008) model the intergenerational transmission of priors about the trustworthiness of others within an overlapping generations framework. Following Dohmen *et al.* (2007), using the German Socio-Economic Panel (GSOEP), they report empirical evidence supporting a positive correlation between the trust of parents and their children by modeling the effect of parents' trust on their children's trust. Due to the limited availability of information on the key variables such as trust, which were elicited from parents and all their offspring who were aged 18 or over at the time of the interview, these two studies analyse information mainly drawn from the 2003 and 2004 waves of the GSOEP, and hence they are unfortunately unable to exploit the panel nature of the data.

More recently, within the economics literature, using data drawn from the U.S. National Longitudinal Survey of Youth 1979, Okumura and Usui (2010) explore the effect of parents' social skills on their children's sociability. Respondents aged between 20 and 28 were asked about their sociability as a child such as the number of clubs they participated in during high school, whereas, due to the absence of information on their parent's social skills, parent's social skills are proxied by the people skills needed in the occupations the respondent's parents were in when the respondent was aged 14.[1] Support is found for a positive association between children's sociability and the proxy for parents' social skills.

In this paper, we focus on social interaction rather than the arguably more general concepts of social capital and trust. Moreover, although a small number of existing studies in this area have presented interesting empirical evidence supporting the existence of positive correlations between the social capital of parents and their offspring, it is apparent however that inferences relating to causality cannot be drawn from such studies. In addition, existing studies have not allowed for the possibility that a parent's social capital may influence that of their child and that the child's social capital may influence that of their parent. In the context of social interaction, such a possibility is arguably particularly apparent. For example, if a child engages in a range of activities, such as sport or dancing lessons, it is conceivable that parents will become involved in social events associated with such activities or, alternatively, may simply meet other parents which may lead to social interaction or information about social interaction opportunities. Hence, an important contribution of our paper lies in the fact that we allow for causality to operate in both directions. In addition, we exploit the panel nature of

[1] The definitions of the people skills required in occupations are based on occupational characteristics detailed in the US Department of Labor's Dictionary of Occupational Titles (DOT), which are related to objective and subjective evaluations, and include eight variables ranging from 'talking and/or hearing' to 'preferences for activities involving business contacts with people versus a preference for activities of a scientific and technical nature' (Okumura and Usui, 2010, p.6).

our data in order to shed some light on the causal nature of such relationships. To be specific, our theoretical framework presented in Section 2 establishes possible theoretical explanations for the two-way intergenerational transfer of social interaction. We then explore this intergenerational relationship from an empirical perspective. In order to explore the robustness of our results, our empirical analysis draws on four data sets namely, the British National Child Development Study, the British Cohort Study, the U.S. Panel Study of Income Dynamics and the U.S. National Longitudinal Survey of Youth. Our empirical analysis supports the existence of positive relationships between parents' and children's social interaction.

2 Theoretical Framework

In this section we set out a theoretical framework establishing possible explanations for the intergenerational transfer of social interaction, which in contrast to the existing literature, is a two-way process (incorporating movements from the younger to older generation as well as the reverse). The section has two parts. The first part briefly introduces Becker's (1974) theory of social interaction. The second part extends the theory to explain how two-way intergenerational social capital transfers might arise.

2.1 A Model of Social Interaction

The foundation for our theoretical framework is the model of social interaction developed by Becker (1974). This model incorporates social interaction (as discussed in the broader context of wants and their determinants in, for example, Bentham, 1789; Marshall, 1962) in a framework of household behavior by introducing non-household individuals whose characteristics affect the production of the household's commodities and which can be influenced by the actions of the household.

Individual i has a utility function

$$U_i = U_i(Z_{i1}, ..., Z_{iq}), \tag{1}$$

where Z_{ij} $(j = 1, ..., q)$ are commodities (or wants) consumed by individual i. Each commodity Z_{ij} has a production function

$$Z_{ij} = Z_{ij}(x_{ij}, t_{ij}, e_i, R_{ij1}, ..., R_{ijr}), \tag{2}$$

where x_{ij} and t_{ij} are, respectively, the individual's endowment of market goods or services and time devoted to the production of commodity j, e_i is a measure of the individual's education, experience and other relevant personal and environmental characteristics, and R_{ijm} $(m = 1, ..., r)$ are characteristics of r 'other' individuals that impact upon i's output of commodity j.

Becker (1974) departs from the traditional model of household production (e.g., see Michael and Becker, 1973) by allowing R_{ijm} to be influenced by the efforts of individual i. Hence social interaction investments influence individual i's social environment through the characteristics of 'other' individuals and these changes are reflected in individual i's utility via its effect on the production of Z_{ij}. For the purposes of our current enquiries it is useful to distinguish between two alternative sets of 'other' individuals whose characteristics affect household production. In the following section we extend

Becker's (1974) model accordingly in order to provide a theoretical explanation for two-way intergenerational transfer of social interaction.

2.2 Intergenerational Transfers of Social Interaction

Like Becker (1974) we begin with a simplified situation in which there is a single commodity, Z. However, in terms of factors which affect Z we include the characteristics of the household's children in addition to the characteristics of 'other' individuals. Essentially, we employ a model in which the household, composed of parents and one or more children, is separated according to (i) income earners and decisions makers (parents) and (ii) non income earners and non decision makers (children). We distinguish between the parents and the children with the parents of household i gaining utility U_i according to Eq. (1) and the children entering parents' utility through the production function Eq. (2) in terms of their characteristics which we denote R_c. For clarity, we now refer to the 'other' individuals whose characteristics feature as inputs in i's production function in Eq. (2), as 'non-household' individuals, and denote their characteristics R_n.[2]

Whereas Becker (1974) includes a single good x as an input into the production of Z, we include time. Let:

$$T = T_w + T_c + T_n, \tag{3}$$

where T_s $(s = c, n)$ is the time required in the production of R_s, T_w is the time devoted to work and T is the total available time. An important assumption in our argument is that T_s incorporates not only time devoted to producing R_s, it also includes time involved in searching for R_s prospects: hence, we envisage a scenario in which there is imperfect information over the available production opportunities and so our model involves search costs.

Maximising utility is now equivalent to maximising the output of commodity Z based upon the utility-output function:

$$U = Z(\mathbf{R}, T), \tag{4}$$

where $\mathbf{R}$ is a two-vector. Following Becker (1974), we assume that the characteristics R_c and R_n have two components:[3]

$$R_s = R_s(D_s, h_s), \quad (s = c, n), \tag{5}$$

where h_s is the effect of the parents' effort on the characteristics of s and D_s is the level of R_s when the parents make no effort. We assume that R_s is increasing in both its arguments:

$$\frac{\partial R_s}{\partial g_s} > 0, \quad (g = D, h). \tag{6}$$

Furthermore, we are interested in introducing into the 'non-household' characteristics, R_n, the characteristics of the household's children. The argument is that the attitude of non-household individuals towards the parents, R_n, is improving in the level of household investment in children's characteristics reflecting, for instance, the social pressure on

[2] We drop the i and j subscripts henceforth as the meaning should be clear from the context.

[3] Although we relax the assumption that the components are perfect substitutes.

being seen to be giving children positive social experiences. To reflect this Eq. (5) becomes:

$$R_c = R_c(D_c, h_c), \tag{7a}$$

$$R_n = R_n(D_n(h_c), h_n), \tag{7b}$$

where D_n is increasing and concave in its argument:

$$D_n'(h_c) > 0, \quad D_n''(h_c) < 0. \tag{8}$$

Hence, parental investment in child social interaction, h_c, has a direct positive effect on child characteristics, R_c, and a further indirect positive effect on 'non-household' individuals' characteristics, R_n.

Eqs. (7a) and (7b) require some explanation in the context of the themes of this paper. Parents can invest in 'non-household' characteristics by raising their own social interaction level, h_n, for example, by increasing their club membership, level of volunteering and so on. They can also invest in 'child' characteristics by raising their children's social interaction, for example, by enrolling their children in more clubs and activities. However, child and non-household characteristics have an autonomous part, D_s $(s = c, n)$: in the absence of any investment 'child' and 'non-household' characteristics may be non-zero. (Of course, D_s can be negative: before any investment in h_s the 'social environment' is negative.) In the case of 'non-household' characteristics the term D_n is quasi-autonomous as it is only constant given changes in h_n but, by Eq. (8), is increasing in h_c.

It follows from Eqs. (7a) and (7b) that maximising utility, Eq. (4), can now be meaningfully expressed in terms of the arguments h_n and h_c (since D_c is exogenous) which we represent by the two-vector, $\mathbf{h}$:[4]

$$U = U(\mathbf{h}). \tag{11}$$

It is now clear that the input of time T_s required in the production of R_s $(s = c, n)$ can also be specified in terms of h_s, hence Eq. (3) can be written:

$$T_s = t_s h_s, \quad (s = c, n), \tag{12a}$$

$$T = T_w + t_c h_c + t_n h_n, \tag{12b}$$

[4]It is important to note that the dependence of R_n on h_c through $D_n(h_c)$ in Eq. (7b) is not inconsistent with Eq. (11) having the usual properties (quasi-concavity in the arguments h_c and h_n). We illustrate with the following simple example.

Example 1. *Let* $U(\mathbf{h}) = h_c.[D_n(h_c) + h_n]$, *i.e.* $D_c = 0$. *The Bordered Hessian for* $U(.)$ *is given by*

$$\begin{vmatrix} 0 & D_n(.) + h_c D_n'(.) + h_n & h_c \\ D_n(.) + h_c D_n'(.) + h_n & 2D_n'(.) + h_c D_n''(.) & 1 \\ h_c & 1 & 0 \end{vmatrix} \tag{9}$$

Quasi-concavity requires that Eq. (9) *is non-negative, hence*

$$[2D_n(.) + 2h_n] - \{h_c^2 D_n''(.)\} \geq 0, \tag{10}$$

Inspecting Eq. (10)*, from Eq.* (8)*,* $\{.\} < 0$. *A sufficient condition for* (10) *to hold is then that* $[.] > 0$ *or, in other words, that* $D_n(.)$ *is not so negative that* $R_n < 0$.

where t_s is the constant time per unit h_s.[5]

One reason for including time in the theoretical framework is to allow us to model search costs in the pursuit of social interaction activities. We initially allow two factors to affect search costs. First, we make the argument that parents may have a stock of knowledge, $\tilde{h}$, about social interaction opportunities which is based upon, say, previous engagement in social interaction which might include the social interaction of the parents before they had children or, indeed, earlier experiences of social interaction with younger siblings. Hence:

$$T_s = t_s(\tilde{h})h_s, \quad (s = c, n), \tag{13}$$

where t_s is non-increasing and convex in its argument:

$$t'_s(\tilde{h}) \leq 0, \quad (s = c, n), \tag{14a}$$

$$t''_s(\tilde{h}) \geq 0. \tag{14b}$$

Second, we recognise that the search costs and hence time involved in one period's (τ) h_s investment, h_s^τ, may be influenced by the search experience relating to h_s and h_{-s} ($-s \neq s = c, n$) investments in the previous period ($\tau - 1$): $h_s^{\tau-1}$ and $h_{-s}^{\tau-1}$. For simplicity, we consider two periods ($\tau = 0, 1$), hence:[6]

$$t_s^0 = t_s^0(\tilde{h}), \quad (s = c, n), \tag{15a}$$

$$t_s^1 = t_s^1(\mathbf{h}^0, \tilde{h}), \tag{15b}$$

where the properties of Eq. (15a) follow directly from Eqs. (14a) and (14b), and t_s^1 is non-increasing and convex in its arguments:

$$\frac{\partial t_s^1(\mathbf{h}^0, \tilde{h})}{\partial k} \leq 0, \quad (k = h_s^0, h_{-s}^0, \tilde{h}) \tag{16a}$$

$$\frac{\partial^2 t_s^1(\mathbf{h}^0, \tilde{h})}{\partial k^2} \geq 0. \tag{16b}$$

Hence, in the initial period, $\tau = 0$, time devoted to each unit of h_s^0 investment, t_s^0, is a function of the original stock of parental social interaction knowledge, $\tilde{h}$. In the next period, $\tau = 1$, time devoted to each unit of h_s^1 investment is a function of the original stock of parental social interaction knowledge, $\tilde{h}$, and the level of investment in h_s^0 and h_{-s}^0 activities in the previous period (with such investments yielding search cost time-saving benefits in period $\tau = 1$). We would naturally expect the marginal effect of the

[5] We assume that the second derivative here is zero for simplicity. Arguably the term could be positive, reflecting the possibility that additional opportunities for social interaction involve higher search costs or are less time efficient (i.e. the most time efficient opportunities are selected first), or negative, reflecting possible time efficiencies or information advantages (reducing search costs) that might result from each extra unit of h_s.

[6] It is important to make a clear distinction between the roles of $\tilde{h}$ and $\mathbf{h}^0$ in t_s^1. The former captures the impact on search costs of parental knowledge from some time before they had the children whose characteristics are measured by R_c, whilst the latter captures the impact of social interaction activities undertaken in some earlier period ($\tau = 0$), in which the characteristics of the children in R_c were taken into account, upon the search costs incurred in social interaction investments in a later period ($\tau = 1$) in which the characteristics of the same children are taken into account. To aid clarity in the later analysis, we resist the temptation to model the latter via allowing $\tilde{h}$ to increase across the two periods.

$\mathbf{h}^0$ elements on t_s^1 to be dependent upon $\tilde{h}$ and vice versa (by Young's Theorem), in the following way:

$$\frac{\partial^2 t_s^1(\mathbf{h}^0, \tilde{h})}{\partial \tilde{h} \partial \mathbf{h}^0} \leq \mathbf{0}. \tag{17}$$

In words, the time-saving effects in terms of reduced search costs for h_s^1 investments due to period $\tau = 0$ investments are likely to be smaller if the parents have a higher initial stock of social interaction capital, $\tilde{h}$. At the extreme, if the parents have such a high stock of capital $\tilde{h}$ that they have full information, then all possible gains from h_s^0 investments in terms of revealing time-saving information are eliminated and $\frac{\partial t_s^1(\mathbf{h}^0, \tilde{h})}{\partial \mathbf{h}^0} = \mathbf{0}$.

We now have two time constraints, one for each period that we wish to model. Hence Eq. (12b), can be written:

$$T = t_w^0 + \sum_{s=c,n} t_s^0(\tilde{h}) h_s^0, \tag{18a}$$

$$T = t_w^1 + \sum_{s=c,n} t_s^1(\mathbf{h}^0, \tilde{h}) h_s^1. \tag{18b}$$

In addition to the time constraints, the parents face a budget constraint:

$$I^\tau = \sum_{s=c,n} p_s h_s^\tau, \tag{19}$$

where I is money income and p_s is the price of a unit of h_s. As is well known, the three constraints, Eqs. (18a), (18b) and (19), can be collapsed into a single constraint for each time period:

$$M = wT + V = \sum_{s=c,n} \left[w t_s^0(\tilde{h}) + p_s \right] h_s^0, \tag{20a}$$

$$M = wT + V = \sum_{s=c,n} \left[w t_s^1(\mathbf{h}^0, \tilde{h}) + p_s \right] h_s^1, \tag{20b}$$

where w is the time-invariant and constant wage rate, V is time-invariant non-labour income and M is the household's 'full income' which, assuming for simplicity no saving or borrowing, is also time-invariant across the two periods.[7]

We now make the following simplifying assumptions. First, we assume that the characteristics R_s do not exhibit memory over the two periods (there are no reputation effects: e.g. investments in R_n in period $\tau = 0$ are forgotten by the non-household individuals in period 1), hence:

$$D_c^\tau = D_c, \quad (\tau = 0, 1), \tag{21a}$$

$$D_n^\tau = D_n(h_c^\tau). \tag{21b}$$

Second, we assume that the search cost benefits for h_s^1 investments due to $\mathbf{h}^0$ investments are not known to the parents, a priori: hence the maximisation problem is separable over the two periods.[8] Finally, assuming an interior solution (so that $\mathbf{h}^\tau > \mathbf{0}$), the maximisation problem can be stated as:

$$\max_{\mathbf{h}^0} U(\mathbf{h}^0), \quad s.t. \quad M = w \sum_{s=c,n} t_s^0(\tilde{h}) h_s^0 + \sum_{s=c,n} p_s h_s^0, \tag{22a}$$

[7] See Becker (1965) for a derivation and discussion of 'full income'.

[8] This along with the non-borrowing/saving assumption allows us to ignore time discounting without loss of generality.

$$\max_{\mathbf{h}^1} U(\mathbf{h}^1), \quad s.t. \quad M = w \sum_{s=c,n} t_s^1(\mathbf{h}^0, \tilde{h}) h_s^1 + \sum_{s=c,n} p_s h_s^1. \tag{22b}$$

Given that the problem is separable over time, the Lagrangian for the maximisation problem facing the parents in period $\tau = 0$ is then:[9]

$$\mathcal{L}(\mathbf{h}^0) = U(\mathbf{h}^0) + \lambda^0 \left[M - w \sum_{s=c,n} t_s^0(\tilde{h}) h_s^0 - \sum_{s=c,n} p_s h_s^0 \right]. \tag{23}$$

The relevant first order conditions for an equality constrained maximum are then:[10]

$$\mathcal{L}_{h_s^0}(\mathbf{h}^0) = U_{h_s^0}(\mathbf{h}^0) - \lambda^0 \left[w t_s^0(\tilde{h}) + p_s \right] = 0, \tag{24a}$$

$$\mathcal{L}_{\lambda^0} = M - w \sum_{s=c,n} t_s^0(\tilde{h}) h_s^0 - \sum_{s=c,n} p_s h_s^0 = 0. \tag{24b}$$

We now address the issue of intergenerational transfer of social interaction from parents to children. First, if the parent's utility function $U = Z(\mathbf{R}, T)$ places high value on social interaction, this may be genetically or socially transmitted to the child through a high valuation of h_c in $R_c(D_c, h_c)$ - i.e. the standard approach to intergenerational transfer. Second, given Eq. (7b) the parents (decision-makers) can influence non-household characteristics R_n via investments in their own social interaction activities h_n and/or investments in child social interaction h_c, they have an incentive to make h_c investments even if they do not have a large positive impact on the child (i.e. $\frac{\partial R_c(D_c, h_c)}{\partial h_c}$ is positive but small). Hence, whilst by Eq. (6) we have ruled out the parents making h_c investments that impact negatively on child characteristics R_c, this (second) line of reasoning for parent to child intergenerational transfer of social interaction follows either from the parent's concern about how they themselves are perceived externally (being seen to do the 'right thing' for their children) or out of a belief that regardless of how low a value the child places on h_c, they (the parents) know what is best and believe that non-household individuals share the same view (e.g. dance lessons might not be the child's chosen activity but the parents and non-household members believe they are beneficial). In either case, unlike the first argument, h_c investments here may not be sustained if the child was the decision-maker. We now exploit the search cost aspect of our model to explain a possible third source of parent to child transfer of social interaction: if the parents have a high initial stock of social interaction capital $\tilde{h}$ this may reduce the search costs associated with child social interaction investment in period $\tau = 0$, reducing $t_c^0(\tilde{h})$, by Eq. (14a), and hence boosting h_c^0. It is straightforward to show that this will be true if $w\lambda^0 \frac{\partial t_n^0(\tilde{h})}{\partial \tilde{h}} \left[w t_c^0(\tilde{h}) + p_c \right]$ is not too large relative to $w\lambda^0 \frac{\partial t_c^0(\tilde{h})}{\partial \tilde{h}} \left[w t_n^0(\tilde{h}) + p_n \right]$, and hence h_n^0-related search costs due to an increase in $\tilde{h}$ do not fall too fast relative to h_c^0-related search costs. To see this, we refer to the first order conditions for period $\tau = 0$, Eqs. (24a) and (24b). Taking total differentials, forming a Hessian matrix $|B|$

[9] Becker (1974) is specifically concerned with the size and behaviour of social income: the sum of money income and the value of the characteristics of non-household income. Our purpose here is to examine the behaviour of investments in h_s $(s = c, n)$, hence it is sufficient to use money income as the relevant term in the constraint rather than social income.

[10] The subscripts h_s $(s = c, n)$ and λ denote partial derivatives.

and using Cramer's rule, given $|B| > 0$ for a maximum:

$$sign\left\{\frac{\partial h_c}{\partial \tilde{h}}\right\} = sign\left\{\left|\begin{array}{ccc} w\lambda^0\frac{\partial t_c^0(\tilde{h})}{\partial \tilde{h}} & U_{cn}(\mathbf{h}^0) & -\left[wt_c^0(\tilde{h})+p_c\right] \\ w\lambda^0\frac{\partial t_n^0(\tilde{h})}{\partial \tilde{h}} & U_{nn}(\mathbf{h}^0) & -\left[wt_n^0(\tilde{h})+p_n\right] \\ w\left[\frac{\partial t_n^0(\tilde{h})}{\partial \tilde{h}}h_n^0+\frac{\partial t_c^0(\tilde{h})}{\partial \tilde{h}}h_c^0\right] & -\left[wt_n^0(\tilde{h})+p_n\right] & 0 \end{array}\right|\right\} \tag{25}$$

Expansion of the R.H.S. of Eq. (25) yields:

$$\begin{aligned} & w\left(\frac{\partial t_n^0(\tilde{h})}{\partial \tilde{h}}h_n^0+\frac{\partial t_c^0(\tilde{h})}{\partial \tilde{h}}h_c^0\right)\left\{U_{nn}(\mathbf{h}^0)\left[wt_c^0(\tilde{h})+p_c\right]-U_{cn}(\mathbf{h}^0)\left[wt_n^0(\tilde{h})+p_n\right]\right\} \\ & +\left[wt_n^0(\tilde{h})+p_n\right]\left\{w\lambda^0\frac{\partial t_n^0(\tilde{h})}{\partial \tilde{h}}\left[wt_c^0(\tilde{h})+p_c\right]-w\lambda^0\frac{\partial t_c^0(\tilde{h})}{\partial \tilde{h}}\left[wt_n^0(\tilde{h})+p_n\right]\right\}, \end{aligned} \tag{26}$$

where $(.) < 0$ and $[.] > 0$. Eq. (26) is positive as required if $w\lambda^0\frac{\partial t_n^0(\tilde{h})}{\partial \tilde{h}}\left[wt_c^0(\tilde{h})+p_c\right]$ is not too large relative to $w\lambda^0\frac{\partial t_c^0(\tilde{h})}{\partial \tilde{h}}\left[wt_n^0(\tilde{h})+p_n\right]$.

We now address the issue of intergenerational transfer of social interaction from children to parents. Here we again exploit the search cost argument, but this time relating to period $\tau = 1$ h_n investments. The Lagrangian for the maximisation problem facing the parents in period $\tau = 1$ is:

$$\mathcal{L}(\mathbf{h}^1) = U(\mathbf{h}^1) + \lambda^1\left[M - w\sum_{s=c,n} t_s^1(\mathbf{h}^0,\tilde{h})h_s^1 - \sum_{s=c,n} p_s h_s^1\right]. \tag{27}$$

The relevant first order conditions for an equality constrained maximum are then:

$$\mathcal{L}_{h_s^1}(\mathbf{h}^1) = U_{h_s^1}(\mathbf{h}^1) - \lambda^1\left[wt_s^1(\mathbf{h}^0,\tilde{h})+p_s\right] = 0, \quad (s=c,n), \tag{28a}$$

$$\mathcal{L}_{\lambda^1} = M - w\sum_{s=c,n} t_s^1(\mathbf{h}^0,\tilde{h})h_s^1 - \sum_{s=c,n} p_s h_s^1 = 0. \tag{28b}$$

We now argue that child to parent intergenerational social interaction effects arise because parental investment in h_c^0 provides information about parental opportunities for h_n^1 investment reducing the associated search costs, $t_n^1(\mathbf{h}^0,\tilde{h})$, by Eq. (16a). It is straightforward to show that this will be true if $w\lambda^1\frac{\partial t_n^1(\mathbf{h}^0,\tilde{h})}{\partial h_c^0}\left[wt_c^1(\mathbf{h}^0,\tilde{h})+p_c\right]$ is not too small relative to $w\lambda^1\frac{\partial t_c^1(\mathbf{h}^0,\tilde{h})}{\partial h_c^0}\left[wt_n^1(\mathbf{h}^0,\tilde{h})+p_n\right]$, and hence h_c^1-related search costs due to an increase in h_c^0 do not fall too fast relative to h_n^1-related search costs. To see this, we refer to the first order conditions for period $\tau = 1$, Eqs. (28a) and (28b). Taking total differentials, forming a Hessian matrix $|B|$ and using Cramer's rule, given $|B| > 0$ for a maximum:

$$sign\left\{\frac{\partial h_n^1}{\partial h_c^0}\right\} = sign\left\{\left|\begin{array}{ccc} w\lambda^1\frac{\partial t_n^1(\mathbf{h}^0,\tilde{h})}{\partial h_c^0} & U_{nc}(\mathbf{h}^1) & -\left[wt_n^1(\mathbf{h}^0,\tilde{h})+p_n\right] \\ w\lambda^1\frac{\partial t_c^1(\mathbf{h}^0,\tilde{h})}{\partial h_c^0} & U_{cc}(\mathbf{h}^1) & -\left[wt_c^1(\mathbf{h}^0,\tilde{h})+p_c\right] \\ w\left[\frac{\partial t_n^1(\mathbf{h}^0,\tilde{h})}{\partial h_c^0}h_n^1+\frac{\partial t_c^1(\mathbf{h}^0,\tilde{h})}{\partial h_c^0}h_c^1\right] & -\left[wt_c^1(\mathbf{h}^0,\tilde{h})+p_c\right] & 0 \end{array}\right|\right\} \tag{29}$$

Expansion of the R.H.S. of Eq. (29) yields:

$$w\left(\frac{\partial t_n^1(\mathbf{h}^0,\tilde{h})}{\partial h_c^0}h_n^1+\frac{\partial t_c^1(\mathbf{h}^0,\tilde{h})}{\partial h_c^0}h_c^1\right)\left\{U_{cc}(\mathbf{h}^1)\left[wt_n^1(\mathbf{h}^0,\tilde{h})+p_n\right]-U_{nc}(\mathbf{h}^1)\left[wt_c^1(\mathbf{h}^0,\tilde{h})+p_c\right]\right\}$$
$$+\left[wt_c^1(\mathbf{h}^0,\tilde{h})+p_c\right]\left\{w\lambda^1\frac{\partial t_c^1(\mathbf{h}^0,\tilde{h})}{\partial h_c^0}\left[wt_n^1(\mathbf{h}^0,\tilde{h})+p_n\right]-w\lambda^1\frac{\partial t_n^1(\mathbf{h}^0,\tilde{h})}{\partial h_c^0}\left[wt_c^1(\mathbf{h}^0,\tilde{h})+p_c\right]\right\}, \tag{30}$$

where $(.)<0$ and $[.]>0$. Eq. (30) is positive as required if $w\lambda^1\frac{\partial t_n^1(\mathbf{h}^0,\tilde{h})}{\partial h_c^0}\left[wt_c^1(\mathbf{h}^0,\tilde{h})+p_c\right]$ is not too small relative to $w\lambda^1\frac{\partial t_c^1(\mathbf{h}^0,\tilde{h})}{\partial h_c^0}\left[wt_n^1(\mathbf{h}^0,\tilde{h})+p_n\right]$.

Given Eq. (17), we conclude that this child to parent transfer of social interaction is more likely to occur if $\tilde{h}$ is small (hence imperfect information keeps the search costs for h_s^0 high, presenting opportunities for heavy reductions in period $\tau=1$ search costs due to period $\tau=0$ social interaction investments) and h_c plays a dominant role in the parent's utility-output function, hence even if the search costs make h_n^0 investments prohibitively expensive, h_c^0 investments, though incurring heavy time penalties, are valued too highly not to undertake. This is consistent with the idea that parents with small children may face heavy social pressure, or attach great value, to their children gaining social interaction. But then having undertaken h_c^0 investments, it is possible that associated information gains help to reduce the search costs to future h_s^1 investments, completing the argument.

Against this, however, since h_c appears in R_n, any increase in h_c will reduce, at no additional cost, the level of h_n required to achieve a given level of R_n, and this will tend to reduce the level of h_n investment.

We conclude that the following channels support parent to child intergenerational social interaction: (i) the parent's utility function $U=Z(\mathbf{R},T)$ places high value on social interaction and this is genetically or socially transmitted to the child, (ii) parents make social interaction investments for their children to be seen to be doing the 'right thing' or based, not on what they intrinsically value for themselves, but what they believe to be 'right' for the well-being of their children, and (iii) parents have a high stock of social interaction capital $\tilde{h}$ which reduces the search costs associated with child social interaction investment. On the other hand, child to parent intergenerational social interaction effects arise because parental investment in h_c^0 provides information about parental opportunities for h_n^1 investment reducing the associated search costs.

3 Data and Methodology

In the remaining sections of the paper, we explore the relationship between the social interaction of parents and their children from an empirical perspective. In order to explore the robustness of our findings, the empirical analysis employs four data sets: two for Great Britain, namely the National Child Development Study (*NCDS*) and the British Cohort Study (*BCS*); and two for the U.S., the Panel Study of Income Dynamics (*PSID*) and the National Longitudinal Survey of Youth 1979 (*NLSY*). Both the *NCDS* and *BCS* are cohort specific studies with the former tracking individuals born in a particular week in 1958, whilst the more recent cohort study, the *BCS*, tracks individuals

born in a particular week in 1970. For the U.S., the *PSID* is a nationally representative panel of individuals ongoing since 1968 conducted at the Institute for Social Research, University of Michigan with the latest wave being in 2007. Finally, the *NLSY* is a nationally representative survey sponsored by the Bureau of Labor Statistics of the U.S. Department of Labor, which, since 1979, has a panel aspect, focusing on gathering information on individuals between the ages of 14 and 22. The four data sets, which provide a wealth of information relating to family background, are ideally suited to our purposes since in each data set it is possible to link parents to their offspring allowing us to explore whether intergenerational associations exist between the social interaction of parents and their offspring.

In the *NCDS* in 1991, when the respondent (i.e. parent) was aged 33, a random sample of one in three of the parents' children were sampled. Matching parents with their offspring leads to a sample size of 1,943, after missing cases, with the average age of the children being 9 years old. For the *BCS* in 2004, when the respondents were aged 34, their children were surveyed yielding a sample size of 1,290, after allowing for missing values, with the average age of the children being 12 years old. In the *PSID*, there is information on the children of the respondents available from the *Child Development Study* (*CDS*) in 1997, 2002 and 2005, which aims to provide information on early human capital formation. In terms of our analysis, we analyse child characteristics in 2002[11] yielding a matched sample of 1,375 observations, where the average age of the children is 14 years old. Finally, the *NLSY* allows us to investigate whether any social interaction linkage exists across generations by matching female respondents from the *NLSY* 1979 with their offspring in 2002, yielding a sample of 1,070 observations, where the average age of the children is 15 years.

In accordance with the small number of related studies in this area as discussed in Section 1, we initially model the social interaction of the i^{th} child ($i = 1, .., n$), SOC^{child}, as a function of the social interaction of the j^{th} parent ($j = 1, .., m$), SOC^{parent}, where the social interaction of both parent and child are measured concurrently, i.e. at time period $T1$:

$$SOC^{child}_{i,T1} = \mathbf{X}'\boldsymbol{\beta}_1 + \gamma SOC^{parent}_{j,T1} + \varepsilon_1. \tag{31}$$

We then expand this framework by jointly modelling the social interaction of the i^{th} child SOC^{child} and the social interaction of his/her parent as a function of the social interaction of the parent and child, respectively, as follows:

$$SOC^{child}_{i,T1} = \mathbf{X}'\boldsymbol{\beta}_1 + \gamma SOC^{parent}_{j,T1} + \varepsilon_1, \tag{32a}$$

$$SOC^{parent}_{j,T1} = \mathbf{Z}'\boldsymbol{\beta}_2 + \phi SOC^{child}_{i,T1} + \varepsilon_2. \tag{32b}$$

Modelling the two outcomes within a bivariate framework allows interdependence between the two equations. Specifically, ε_1 and ε_2 are the stochastic disturbance terms where $\varepsilon_1, \varepsilon_2 \sim N(0, 0, \sigma_1^2, \sigma_2^2, \rho)$ and the covariance is given by $\sigma_{12} = \rho\sigma_1\sigma_2$. If $\rho \neq 0$ then joint estimation is characterised by greater efficiency. Finally, the extent of interdependence between the social interaction of parents and their offspring is captured by the estimated parameters γ and ϕ.

[11] The year 2002 is chosen for modelling reasons so that there is a timing difference between when the social interaction of the parent and child social interaction are measured in order to reduce the potential for reverse causality, see below.

A major advantage of the data that we employ is that it is generally possible to take account of the fact that individuals are followed over time to allow timing differences in the measures of social interaction. In the empirical analysis that follows we focus on the following approach:

$$SOC_{i,T1}^{child} = \mathbf{X}'\boldsymbol{\beta}_1 + \gamma SOC_{j,T2}^{parent} + \varepsilon_1, \tag{33a}$$

$$SOC_{j,T3}^{parent} = \mathbf{Z}'\boldsymbol{\beta}_2 + \phi SOC_{i,T4}^{child} + \varepsilon_2. \tag{33b}$$

where $T1 > T2$ and $T3 > T4$. This approach reduces the potential for reverse causality since, as argued by Angrist and Pischke (2009), the social interaction of the child (parent) is measured *ex ante*, that is, it predates the outcome variable, i.e. parental (child) social interaction.

With respect to the specific definitions of the dependent variables, in the *NCDS* and *NLSY*, the dependent variable SOC^{child} is defined as a binary indicator of whether the child is a member of a club. Specifically, in the *NCDS*, this is measured in 1991 (T1=1991 in Eq. (33a)) and in the *NLSY* this is measured in 2002 (T1=2002). In the *NCDS*, the binary indicator for whether the child is a member of a club is based on parents' responses to the following question "does your child get any special lessons (for example musical) or belong to any organisations that encourage activities such as sport, music, art, dance, drama etc?" For the *NLSY* commencing in 1986, for the children of female respondents, it is possible to investigate whether the child belonged to a club, either in or out of school, between the ages of 10 to 14. Specifically, a binary social interaction measure is based on the child's responses to the following questions "do you belong to any clubs or organizations not sports-related, either in or out of school?" and "do you belong to any sports teams, clubs, or organized sports activities, either in or out of school?" In terms of the *NCDS* and the *NLSY*, the social interaction of the child is modelled via a probit specification, i.e. exploring the determinants of the probability of club membership. For both the *BCS* and the *PSID*, we construct an index of the number of clubs that the child attends. Specifically in the *BCS*, this is measured in 2004 (i.e. T1=2004 in Eq. (33a)) and, in the *PSID*, this is measured in 2002 (i.e. T1=2002). In the *BCS*, the number of clubs that the child attends ranges from zero to three or more clubs. This measure is constructed from the child's responses to whether they attended a youth club, scouts or guides, a sports club or lessons, a party, or some other unspecified event. The measure of SOC^{child} in the *PSID* is also an ordered index ranging from zero clubs to attending four or more clubs, constructed from the child's responses in the *CDS* 2002 to the following questions: "in the past 12 months, did you participate in religious clubs and activities?"; "during the past 12 months, did you spend time on social activities such as clubs or student government?"; "were you a member of any groups in the community such as scouts or hobby clubs in the last 12 months?"; "did you spend time on volunteer service activities over the last 12 months?"; "during last summer, were you involved in any organised summer or after-school sports or recreational programmes?"; and, finally, "were you a member of any athletic or sports teams at school in the last 12 months?" For both the *BCS* and the *PSID*, the dependent variable, SOC^{child} , is modelled as an ordered probit specification, i.e. exploring the determinants of the probability of being a member of zero clubs, one club, through to three (four) or more clubs.

In both the *NCDS* and the *BCS*, parental social interaction is modelled as an ordered probit specification, where the dependent variable is an ordered index of the number of clubs that the parent is a member of. Specifically, in the *NCDS*, this is measured in 1991 and 2000 (T3=1991 or 2000 in Eq. (33b)) whilst, in the *BCS*, this is measured in 2004 (T3=2004). The different types of club include active current membership of: 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; and/or trade union/staff associations. In the *PSID*, parental social interaction is proxied by information on voluntary activity undertaken in the calendar year 2004 (i.e. T3=2004) and is measured as follows: firstly, by the probability of volunteering for unpaid work, ranging from never (0) through to daily (3); secondly, by the number of times that the individual volunteered during the year (0 through to 100 times); and, finally, by the number of hours volunteered (0 to 2,920). For the *NLSY*, the number of weeks that the parent undertook unpaid voluntary work is the measure of social interaction in 2005 (T3=2005). In both of the U.S. data sets, with the exception of the probability of volunteering, the dependent variable is essentially a non-negative integer count and, hence, it is modelled via a negative binomial model in order to take into account the over dispersion of zeros. It is not modelled by OLS since the tails of the distributions would not be accurately predicted. The summary statistics relating to the dependent variables are presented in Table 1A.

As detailed in Eqs. (31), (32), (33a) and (33b) above, with respect to the explanatory variables, the empirical specification also allows parental (child) social interaction to be an explanatory variable in the child (parent) social interaction equation in order to ascertain the existence or otherwise of an intergenerational relationship. The following discussion focuses initially upon specifications where the child outcome is the dependent variable. In the *NCDS*, parental social interaction is measured by the number of clubs attended in 1991 (T2=1991) and also in 1981 (T2=1981) entered into the empirical specification as a set of binary controls, i.e. a member of one club, two or three clubs or four or more clubs, with no clubs as the reference category and is as defined above. The timing difference between the outcome variable and the parent's social interaction, when measured in 1981, reduces the potential for reverse causality since SOC^{parent} is measured *ex ante*, i.e. $T1 > T2$. We are also able to analyse a timing differential in the *BCS*, where the number of clubs (as defined above) is entered as a binary control, i.e. one club, two or more clubs, with no club attendance as the reference category. The measurement of SOC^{parent} is in 2000 (T2=2000). Similarly, for the U.S., in the *PSID* and *NLSY* timing differences can be exploited. Specifically, in the *PSID*, the number of clubs that the parent was a member of in 1997 (T2=1997) is entered into the SOC^{child} equation where the outcome variable is measured in 2002. For the *NLSY*, binary controls are adopted for whether the parent was a member of a club during high school (i.e. $T1 > T2$). In both U.S. data sets, the number of clubs attended by the parent in 1997 is entered as a set of binary controls, i.e. a member of one club, two or three clubs, and four or more clubs, with no club attendance as the reference category.

Turning to the case where the parent outcome is the dependent variable, for the *NCDS* (*BCS*) SOC^{child} is entered as a binary control for whether the child is a member of a club in 1991 (2004), i.e. $T3 > T4$ ($T3 = T4$ in the *BCS*). In the U.S., for the *PSID*, SOC^{child} is measured as the number of clubs attended in 2002 ($T3 > T4$) and is entered as a set of binary variables, one club, two or three clubs, or four or more clubs, where no

club attendance by the child is the reference category. Finally, in the *NLSY*, SOC^{child} is measured by whether the child was a club member in 2002, where again $T3 > T4$. For each data set, the variables are defined from the same survey questions used to define the outcome variables.[12] Summary statistics for SOC^{child} and SOC^{parent} when used as control variables are given in Table 1B.

A range of additional covariates are employed where $\mathbf{X}$ and $\mathbf{Z}$ denote vectors of explanatory variables in the child and parent social interaction equations, respectively. In the child's social interaction equation, variables in $\mathbf{X}$ consist of child covariates and parental characteristics. In particular, the child covariates are binary controls for whether the child: is male; is in good health; has any siblings; lives in a single parent family; and is white. A quadratic in the age of the child is included along with the number of schools that the child has attended, the number of friends that the child has and the number of books owned by the child. Parental controls, $\mathbf{Z}$, entered into the child social interaction equation include binary indicators for whether the parent: is male; educational attainment[13]; and housing tenure, specifically for whether the house is owned outright or on a mortgage. We also control for household finances by including the natural logarithm of benefits, non labour income and labour income.[14] Finally regional controls are also included.

For the parent's social interaction equation, control variables in $\mathbf{Z}$ are parent characteristics, some of which are also covariates in the child social interaction equation. The variables in $\mathbf{Z}$ consist of binary indicators for whether the parent: is white; is married; is male; highest educational attainment (as defined above); housing tenure; attends religious services; and works more a 45 hour week or more. Other controls include: the number of adults in the household; the number of children in the household; controls for household finances (as defined above); the frequency that the family eats together; and the frequency that the family sees their relatives (specifically those living outside the household). In the U.S. data sets, it is possible to also include a quadratic in the age of the parent since the data is not cohort specific. Finally, we include a set of regional controls. Summary statistics for both sets of covariates, $\mathbf{X}$ and $\mathbf{Z}$, are provided in Table 1C and full definitions are given in Table A1.

[12] Ideally, individuals and their offspring would be tracked over time in each data set which would then enable the use of a panel data modelling approach in order to control for time invariant unobserved fixed effects. Limited data availability unfortunately precludes this approach.

[13] In the *NCDS* and *BCS*, educational attainment is defined as highest level of educational attainment: degree (undergraduate or postgraduate); diploma level, nursing or teaching qualification; Advanced (A) level and Ordinary (O) level. O' level qualifications are taken after eleven years of formal compulsory schooling and approximate to the U.S. honours high school curriculum. The A' level qualification is a public examination taken by 18 year olds over a two year period studying between one to four subjects and is the main determinant of eligibility for entry to higher education in the UK. No education is the reference category. In the U.S., for the *NLSY*, three binary indicators are used to measure the highest level of education attained, specifically completed high school; completed some college; and attained a degree (undergraduate or postgraduate). Less than high school completion is the reference category. In the *PSID*, educational attainment is measured as a continuous variable by years of completed schooling.

[14] In the *NLSY*, family finances are measured by the natural logarithm of family income as it is not possible to decompose income into the constituent elements in 2002 due to missing values.

4 Results

As discussed in the introduction, the majority of the economics literature in this area has focused upon the concepts of social capital and trust rather than specifically on social interaction. Furthermore, the empirical evidence has concentrated on the influence of parental social capital upon the social capital of their offspring, e.g. Okumura and Usui (2010). The only exception which we are aware of is Duncan *et al.* (2005) who analyse mother-daughter correlations between participation in school clubs, across generations using the U.S. *NLSY*. However, they do not investigate bi-directional influences in social interaction between parents and their offspring. Analysing correlations is the starting point for our empirical analysis whereby we estimate Eq. (31) based upon the British *NCDS* exploring the influence of parental social interaction upon the probability that their child is a member of a club. This is estimated as a univariate probit model with the results shown in Table 2 Panel A. Older children clearly have a higher probability of being a member of a club in 1991, whilst there are no gender or ethnicity effects.

However, the number of close friends that the child has and the number of books owned by the child both have positive and significant impacts upon the probability of child club membership, where the latter is a potential proxy for home resources. Parental influences are dominated by the effect of the highest educational qualification obtained by 1991, where a child whose parent has a degree as their highest academic qualification (relative to no education) has a 17 percentage point higher probability of being a club member. Income effects are small and stem from household labour income. The number of clubs that the parent is a member of is as equally important as parental education in terms of magnitude, whereby a child whose parent is a member of four or more clubs (relative to no clubs) has a 22 percentage point higher probability of club membership. A possible concern with the analysis thus far is reverse causality and ideally we would either instrument parental social interaction or measure it *ex ante*, so that the primary explanatory variable of interest predates the outcome variable.[15] The latter is possible in the *NCDS* and, hence, in Table 2 Panel B, we measure parental club membership in 1981 and child club membership in 1991, i.e. in terms of Eq. (33a) $T1 > T2$. The results are consistent with those in Panel A, where the membership of clubs across generations is measured concurrently, with a monotonic relationship being evident, i.e. the extent of the social interaction of the parent matters.

We now depart from the approach adopted in the existing empirical literature and explore the prediction from the theoretical framework presented in Section 2 that the social interaction of the child may also influence that of their parents. This might occur through spillover effects by reducing search costs whereby parents become involved in social events, i.e. investment in h_c provides information about parental opportunities for h_n (see Section 2.2). In what follows, the empirical analysis allows the causality to operate in both directions. Specifically, the social interaction of the child and that of the parent are modelled simultaneously, see Eqs. (33a) and (33b). Table 2 Panel D reports the results of modelling the probability that the child is a member of a club conditional upon the same covariates as in Panel A and binary controls for the number of clubs that the parent is a member of in 1981 (i.e. $T1 > T2$). The results are in line with those reported in Panels A and B indicating that parental social interaction has a statistically

[15] Given the difficulty in identifying suitable instruments, we do not pursue the instrumentation of parental social interaction.

significant impact on their offspring's social interaction.

We now focus on the effect of the children's social interaction on their parent's social interaction, which has largely been neglected in the literature. The corresponding parental outcome, jointly estimated with their child's social interaction (see Table 2 Panel C), is shown in the first column of Table 3. Clearly, the value of the correlation coefficient, ρ, is statistically significant endorsing the joint modelling approach. Initially, the number of clubs that the parent is a member of is measured in 1991, i.e. at the same time as that of the child's club membership ($T3 = T4$ in Eq. (33b)). We show outcomes for the probability that the parent is a member of no clubs and for the probability that the parent is a member of four or more clubs in 1991. The number of adults in the household serves to lower the probability of the parent being a member of no clubs and may proxy household resources to care for children when the parent is socialising. In terms of our theoretical model, this stems from reducing the costs associated with parental social interaction, h_n, by reducing child care costs, i.e. through a reduction in p_n, see Section 2. The influence of education is apparent and, where statistically significant, is monotonically associated with a lower probability of not being a member of any clubs culminating in around 21 percentage points for those parents with a degree as their highest qualification (relative to those with no education). The significant positive correlation between social interaction and education is consistent with the existing empirical evidence to date, e.g. Glaeser *et al.* (2002). The influence of income is relatively small and only labour income influences the probability of the parent attending no clubs (four or more clubs) by around -2 (0.6) percentage points. As found with the social interaction of the child, there are no gender or ethnicity effects.

Controlling for the social network of the family by including the frequency that the family (i.e. household members) eat together and see relatives (i.e. outside of the household) has no influence upon the parents' club membership. The extent to which the parent may be able to become involved in social interaction outside of the family environment may be hindered by the amount of time that they have available for social activities outside work. However, including a binary control for whether the parent works a 45 hour week or more has no influence on the probability of not being a member of a club and only around a 2.7 percentage point association with decreasing the probability of being a member of four or more clubs. Focusing upon the primary covariate of interest, whether the respondent's child is a member of a club in 1991 reduces the probability that the parent is a member of no clubs by around 42 percentage points and increases the probability of being a member of four or more clubs by 8.4 percentage points. This is an effect over and above social interaction within the family and social interaction related to attendance at religious services.[16]

The *NCDS* allows us to reduce the potential for reverse causality in the parent social interaction equation by measuring the child's social interaction *ex ante*, specifically by focusing upon the same definition of parental club membership but in 2000, i.e. in

[16]There is a growing literature on the economics of religion and its association with a variety of economic outcomes such as education (see Iannaccone, 1998). In the empirical analysis, our aim is to investigate social interaction which arises over and above that stemming from attending religious services. Furthermore, attending religious services would potentially dominate other types of social interaction especially for the U.S. where, on average, in the *PSID* and *NLSY* approximately 70 per cent of parents attended religious services, see Table 1C.

terms of Eq. (33b), $T3 > T4$. The results relating to the determinants of the probability that the child is a member of a club, shown in Table 2 Panel D, are largely unaltered. Focusing upon the corresponding parental social interaction results, in the second column of Table 3, where social interaction is now measured in 2000, there are a couple of notable differences. Firstly, there is a significant gender differential in that males are approximately 5.8 percentage points less likely than females not to be a member of any clubs. Secondly, the frequency that the family visits relatives has a statistically significant positive impact upon the likelihood of not being a member of any clubs, potentially implying that social interaction inside the family might be a substitute for social interaction outside of the family environment. The amount of leisure time available to the parent now has a relatively large effect on the probability of not being a member of any clubs, where those who work long hours are more likely not to attend clubs. However, the primary result that the social interaction of the child is positively associated with the extent of the social interaction of the parent remains robust.

The results based upon the British *NCDS* are arguably cohort specific since the empirical analysis focused on the social interaction of the parent when aged either 33 or 42. To investigate this further, we make use of the more recent *BCS* cohort data. Furthermore, the measurement of the child's club membership in 2004 in the *BCS*is more detailed than that of the *NCDS*, as detailed in Section 3 above. The results of estimating a bivariate ordered probit as in Eqs. (33a) and (33b) are shown in Table 4, for the child's social interaction, and Table 5, for the parent's social interaction.[17] Focusing upon the child outcome in 2004, parental social interaction is measured in 2000 so $T1 > T2$. As compared to the results from the *NCDS*, the gender and ethnicity of the child are now statistically significant, although the summary statistics in Table 1C reveal similar mean characteristics. Whether the child is in good health reduces (increases) the probability of not being a member of a club (being a member of three or more clubs) by about 4.7 (4.2) percentage points. As found in the *NCDS*, the number of friends and the number of books that the child has are both positively associated with the extent of their club membership. The influence of parental characteristics is less evident in that there are no effects from the gender of the parent or income. If the parent belongs to two or more clubs in 2000 (relative to being a member of no clubs) then the probability that their child is a member of three or more clubs increases by 10 percentage points. Hence, the underlying results related to the child's social interaction do not appear to be cohort specific.

Turning to the social interaction of the parent in Table 5, it is not possible to model the parental outcome at a different time to the measurement of their offspring's social interaction due to data restrictions, hence $T3 = T4$. There are some differences in comparison to the results based on the *NCDS* in that ethnicity is clearly important, as are the number of children in the household rather than the number of adults in the household, and social interaction within the household (as proxied by the frequency the family eats together) all serve to increase the probability that the parent is a member of four or more clubs. However, the underlying result that there is a positive relationship between the social interaction of the child and that of the parent is also apparent in the *BCS*, where the extent of the child's club membership does not seem to be important. Specifically, whether the child is a member of one, two or three or more clubs in 2004

[17]The bivariate ordered probit approach is based on Sajaia (2008).

(relative to no clubs) is associated with around a 10 percentage point increase in the probability that the parent is a member of four or more clubs. As found with the *NCDS*, the joint modelling approach of social interaction across generations yields an efficiency gain and suggests interdependence between the social interaction of parents and their offspring.

So far our empirical analysis supports the existence of bi-directional social interaction effects across generations, which is consistent with our theoretical priors discussed in Section 2. We now further explore the robustness of these findings by investigating two U.S. datasets. Whilst, in both the *PSID* and *NLSY*, the social interaction of the child is measured in a similar fashion to that in the *NCDS* and the *BCS*, namely by the number of clubs and the probability of being a member of a club, the measurement of parental social interaction is arguably more comprehensive in the U.S. data sets. This is because, as well as being able to measure the number of clubs that a parent is a member of, information is also available upon the number of hours spent in a particular social activity. In addition, in what follows for both the *PSID* and *NLSY*, we take advantage of timing differences in the measurement of social interaction, so as to reduce the potential for reverse causality in estimating Eqs. (33a) and (33b), i.e. $T1 > T2$ and $T3 > T4$.

Focusing upon the *PSID*, the social interaction of the child is proxied by the number of clubs they were a member of in 2002 and this is modelled with the same covariates $\mathbf{X}$ and $\mathbf{Z}$ as employed in the British data sets. Following the analysis of the British data sets, the initial measure of parental social interaction consists of binary controls for whether the parent was a member of one, two/three clubs, or four or more clubs in 1997. The results relating to the child outcome are shown in Table 6 Panel A. There are some interesting differences in comparison to the British data sets. For example, older children are more likely to attend more clubs, whereas the opposite was found when considering the *BCS*.[18] This might be because, on average, children are slightly older in the U.S. data sets, see Table 1C. Another difference is that the gender of the child is important: males are approximately 4 (5.5) percentage points less (more) likely not to attend (attend four or more) clubs. In contrast to the British evidence, the social network of the child, as indicated by the number of friends they have, has no influence upon the likelihood of club membership. There are no effects from the education of the parent and income effects, where statistically significant, are small in terms of magnitude. However, as in the *BCS*, whether the parent owns their home is positively associated with the probability of the child being a club member, where housing tenure may provide a proxy for the stock of wealth. As found with the British data sets, and consistent with our theoretical framework presented in Section 2, the extent of the social interaction of the parent has a positive influence upon their offspring's social interaction. Specifically, whether the parent is a member of four or more clubs in 1997 increases the probability that their child is a member of four or more clubs in 2002 by approximately 10 percentage points.

The corresponding parental outcome is shown in Table 7 Panel A, where the probability that the parent volunteers for unpaid work in 2005 is modelled conditional upon the social interaction of the child in 2002, i.e. $T3 > T4$. The results are similar to those found using the British data sets in that there is an effect of the child's social interac-

[18] It should be noted that the types of clubs that the child is a member of differ across the *BCS* and *PSID*.

tion over and above the inclusion of controls for intra household social interaction and religious activities. The extent of the club membership of the child has a monotonic association with parental social interaction, where for a parent whose child is a member of four or more clubs, this culminates in an 8 percentage point higher probability of volunteering daily. The correlation in the error terms is statistically insignificant in the *PSID* and, hence, in what follows, each equation of the model (33a) and (33b) is estimated via a univariate framework.[19]

As mentioned above, one advantage of the *PSID* is that it is possible to examine the extent of the parents' club involvement. Focusing initially on the children's social interaction as the outcome variable, the probability of being a member of four or more clubs is increasing in the number of hours that the parent spends in clubs during 1991, see Table 6 Panel B. Given that the average number of hours that the parent volunteered in 1997 is three hours, based on this mean, this effect increases the probability that the child is a member of four or more clubs in 2002 by over 3 percentage points. In terms of the parental outcome, we consider the number of hours volunteered in 2004, (Table 7 Panel B), and the number of times the parent volunteered in 2004, (Table 7 Panel C), conditional upon the child's social interaction in 2002 (i.e. $T3 > T4$). The results reveal a positive association between the extent of the child's club membership and the time that the parent spends in unpaid voluntary work during 2004. In particular, if the child is a member of four or more clubs in 2002 then the parent volunteers an additional hour of their time (see Panel B) or volunteered an additional time (see Panel C).

In the final dataset, the *NLSY*, in contrast to the other three data sets, the sample of parents are all mothers. The child's social interaction is modelled as the probability of being a member of a club in 2002. Clearly, as in the results for the other three data sets, the age of the child matters in that the likelihood of club membership is increasing in age, albeit at a decreasing rate. Whilst there is no influence from the number of friends that the child has, the number of books owned is positively associated with the probability of club membership. Whether the child lives in a single parent family reduces the probability of club membership by 4 percentage points, which is an effect over and above family income. Whether the parent was a member of a club during their high school years, hence $T1 > T2$, has a monotonic influence on the child's probability of club attendance. In particular, if the mother attended four or more clubs during high school then the child is around 6.5 percentage points more likely to be a club member in 2002. Turning to the parent's social interaction, we focus on the number of weeks that the parent undertook unpaid voluntary work in 2005. Mothers whose highest level of educational attainment was a degree (relative to not completing high school) are more likely to undertake voluntary work as are older individuals. Clearly, the mother's social interaction within the family and social interaction with relatives outside of the household are both important in terms of magnitude and statistical significance. Whether the mother's child was a member of a club in 2002 has a similar influence in terms of magnitude as attending religious services, increasing the number of weeks that the parent undertook voluntary work by around a half, i.e. 3.5 days. To summarise, across the four data sets, we find convincing empirical evidence supporting a bi-directional relationship between the social interaction of parents and their offspring. Furthermore, this relationship exists in the U.S. and Great Britain and is robust across a range of

[19] This is also the case for the *NLSY*.

measures of social interaction.

5 Conclusions

In this paper, we have explored the relationship between the social interaction of parents and their offspring from both a theoretical and an empirical perspective. Our theoretical framework established possible explanations for the intergenerational transfer of social interaction whereby the social interaction of the parent may influence that of their offspring and vice versa. The empirical evidence, based on four data sets covering both Britain and the U.S., is supportive of our theoretical priors. We find robust evidence of intergenerational links between the social interaction of parents and their offspring, which is consistent with the findings of Duncan *et al.* (2005) and Okumura and Usui (2010). Moreover, these links exist over and above an extensive set of controls covering family background such as income and wealth, intra family social interaction and attendance at religious services. Our empirical evidence indicates that higher levels of social interaction of the parent (child) results in higher levels of social interaction of the child (parent). Hence, it would appear that positive bi-directional intergenerational effects exist in social interaction. Our findings contribute more generally to the existing literature on intergenerational economic outcomes, such as earnings (e.g Solon, 1999), formal educational outcomes (e.g. Blanden *et al.*, 2007) and test scores (e.g. Brown *et al.*, 2011).

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Table 1A: Summary Statistics - Dependent Variables

	AVERAGE			
	NCDS	BCS	PSID	NLSY
Child outcome $SOC^{child}_{i,T1}$				
Member of a club in 1991 $\{0,1\}$ (T1=1991)	0.63	-	-	-
Number of clubs a member of in 2004 $\{0, \geq 3\}$ (T1=2004)	-	1.46	-	-
Number of clubs a member of in 2002 $\{0, \geq 4\}$ (T1=2002)	-	-	2.09	-
Member of a club in 2002 $\{0,1\}$ (T1=2002)	-	-	-	0.25
Parent outcome $SOC^{parent}_{j,T3}$				
Number of clubs a member of in 1991 $\{0, \geq 3\}$ (T3=1991)	1.01	-	-	-
Number of clubs a member of in 2000 $\{0, \geq 3\}$ (T3=2000)	0.77	-	-	-
Number of clubs a member of in 2004 $\{0, \geq 4\}$ (T3=2004)	-	1.40	-	-
Voluntary work in 2005 $\{0 = never, 3 = daily\}$ (T3=2004)	-	-	0.66	-
Number of times volunteered in 2005 $\{0, 100\}$ (T3=2004)	-	-	2.25	-
Number of hours volunteered in 2005 $\{0, 2920\}$ (T3=2004)	-	-	69.34	-
Number of weeks volunteered in 2006 $\{0, 52\}$ (T3=2005)	-	-	-	6.05
OBSERVATIONS	1,943	1,290	1,375	1,070

Table 1B: Summary Statistics - Social Interaction Independent Variables

	AVERAGE			
	NCDS	BCS	PSID	NLSY
Child outcome, parental social interaction $SOC^{parent}_{j,T2}$				
Member of 1 club in 1991 $\{0,1\}$ (T2=1991)	0.36	-	-	-
Member of 2-3 clubs in 1991 $\{0,1\}$ (T2=1991)	0.23	-	-	-
Member of 4 or more clubs in 1991 $\{0,1\}$ (T2=1991)	0.03	-	-	-
Member of 1 club in 1981 $\{0,1\}$ (T2=1981)	0.31	-	-	-
Member of 2-3 clubs in 1981 $\{0,1\}$ (T2=1981)	0.23	-	-	-
Member of 4 or more clubs in 1981 $\{0,1\}$ (T2=1981)	0.03	-	-	-
Member of 1 club in 2000 $\{0,1\}$ (T2=2000)	-	0.23	-	-
Member of 2 or more clubs in 2000 $\{0,1\}$ (T2=2000)	-	0.05	-	-
Member of 1 club in 1997 $\{0,1\}$ (T2=1997)	-	-	0.26	-
Member of 2-3 clubs in 1997 $\{0,1\}$ (T2=1997)	-	-	0.23	-
Member of 4 or more clubs in 1997 $\{0,1\}$ (T2=1997)	-	-	0.07	-
Member of 1 club in high school $\{0,1\}$	-	-	-	0.25
Member of 2-3 clubs in high school $\{0,1\}$	-	-	-	0.28
Member of 4 or more clubs in high school $\{0,1\}$	-	-	-	0.05
Parent outcome, child social interaction $SOC^{child}_{j,T4}$				
Member of a club in 1991 $\{0,1\}$ (T4=1991)	0.63	-	-	-
Member of 1 club in 2004 $\{0,1\}$ (T4=2004)	-	0.39	-	-
Member of 2 clubs in 2004 $\{0,1\}$ (T4=2004)	-	0.27	-	-
Member of 3 or more clubs in 2004 $\{0,1\}$ (T4=2004)	-	0.18	-	-
Member of 1 club in 2002 $\{0,1\}$ (T4=2002)	-	-	0.21	-
Member of 2-3 clubs in 2002 $\{0,1\}$ (T4=2002)	-	-	0.44	-
Member of 4 or more clubs in 2002 $\{0,1\}$ (T4=2002)	-	-	0.20	-
Member of a club in 2002 $\{0,1\}$ (T4=2002)	-	-	-	0.25
OBSERVATIONS	1,943	1,290	1,375	1,070

Table 1C: Summary Statistics - Independent Variables

	AVERAGE			
	NCDS	BCS	PSID	NLSY
Child characteristics				
Age of child (**X**)	9.19	11.91	14.11	14.75
Age of child age squared (**X**)	92.28	114.99	205.60	223.85
Male (**X**)	0.49	0.49	0.53	0.52
Child in good health (**X**)	0.87	0.93	0.84	0.39
Child has siblings (**X**)	0.91	0.91	0.83	0.53
Number of schools child attended (**X**)	1.72	1.90	1.52	1.41
Number of friends child has (**X**)	3.52	1.89	3.81	1.75
Number of books owned by child (**X**)	3.80	3.97	3.65	1.43
Child in single parent family (**X**)	0.45	0.20	0.46	0.49
White (**X**)	0.96	0.93	0.51	0.56
Parent characteristics				
Age of parent (**X**, **Z**)[♯]	-	-	45.89	24.99
Age of parent squared (**X**, **Z**)	-	-	2168.73	626.53
Male (**X**, **Z**)	0.32	0.19	0.69	-
O levels highest qualification (**X**, **Z**)	0.38	0.28	-	-
A levels highest qualification (**X**, **Z**)	0.10	0.04	-	-
Diploma highest qualification (**X**, **Z**)	0.11	0.10	-	-
Degree highest qualification (**X**, **Z**)	0.05	0.03	-	-
Number of years of schooling (**X**, **Z**)	-	-	12.83	-
High school highest qualification (**X**, **Z**)	-	-		0.69
College highest qualification (**X**, **Z**)	-	-		0.05
Degree highest qualification (**X**, **Z**)	-	-		0.09
Log benefits (**X**, **Z**)	3.37	4.92	1.16	-
Log non labour income (**X**, **Z**)	1.55	3.94	1.10	-
Log labour income (**X**, **Z**)	3.37	5.34	7.88	-
Log net family income (**X**, **Z**)	-	-	-	9.04
Own house, outright or mortgaged (**X**, **Z**)	0.68	0.58	0.70	0.37
Number of adults in household (**Z**)	1.97	1.87	2.28	2.45
Number of children in household (**Z**)	2.43	2.68	1.82	1.81
Whether attend religious service (**Z**)	0.37	0.15	0.79	0.67
Frequency family eats together (**Z**)	1.73	1.70	2.58	0.36
Frequency family see relatives (**Z**)	2.21	0.86	0.70	0.84
Parent works $\geq$ 45 hrs per week (**Z**)	0.34	0.13	0.26	0.06
Married (**Z**)	0.82	0.57	0.64	0.51
White (**Z**)	0.96	0.95	0.55	0.68
OBSERVATIONS	1,943	1,290	1,375	1,070

[♯] All parents in the *NCDS* (*BCS*) are 33 in 1991 (34 in 2004), there is no variation as the data is cohort specific, hence age is not included as a covariate.

Table 2: Great Britain (NCDS) - Probability Child is a Member of a Club in 1991

	CHILD OUTCOME 1991 - probability club member	
PANEL A	M.E.	TSTAT
Child characteristics		
Age of child	0.1049	(5.35)
Age of child age squared	-0.0063	(5.98)
Male	-0.0269	(1.18)
Child in good health	-0.0036	(0.11)
Child has siblings	0.0489	(1.19)
Number of schools child attended	0.0088	(0.60)
Number of friends child has	0.0151	(1.98)
Number of books owned by child	0.0188	(1.92)
Child in single parent family	0.0842	(2.96)
White	0.0809	(1.26)
Parent characteristics		
Male	0.0479	(1.51)
O levels highest qualification	0.1369	(5.35)
A levels highest qualification	0.1323	(3.68)
Diploma highest qualification	0.2006	(6.12)
Degree highest qualification	0.1692	(3.40)
Log benefits	-0.0028	(0.25)
Log non labour income	-0.0117	(1.51)
Log labour income	-0.0106	(2.01)
Own house	0.0142	(0.20)
Member of 1 club in 1991	0.0641	(2.47)
Member of 2-3 clubs in 1991	0.1489	(5.17)
Member of 4 or more clubs in 1991	0.2173	(3.69)
LR chi squared (32)	251.27 p=[0.000]	
PANEL B - Timing difference	M.E.	TSTAT
Parent characteristics		
Member of 1 club in 1981	0.0342	(2.27)
Member of 2-3 clubs in 1981	0.0759	(2.48)
Member of 4 or more clubs in 1981	0.1945	(3.08)
LR chi squared (32)	233.92 p=[0.000]	
Controls	As in Panel A	
PANEL C - Joint modelling, parent outcome 1991	M.E.	TSTAT
Parent Characteristics		
Member of 1 club in 1981	0.0674	(2.76)
Member of 2-3 clubs in 1981	0.1402	(5.19)
Member of 4 or more clubs in 1981	0.2609	(5.60)
LR chi squared (60)	1,366.58 p=[0.000]	
ρ	-0.5942 p=[0.000]	
Controls	As in Panel A	
PANEL D - Timing difference and joint modelling, parent outcome 2000	M.E.	TSTAT
Parent Characteristics		
Member of 1 club in 1981	0.0450	(2.82)
Member of 2-3 clubs in 1981	0.1109	(4.05)
Member of 4 or more clubs in 1981	0.2145	(4.15)
OBSERVATIONS	1,943	

Notes: (i) regional controls included; (ii) regional controls included;
(iii) panel C joint model corresponding parent outcome in 1991 is in Table 3 column 1;
(iv) panel D joint model corresponding parent outcome in 2000 is in Table 3 column 2.

Table 3: Great Britain (NCDS) - Parent Club Membership (Joint Modelling)

	Column 1 PARENT OUTCOME 1991 - probability of				**Column 2** PARENT OUTCOME 2000 - probability of			
	ZERO CLUBS		≥ 4 CLUBS		ZERO CLUBS		≥ 4 CLUBS	
	M.E.	TSTAT	M.E.	TSTAT	M.E.	TSTAT	M.E.	TSTAT
Child Characteristics								
Child a member of a club in 1991	-0.4178	(9.05)	0.0835	(4.40)	-0.4287	(9.69)	0.0219	(2.74)
Parent characteristics								
Number of adults in household	-0.0570	(3.06)	0.0132	(2.92)	-0.0238	(1.36)	0.0013	(1.31)
Number of children in household	-0.0086	(0.78)	0.0020	(0.77)	0.0171	(1.36)	-0.0009	(1.33)
White	-0.0111	(0.22)	0.0025	(0.23)	0.0417	(0.73)	-0.0025	(0.63)
Married	0.0212	(0.85)	-0.0051	(0.81)	0.0449	(1.74)	-0.0026	(1.50)
Male	-0.0395	(1.86)	0.0095	(1.65)	-0.0577	(2.35)	0.0033	(1.98)
O levels highest qualification	-0.0273	(1.11)	0.0064	(1.13)	-0.0289	(1.08)	0.0016	(1.10)
A levels highest qualification	-0.0612	(1.94)	0.0166	(1.64)	0.0004	(0.01)	-0.0001	(0.01)
Diploma highest qualification	-0.0888	(2.65)	0.0256	(2.29)	-0.0753	(2.00)	0.0049	(2.79)
Degree highest qualification	-0.2084	(6.81)	0.1031	(3.58)	-0.2532	(7.14)	0.0310	(3.55)
Log benefits	0.0114	(1.26)	-0.0026	(1.25)	-0.0001	(0.13)	0.0001	(0.13)
Log non labour income	-0.0111	(1.71)	0.0026	(1.66)	0.0115	(1.37)	-0.0006	(1.32)
Log labour income	-0.0239	(4.99)	0.0055	(4.32)	-0.0288	(7.52)	0.0015	(3.78)
Own house	0.1353	(2.10)	-0.0551	(2.10)	0.0389	(0.59)	-0.0109	(0.59)
Attends religious service	-0.4729	(6.30)	0.2075	(4.53)	-0.5941	(9.66)	0.1605	(9.53)
Frequency family eats together	0.0016	(0.17)	0.0078	(1.69)	-0.0193	(1.34)	0.0010	(1.31)
Frequency family see relatives	-0.0089	(0.87)	0.0056	(1.31)	0.0200	(1.84)	-0.0011	(1.67)
Parent works ≥ 45 hrs per week	0.0344	(1.50)	-0.0270	(2.79)	0.1390	(3.34)	-0.0052	(3.02)
LR chi squared (60)	1,366.58 p=[0.000]				1,453.49 p=[0.000]			
ρ	-0.5942 p=[0.000]				-0.6095 p=[0.000]			
OBSERVATIONS	1,943							

Notes: (i) regional controls included; (ii) column 1 corresponding child outcome in joint modelling is in Table 2 Panel C; (iii) column 2 corresponding child outcome in joint modelling is in Table 2 Panel D.

Table 4: Great Britain (BCS) - Probability Child is a Member of a Club in 2004 (Joint Modelling)

	CHILD OUTCOME 2004 - probability of			
	ZERO CLUBS		≥THREE CLUBS	
	M.E.	TSTAT	M.E.	TSTAT
Child characteristics				
Age of child	0.1135	(2.04)	-0.1201	(2.04)
Age of child age squared	-0.0046	(2.08)	0.0048	(2.08)
Male	0.0229	(1.73)	-0.0242	(1.74)
Child in good health	-0.0469	(2.08)	0.0420	(2.10)
Child has siblings	0.0031	(0.12)	-0.0033	(0.12)
Number of schools child attended	0.0064	(0.91)	-0.0068	(0.91)
Number of friends child has	-0.0377	(4.89)	0.0399	(4.90)
Number of books owned by child	-0.0116	(2.64)	0.0123	(2.64)
Child in single parent family	0.0277	(1.35)	-0.0272	(1.45)
White	0.0754	(3.79)	-0.1128	(2.70)
Parent characteristics				
Male	0.0332	(1.59)	-0.0322	(1.53)
O levels highest qualification	-0.0774	(5.42)	0.0967	(4.66)
A levels highest qualification	0.0371	(0.93)	-0.0340	(1.08)
Diploma highest qualification	-0.1105	(8.21)	0.1952	(5.26)
Degree highest qualification	0.0049	(0.11)	-0.0051	(0.11)
Log benefits	0.0006	(0.09)	-0.0006	(0.09)
Log non labour income	0.0113	(0.75)	-0.0120	(0.75)
Log labour income	0.0027	(1.18)	-0.0029	(1.18)
Own house	-0.0382	(2.29)	0.0394	(2.35)
Member of 1 club in 2000	-0.0310	(2.02)	0.0394	(1.97)
Member of 2 or more clubs in 2000	-0.0715	(3.14)	0.1076	(2.35)
LR chi squared (60)	743.91 p=[0.000]			
ρ	-0.8337 p=[0.000]			
OBSERVATIONS	1,290			

Notes: (i) regional controls included; (ii) parent outcome shown in Table 5.

Table 5: Great Britain (BCS) - Probability Parent is a Member of a Club in 2004 (Joint Modelling)

	PARENT OUTCOME 2004 - probability of			
	ZERO CLUBS		≥FOUR CLUBS	
	M.E.	TSTAT	M.E.	TSTAT
Child characteristics				
Member of 1 club in 2004	-0.1350	(3.45)	0.0956	(3.31)
Member of 2 clubs in 2004	-0.1340	(3.23)	0.0985	(2.99)
Member of 3 or more clubs in 2004	-0.1427	(3.22)	0.1089	(2.88)
Parent characteristics				
Number of adults in household	-0.0030	(0.10)	0.0020	(0.10)
Number of children in household	-0.0418	(3.52)	0.0316	(3.50)
White	-0.2811	(4.79)	0.1443	(6.44)
Married	-0.1161	(3.80)	0.0778	(3.85)
Male	-0.0231	(0.63)	0.0160	(0.62)
O levels highest qualification	-0.0939	(3.07)	0.0673	(2.91)
A levels highest qualification	-0.0718	(1.17)	0.0529	(1.08)
Diploma highest qualification	-0.1416	(3.44)	0.1106	(3.01)
Degree highest qualification	-0.2364	(3.92)	0.2135	(2.98)
Log benefits	-0.0076	(0.68)	0.0052	(0.68)
Log non labour income	-0.0550	(1.84)	0.0375	(1.84)
Log labour income	-0.0128	(2.92)	0.0087	(2.91)
Own house	-0.0768	(2.55)	0.0517	(2.57)
Attends religious service	-0.2114	(6.34)	0.1733	(5.29)
Frequency family eats together	-0.0844	(4.22)	0.0575	(4.34)
Frequency family see relatives	0.0211	(0.52)	-0.0146	(0.51)
Parent works ≥ 45 hrs per week	-0.0237	(0.29)	0.0166	(0.28)
LR chi squared (60)	743.91 p=[0.000]			
ρ	-0.8337 p=[0.000]			
OBSERVATIONS	1,290			

Notes: (i) regional controls included; (ii) child outcome shown in Table 4.

Table 6: U.S. (PSID) - Probability Child is a Member of a Club in 2002

PANEL A - Number of clubs parent attends	CHILD OUTCOME 2002 - probability of			
	ZERO CLUBS		≥FOUR CLUBS	
	M.E.	TSTAT	M.E.	TSTAT
Child characteristics				
Age of child	-0.1665	(4.19)	0.2085	(4.21)
Age of child age squared	0.0055	(3.70)	-0.0069	(3.72)
Male	0.0438	(3.54)	-0.0554	(3.52)
Child in good health	-0.0460	(2.32)	0.0499	(2.67)
Child has siblings	-0.0149	(0.84)	0.0178	(0.88)
Number of moves	0.0113	(0.89)	-0.0142	(0.89)
Number of friends child has	-0.0024	(0.78)	0.0030	(0.78)
Number of books owned by child	-0.0142	(1.49)	0.0178	(1.49)
Child in single parent family	0.0053	(0.33)	-0.0066	(0.31)
White	0.0033	(0.21)	-0.0041	(0.21)
Parent characteristics				
Male	-0.0029	(0.15)	0.0037	(0.15)
Years of schooling	-0.0026	(0.24)	0.0033	(0.24)
Log benefits	0.0020	(0.64)	-0.0025	(0.64)
Log non labour income	0.0037	(0.95)	-0.0046	(0.95)
Log labour income	-0.0031	(1.95)	0.0039	(1.96)
Own house	-0.0416	(2.42)	0.0482	(2.62)
Member of 1 club in 1997	0.0105	(0.66)	-0.0128	(0.68)
Member of 2-3 clubs in 1997	-0.0275	(2.81)	0.0369	(2.68)
Member of 4 or more clubs in 1997	-0.0586	(3.16)	0.0971	(2.40)
LR chi squared (82)	609.86 p=[0.000]			
ρ	-0.2222 p=[0.149]			
PANEL B - Number of hours parents spend in clubs	CHILD OUTCOME 2002 - probability of			
	ZERO CLUBS		≥FOUR CLUBS	
	M.E.	TSTAT	M.E.	TSTAT
Parents characteristics				
Number of hours parent spends in clubs in 1997	-0.0091	(2.67)	0.0114	(2.72)
LR chi squared (42)	174.24 p=[0.000]			
Controls	As in Panel A			
OBSERVATIONS	1,375			

Notes: (i) state controls included;
(ii) panel A joint model, corresponding parent outcome in 2004 in Table 7 panel A.

Table 7: U.S. (PSID) - Parental Social Interaction in 2004

PANEL A - probability of volunteering	NEVER		DAILY	
	M.E.	TSTAT	M.E.	TSTAT
Child characteristics				
Member of 1 club in 2002	-0.0543	(1.15)	0.0204	(1.09)
Member of 2-3 clubs in 2002	-0.0978	(2.34)	0.0359	(2.25)
Member of 4 or more clubs in 2002	-0.1881	(3.85)	0.0805	(3.21)
Parent characteristics				
Age	-0.0168	(1.13)	0.0060	(1.13)
Age squared	0.0002	(1.46)	-0.0001	(1.45)
Number of adults in household	0.0060	(0.32)	-0.0021	(0.32)
Number of children in household	-0.0108	(0.67)	0.0039	(0.67)
White	-0.1004	(3.34)	0.0357	(3.28)
Married	-0.0619	(1.09)	0.0217	(1.11)
Male	-0.0741	(1.24)	0.0256	(1.28)
Years of schooling	-0.0365	(6.53)	0.0131	(6.12)
Log benefits	-0.0077	(1.12)	0.0028	(1.11)
Log non labour income	-0.0126	(1.74)	0.0045	(1.63)
Log labour income	-0.0034	(0.79)	0.0012	(2.79)
Own house	-0.0512	(1.56)	0.0178	(1.60)
Attends religious service	-0.1085	(0.96)	0.0356	(3.76)
Frequency family eats together	-0.0205	(2.73)	0.0074	(2.7)
Frequency family see relatives	-0.0482	(0.96)	0.0184	(0.91)
Parent works $\geq$ 45 hours per week	-0.0700	(2.30)	0.0265	(2.17)
LR chi squared (82)	609.86 p=[0.000]			
ρ	-0.2222 p=[0.149]			

PANEL B - Number of hours volunteered in 2004		
Child characteristics	COEF	TSTAT
Member of 1 club in 2002	0.5253	(1.27)
Member of 2-3 clubs in 2002	0.6527	(2.03)
Member of 4 or more clubs in 2002	0.9307	(2.34)
LR chi squared (43)	116.32 p=[0.000]	
Controls	As in Panel A	

PANEL C - Number of times volunteered in 2004		
Child characteristics	COEF	TSTAT
Member of 1 club in 2002	0.7147	(2.95)
Member of 2-3 clubs in 2002	0.8817	(4.11)
Member of 4 or more clubs in 2002	1.1175	(4.51)
LR chi squared (43)	240.70 p=[0.000]	
Controls	As in Panel A	
OBSERVATIONS	1,375	

Notes: (i) state controls included.

Table 8: U.S. (NLSY) - Probability Child is a Member of a Club in 2002

	M.E.	TSTAT
Child characteristics		
Age of child	0.9223	(11.13)
Age of child age squared	-0.0334	(11.38)
Male	-0.0058	(0.42)
Child in good health	-0.0004	(0.02)
Child has siblings	-0.0165	(1.15)
Number of schools child attended	-0.0073	(0.70)
Number of friends child has	-0.0065	(0.93)
Number of books owned by child	0.0320	(3.91)
Child in single parent family	-0.0409	(2.48)
White	-0.0199	(1.24)
Parent characteristics		
High school highest qualification	0.0185	(1.00)
College highest qualification	-0.0107	(0.30)
Degree highest qualification	-0.0151	(0.56)
Log net family income	0.0046	(2.37)
Own house	0.0061	(0.40)
Member of 1 club in high school	0.0111	(0.60)
Member of 2-3 clubs in high school	0.0322	(2.70)
Member of 4 or more clubs in high school	0.0647	(2.45)
LR chi squared (22)	498.07 p=[0.000]	
OBSERVATIONS	1,070	

Notes: (i) regional controls included.

Table 9: U.S. (NLSY) - Number of Weeks Parent Undertook Voluntary Work in 2005

	COEF	TSTAT
Child characteristics		
Member of a club in 2002	0.5009	(3.09)
Parent characteristics		
Age	8.4191	(3.32)
Age squared	-0.1717	(3.38)
Number of adults in household	-0.0542	(0.84)
Number of children in household	-0.0659	(0.73)
White	0.3221	(1.50)
Married	1.4741	(6.35)
High school highest qualification	0.3945	(1.43)
College highest qualification	0.1430	(0.42)
Degree highest qualification	0.7232	(2.09)
Log net family income	0.0882	(4.00)
Own house	0.4184	(1.96)
Attends religious service	0.5827	(3.14)
Frequency family eats together	0.3853	(2.42)
Frequency family see relatives	0.3236	(3.46)
Parent works $\geq$ 45 hours per week	-0.4173	(1.48)
LR chi squared (20)	277.77 p=[0.000]	
OBSERVATIONS	1,070	

Notes: (i) regional controls included.

Table A1: Definition of Independent Variables

Child Characteristics	
Age of child (**X**)	Age of the child at time of interview
Age of child age squared (**X**)	Age of the child squared
Male (**X**)	Binary variable; 1=male child , 0=female child
Child in good health (**X**)	Binary variable defined at time of interview; 1=child in good or excellent health; 0=otherwise
Child has siblings (**X**)	Binary variable defined at time of interview; 1=child has one or more siblings; 0=no siblings
Number of schools child attended (**X**)	*NCDS*, *BCS*, *NLSY*: number of schools attended by time of interview. *PSID*: number of times moved home
Number of friends child has (**X**)	Number of friends that the child has at time of interview
Number of books owned by child (**X**)	Number of books that the child has at time of interview
Child in single parent family (**X**)	Binary variable defined at time of interview; 1=single parent family; 0=otherwise
White (**X**)	Binary variable; 1=child white, 0=child non white
Parent Characteristics	
Age of parent (**X, Z**)	Age of parent at time of interview
Age of parent squared (**X, Z**)	Age of parent at time of interview squared
Male (**X, Z**)	Binary variable; 1=parent male, 0=parent female
O levels highest qualification (**X, Z**)	*NCDS*, *BCS*: Binary variable defined at time of interview; 1=O level highest qualification, 0=otherwise
A levels highest qualification (**X, Z**)	*NCDS*, *BCS*: Binary variable defined at time of interview; 1=A level highest qualification, 0=otherwise
Diploma highest qualification (**X, Z**)	*NCDS*, *BCS*: Binary variable defined at time of interview; 1=diploma highest qualification, 0=otherwise
Degree highest qualification (**X, Z**)	*NCDS*, *BCS*: Binary variable defined at time of interview; 1=degree highest qualification, 0=otherwise
Number of years of schooling (**X, Z**)	*PSID*: number of years of completed education at time of interview
High school highest qualification (**X, Z**)	*NLSY*: Binary variable defined at time of interview; 1=high school highest qualification, 0=otherwise
College highest qualification (**X, Z**)	*NLSY*: Binary variable defined at time of interview; 1=college education highest qualification, 0=otherwise
Degree highest qualification (**X, Z**)	*NLSY*: Binary variable defined at time of interview; 1=degree highest qualification, 0=otherwise
Log benefits (**X, Z**)	*NCDS, BCS, PSID*: logarithm of the sum of child and unemployment benefits defined at time of interview
Log non labour income (**X, Z**)	*NCDS, BCS, PSID*: logarithm of income from any source other than labour income or benefits
Log labour income (**X, Z**)	*NCDS, BCS, PSID*: logarithm of all sources of income earned through employment defined at time of interview
Log net family income (**X, Z**)	*NLSY*: logarithm of the net sum of all sources of income defined at time of interview
Own house (**X, Z**)	Binary variable defined at time of interview; 1=own home (outright or mortgage); 0=otherwise
Number of adults in household (**Z**)	Number of adults (over 16) in the household at time of interview
Number of children in household (**Z**)	Number of children (16 or younger) in the household at time of interview
Attends religious service (**Z**)	Binary variable defined at time of interview; 1=attends religious service; 0=otherwise
Frequency family eats together (**Z**)	0=never, 1=weekly, 2=once per day, 3=more than once per day
Frequency family see relatives (**Z**)	*NCDS, PSID, NLSY*: 0=never, 1=yearly, 2=monthly, 3=weekly. *BCS*: 1=visited family last month, 0=otherwise
Parent works $\geq$45 hrs per week (**Z**)	Binary variable defined at time of interview; 1=parent works more than 44 hours per week; 0=otherwise
Married (**Z**)	Binary variable defined at time of interview; 1=parent married or cohabiting; 0=otherwise
White (**Z**)	Binary variable; 1=parent white, 0=parent non white