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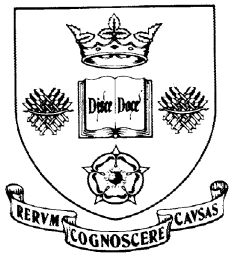

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On Modelling the Social Interaction of Couples*

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Abstract

In this paper we contribute to the existing microeconomic literature on social interaction, which has generally focused on social interaction from an individual's perspective. Given that decisions regarding social interaction are often made within the context of a couple or family, we explore the potential interdependence between the social interaction of husbands and wives from both a theoretical and an empirical perspective. We develop a theoretical framework based on an extension of Becker (1974) to include factors which characterise aspects of a couple's decision-making in relation to social interaction and show that these factors support a tendency towards a positive correlation between the husband's and wife's levels of social interaction. Indeed, our empirical findings suggest such a positive association between the social interaction of husbands and wives as measured by active club membership and the frequency of the social interaction activities. In addition, we find that this positive association is particularly pronounced across the same types of club membership or social activities.

Keywords: Couples; Panel Data; Social Interaction
JEL Classification: D12; D14

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1 Introduction and Background

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 (see, for example, Brown and Taylor, 2007; Iannaccone, 1998; Glaeser *et al.*, 2002). The focus has generally been on analysing social interaction at the individual level. Such an approach, however, does not allow for the fact that decisions regarding social interaction are often made within the context of a family or couple. Hence, there has been limited discussion in the existing economics literature of the potential interdependence between decisions regarding social interaction at the household level.

Such interdependence may reflect assortative mating whereby individuals match with individuals with similar characteristics and preferences to themselves. Hence, with positive assortative matching, an individual who is disposed to joining and participating in clubs or groups is likely to match with an individual who is similarly inclined. Indeed, it may be the case that such people meet their future partners when participating in such activities. On the other hand, interdependence between a husband and wife's social interaction may reflect the coordination of child care and household responsibilities within a couple. Such responsibilities may serve to limit the extent to which both partners are able to engage in social interaction or the time available for such activities. Additionally, the findings in the household labour supply literature suggest that married individuals enjoy spending leisure time together (see, for example, Hamermesh, 2000; Hallberg, 2003; Jenkins and Osberg, 2005). Hence, married individuals may engage in joint social interaction during their leisure time.

The aim of this paper is, therefore, to explore the potential interdependence between the social interaction of husbands and wives in order to further our understanding of the determinants of social interaction, which has been found in the existing literature to play a key role in social and economic development. At the microeconomic level, for example, empirical evidence supports a positive association between education and social interaction. Indeed, Glaeser *et al.* (2002), who report evidence supporting a positive correlation between education and social interaction, argue that this relationship is not only well known in the social capital literature, but is also 'one of the most robust empirical regularities in the social capital literature.' (Glaeser *et al.*, 2002, p.F455). In addition, Brown and Taylor (2009) report a positive association between parental social interaction and the academic test scores of their children thereby highlighting an intergenerational dimension to the relationship between educational attainment and social interaction. Whilst at the macroeconomic level, there has been considerable discussion of the benefits of social capital and social interaction for economic growth (see, for example, Knack and Keefer, 1997; Algan and Cahuc, 2010).

The next section presents the theoretical framework which motivates our econometric analysis, which exploits household level panel data to explore the potential interdependence between the social interaction between husbands and wives. Our theoretical framework develops the model of social interaction due to Becker (1974). We augment the model to include factors which characterize aspects of a couple's decision-making in relation to social interaction that might not be relevant for non-couples. We show that these factors support a tendency towards a positive correlation between the husband's

and wife's levels of social interaction even in the case of negative assortative matching and establish that this tendency may persist in the presence of children where one partner takes on the main responsibility for childcare provision. Our empirical findings, based on jointly modelling the social interaction of husbands and wives, suggest that there is a positive association between the social interaction of husbands and wives. Moreover, our empirical findings endorse adopting a joint modelling approach. In addition, we find that this positive association is particularly pronounced across the same types of club membership or social activities.

2 Theoretical Framework

We now set out a theoretical framework of social interaction based on Becker (1974) which we later extend to include interplay within couples in the determination of each other's social interaction choices. In Becker's (1974) model, social interaction is introduced into the framework of household behavior by allowing the production of the household's commodities to be affected by the characteristics of non-household individuals. In the model, the utility for individual i:

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

is expressed in terms of commodities or wants[1], Z_{iq} $(q = 1, ..., Q)$, that are consumed by i and produced according to the production function:

$$Z_{iq} = Z_{iq}(y_{iq}, t_{iq}, e_i, R_{iq1}, ..., R_{iqL}). \tag{2}$$

In Eq. (2) y_{iq} and t_{iq} are, respectively, goods or services and time devoted by i to the production of commodity q, e_i captures i's relevant personal and environmental characteristics (e.g., education and experience), and R_{iql} $(l = 1, ..., L)$ are the characteristics of L 'other' individuals that affect i's output of commodity q.

The central argument in Becker (1974), through which it departs from the traditional household model of production (e.g., Michael and Becker, 1973), is that the individual is able to influence it's social environment (represented by the characteristics of non-household members, R_{iqL}), by undertaking social interaction. It is these social interaction 'investments' which form the basis for our theoretical characterisation of social interaction in this paper.

2.1 Explaining the Social Interaction of Couples

In this section we develop a theoretical framework that allows us to examine the social interaction investments of couples in the context of a household with associated partner interrelationships.[2] Like Becker (1974), we include social interaction in our model by allowing an individual i's production of a commodity Z, which they consume, to be affected by the characteristics of 'others' (or non-household individuals) and that the

[1] See, for example, Bentham (1789) and Marshall (1962) who discuss social interaction in the wider context of wants and their determinants.

[2] However, we are careful to select certain partner interrelationships concerned directly with social interaction to take an endogenous role in our model and explicitly exclude others, e.g., the endogenous determination of the household allocation of time to specialisation in job market or household work, so as to maintain clarity and transparency.

individual can affect the characteristics of 'others' by making 'social interaction' investments, s_i. We adapt the model of Becker (1974) to include two agents ($i = 1, 2$) each making simultaneous choices about social interaction investments - thereby attempting to influence the characteristics of the non-household individuals.[3] For simplicity we summarise the non-household characteristics through a single non-household individual n (hence $L = 1$ in Eq. (2)).

Following Becker (1974), we assume that the characteristics, R_i, of the non-household individual n relating to individual i, have two components:[4]

$$R_i = R_i(D_i, s_i), \quad (i = 1, 2), \tag{3}$$

where s_i represents investments by i to affect the characteristics of n and D_i is the level of R_i when $s_i = 0$. We assume that R_i is increasing and concave in both its arguments.

Since we are interested in taking into account possible interplay between the members of the couple in terms of social interaction investments, we allow the production function of one partner to be dependent upon the social interaction of the other partner. For simplicity, we assume that only one of the pair, individual 1, exhibits this and that individual 2's production function depends only on their own social interaction. Hence the characteristics of the non-household individual with respect to individual 2, R_2, are also important to individual 1. In particular, we assume that individual 1 gains from the social interaction of the partner 2 since the non-household individual characteristics relating to 1 are enhanced by R_2. In accordance with Eqs. (1) and (2), utility for individuals 1 and 2, can be expressed in general terms as:

$$U_1 = U_1(Z_1(R_1(R_2)), T_1), \tag{4a}$$

$$U_2 = U_2(Z_2(R_2), T_2). \tag{4b}$$

where T_i is the total time available to individual i. Maximising utility for individual i is now equivalent to maximising the output of commodity Z based upon the utility-output function:

$$U_i = Z_i(R_i, T_i). \tag{5}$$

Given that R_2 is of interest to individual 1, we allow individual 1 to make cross-partner investments, s_x, in individual 2's social interaction.[5] Hence Eq. (3) becomes:

$$R_1 = R_1(D_1(s_x, s_2), s_1), \tag{6a}$$

$$R_2 = R_2(D_2(s_x), s_2). \tag{6b}$$

We assume that $D_i(.)$ $(i = 1, 2)$ is increasing and concave in its element(s). Hence, investments by individual 1 in their partner's social interaction s_x, have a direct (indirect) and positive effect on the non-household characteristics with respect to individual 2 (1). We assume throughout that the marginal benefit to individual 1 of an increase in s_x is

[3] In Becker (1974) social interaction in relation to non-household individuals is treated separately from social interaction within the household. In this paper we combine the two.

[4] Unlike Becker (1965) we do not treat the components as perfect substitutes.

[5] To motivate this, note that the characteristics of n towards individual 1 are influenced by the social interaction of the partner, hence individual 1 might find it productive to invest in boosting their partner's social interaction.

at least as great as the effect of an increase in s_2 since individual 1 can always select to pay for the activity under s_x that individual 2 would have opted for at the margin under it's next best s_2 investment. Individual 1 will, however, select the s_x which suits themselves the best.[6]

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

$$T_i = T_i^E + T_i^H + T_i^S, \quad (i = 1, 2), \tag{7}$$

where T_i^S is the time required in the production of R_i, T_i^E is the time devoted to paid employment and T_i^H is the time devoted to household productivity.[7]

It is now clear that the input of time, T_i^S, required in the production of R_i $(i = 1, 2)$ can also be specified in terms of s_i, hence Eq. (7) can be written:

$$T_1 = T_1^E + T_1^H + t_1^S s_1 + t_{xv}^S s_x, \tag{8a}$$

$$T_2 = T_2^E + T_2^H + t_2^S s_2 + t_{xf}^S s_x. \tag{8b}$$

where t_k^S is the constant time per unit s_k $(k = 1, 2, x)$. For individual 2, T_2^S includes time devoted to their own s_2 investments as well as those received from the partner, s_x. We use t_{xv}^S to represent the variable part of time associated with s_x experienced by individual 1 who undertakes the search for s_x and t_{xf}^S to represent the time that individual 2 expends in undertaking a unit of s_x which is fixed. For simplicity, throughout we assume that the fixed part of the social interaction, relating to undertaking the activity itself rather than the search is common across all activity types, hence $t_{xf}^S \leq t_i^S$ $(i = 1, 2)$ since the former includes no search cost.

An important assumption in our argument, then, is that T_i^S incorporates not only time devoted to producing R_i, it also includes time involved in searching for R_i prospects: hence, we envisage a scenario in which there is imperfect information over the available production opportunities and so our model involves search costs. Let $\tilde{s}_i$ be the stock of social interaction of individual i, where higher levels of $\tilde{s}_i$ are associated with lower search costs. Assuming that there is information sharing in the household we assume that search costs for individual i are a function of both individuals' stocks of social interaction, hence:

$$t_k^S = t_k^S(\tilde{s}_1, \tilde{s}_2), \quad (k = 1, 2, xv), \tag{9}$$

where t_k^S is non-increasing and convex in both its arguments. Hence, if in an earlier period individual i accumulates a large stock of social interaction because, say, social

[6] It is worth noting that though s_x and s_2 could be perfect substitutes in U_2, this is unlikely in reality. Indeed, in U_2, s_x may even be inferior. Recall, s_x investments are made by individual 1 to raise U_1 through R_2 and R_1 and not through U_2. In practice, though not modelled here, s_k investments will have a direct effect on utility, possibly both positive and negative, through the social interaction experience itself rather than just through the effect it has on the characteristics of non-household individuals. Here, individual 1 is interested in the R_2 impact of s_x investments only and there may be little incentive for 1 to select s_x investments that yield direct utility to individual 2. Of course, individual 2 may or may not engage fully with the social interaction associated with s_x, and this may act as a 'participation' constraint on the 'quality' of s_x investments from a U_2 perspective.

[7] In this paper we are not concerned with explaining the allocation of time for household production and hence leave this as exogenously determined.

interaction has a high priority in their utility function, then in the next period it may lead to a reduction in the costs of social interaction for both i and eventually the other member of the couple, $-i$ ($-i \neq i = 1, 2$), after search cost-saving information has been shared.

In addition to the time constraints Eqs. (8a) and (8b), we have two budget constraints:[8]

$$I_1 = \sum_{v=1,x} s_v p_s, \tag{10a}$$

$$I_2 = s_2 p_s, \tag{10b}$$

where I_i is the money income of individual i and p_s is the price of a unit of social interaction, which for convenience we assume constant and common across all s_k ($k = 1, 2, x$).

It is well known (e.g., Becker, 1965) that Eqs. (8a), (8b), (10a) and (10b) can be collapsed as follows:

$$M_1 = wT_1 + V_1 = \sum_{v=1,x} s_v p_s + wt_v^S(\tilde{s}_1, \tilde{s}_2)s_v, \tag{11a}$$

$$M_2 = wT_2 + V_2 = s_2 p_s + wt_2^S(\tilde{s}_1, \tilde{s}_2)s_2 + w\bar{t}_x^S s_x, \tag{11b}$$

where M_i is the 'full income' (see Becker, 1965) and V_i is the non-labour income of individual i and w is the wage rate which we assume common to both individuals.[9] Note, $t_x^S(\tilde{s}_1, \tilde{s}_2) \equiv t_{xv}^S$ and $\bar{t}_x^S \equiv t_{xf}^S$.

It follows that maximising utility, Eq. (5), can now be meaningfully expressed in terms of s_k, hence:

$$U_1 = U_1(s_1, s_x; s_2), \tag{12a}$$

$$U_2 = U_2(s_2; s_x). \tag{12b}$$

The maximisation problem can now be stated as:

$$\max_{s_1, s_x} U_1(s_1, s_x; s_2) = U_1(s_1, s_x; s_2), \quad \text{s.t.} \quad M_1 = \sum_{v=1,x} s_v p_s + wt_v^S(\tilde{s}_1, \tilde{s}_2)s_v, \tag{13a}$$

$$\max_{s_2} U_2(s_2; s_x) = U_2(s_2; s_x), \quad \text{s.t.} \quad M_2 = s_2 p_s + wt_2^S(\tilde{s}_1, \tilde{s}_2)s_2 + w\bar{t}_x^S s_x, \tag{13b}$$

with associated Lagrangians:

$$\mathfrak{L}_1 = U_1(s_1, s_x; s_2) + \lambda_1(M_1 - \{\sum_{v=1,x} s_v p_s - wt_v^S(\tilde{s}_1, \tilde{s}_2)s_v\}), \tag{14a}$$

$$\mathfrak{L}_2 = U_2(s_2; s_x) + \lambda_2 \left(M_2 - s_2 p_s - wt_2^S(\tilde{s}_1, \tilde{s}_2)s_2 - w\bar{t}_x^S s_x\right). \tag{14b}$$

[8] Note, whilst individual 1 pays, and incurs the search cost, for s_x, individual 2 is assumed to incur the time cost of consuming s_x. It is possible that individual 2 participates less fully in s_x than s_2 activities. Ultimately, we allow for this in the set up of the model and this does not impact on our results so long as individual 2 behaves as expected by individual 1 under s_x investments e.g., a limited but positive participation being enough to have the desired influence on R_2.

[9] In this paper we are concerned with understanding the possible implications of the interplay within couples of their social interaction and wish to keep this separate from the modelling of the household allocation of labour. Hence we do not allow V_i to be non-pooled and T_i^H to be determined exogenously, e.g., by institutional factors.

The first order conditions for a maximum under the Cournot-Nash assumption are then:[10]

$$\frac{\partial \mathfrak{L}_1}{\partial s_1} = \frac{\partial U_1(s_1, s_x; s_2)}{\partial s_1} - \lambda_1(p_s + wt_1^S(\tilde{s}_1, \tilde{s}_2)) = 0, \tag{15a}$$

$$\frac{\partial \mathfrak{L}_2}{\partial s_2} = \frac{\partial U_2(s_2; s_x)}{\partial s_2} - \lambda_2(p_s + wt_2^S(\tilde{s}_1, \tilde{s}_2)) = 0, \tag{15b}$$

$$\frac{\partial \mathfrak{L}_1}{\partial s_x} = \frac{\partial U_1(s_1, s_x; s_2)}{\partial s_x} - \lambda_1(p_s + wt_x^S(\tilde{s}_1, \tilde{s}_2)) = 0, \tag{15c}$$

$$\frac{\partial \mathfrak{L}_1}{\partial \lambda_1} = M_1 - p_s(s_1 + s_x) - w[t_1^S(\tilde{s}_1, \tilde{s}_2)s_1 + t_x^S(\tilde{s}_1, \tilde{s}_2)s_x] = 0, \tag{15d}$$

$$\frac{\partial \mathfrak{L}_2}{\partial \lambda_2} = M_2 - s_2 p_s - w[t_2^S(\tilde{s}_1, \tilde{s}_2)s_2 + \bar{t}_x^S s_x] = 0. \tag{15e}$$

Note that the second order conditions are satisfied under the usual assumptions.

Taking total differentials of Eqs. (15a)-(15e) and forming the Hessian:[11]

$$\big|H\big| = \begin{vmatrix} U_{1(11)} & U_{1(12)} & U_{1(1x)} & -\alpha_1 & 0 \\ 0 & U_{2(22)} & U_{2(2x)} & 0 & -\alpha_2 \\ U_{1(x1)} & U_{1(x2)} & U_{1(xx)} & -\alpha_x & 0 \\ -\alpha_1 & 0 & -\alpha_x & 0 & 0 \\ 0 & -\alpha_2 & -w\bar{t}_x^S & 0 & 0 \end{vmatrix}. \tag{16}$$

Note that under the usual assumptions, a sufficient condition for $|H| < 0$ is that $U_{1(1x)}t_1^S(.) \geq U_{1(12)}\bar{t}_x$. However, we earlier noted that $\bar{t}_x \leq t_1^S(.)$, since the former contains no search cost element, and $U_{1(1x)} \geq U_{1(12)}$, as individual 1 can always choose the best s_2 investment at the margin as its next s_x investment, but will ultimately choose an s_x that yields it the greatest benefit at the margin. Hence, we can make the following comparative static observations using Cramer's rule. First, we consider how the stock of information $(\tilde{s}_1, \tilde{s}_2)$ influences social interaction investments.

$$\begin{aligned} &sign\left\{\frac{\partial s_2}{\partial \tilde{s}_1}\right\} \\ &= -sign\{\alpha_2\{U_{1(x1)}[\alpha_x w s_2 t_{2(1)}^S(.) - w^2\bar{t}_x(s_1 t_{1(1)}^S(.) + s_x t_{x(1)}^S(.))] \\ &\qquad - \alpha_1[w^2\lambda_1 t_{x(1)}^S(.)\bar{t}_x + U_{1(xx)} w s_2 t_{2(1)}^S(.)]\} \\ &\qquad - \alpha_x\{U_{1(11)}[\alpha_x w s_2 t_{2(1)}^S(.) - w^2\bar{t}_x(s_1 t_{1(1)}^S(.) + s_x t_{x(1)}^S(.))] \\ &\qquad - \alpha_1[w^2\lambda_1 t_{1(1)}^S(.)\bar{t}_x + U_{1(1x)} w s_2 t_{2(1)}^S(.)]\}. \end{aligned} \tag{17}$$

It follows from Eq. (17) that if $t_{2(1)}^S(.)$ is sufficiently greater than $t_{1(1)}^S(.)$ and $t_{x(1)}^S(.)$ then $\partial s_2/\partial \tilde{s}_1 > 0$. For instance, if partner 1 has accumulated a high stock of social interaction information so that in the present period their search costs for s_1 and s_x are

[10] We opt for the assumption of independent rather than joint maximisation here in recognition of the fact that, as previously noted, s_x investments might not be the same as s_2 (e.g., inferior in U_2) and would not logically feature in the optimising bundle of s_k under joint maximisation. The assumption also helps to preserve transparency of the 'couple effects' that are at play in the model: couple effects on social interaction come through information sharing to reduce search costs and cross-partner investments.

[11] Subscripts in parentheses '(ab)' represent partial derivatives with respect to s_a and to s_b where $(a, b = 1, 2, x)$. Also, for simplicity $\alpha_k \equiv (p_s + wt_k^S(.))$ and $t_{a(b)}$ indicates the partial derivative of t_a with respect to $\tilde{s}_b$ $(a, b = 1, 2, x)$.

low (and hence α_1 and α_x are small relative to α_2) and relatively insensitive to further accumulation of social interaction information then $t^S_{1(1)}(.)$ and $t^S_{x(1)}(.)$ are close to zero. On the other hand, by sharing the stock of social interaction information with partner 2 this might lead to $t^S_{2(1)}(.)$ being a quite large negative term, resulting in an increase in s_2.

We now consider how a change in the available time or income of individual 2 influences the investment of that individual in their own social interaction:

$$sign\left\{\frac{\partial s_2}{\partial M_2}\right\} = -sign\left\{\alpha_2\left(\alpha_1[U_{1(xx)}\alpha_1 - U_{1(x1)}\alpha_x] - \alpha_x[U_{1(1x)}\alpha_1 - U_{1(11)}\alpha_x]\right)\right\} > 0. \tag{18}$$

Hence, if there is a reduction in M_2 due to, for instance, having children which impacts on T^H_2 rather than T^H_1 (lowering the time available for work and/or social interaction), then s_2 also falls. However, it is also possible that under a fall in M_2 there can be offsetting effects in individual 2's social interaction via s_x investments.

$$sign\left\{\frac{\partial s_x}{\partial M_2}\right\} = -sign\left\{\alpha_1\alpha_2\left[U_{1(12)}\alpha_x - U_{1(x2)}\alpha_1\right]\right\}. \tag{19}$$

Hence Eq. (19) is negative and a fall in M_2 leads to a rise in s_x if $[.] > 0$ which requires that the (weighted) change in marginal benefit to individual 1 of an extra unit of s_1 is greater following an increase in s_2 relative to an increase in s_x. Of course, in the case that s_x and s_2 are perfect substitutes, $[.] > 0$ under the usual assumptions.

In this section we have developed a theoretical framework for analysing factors which may influence social interaction of individuals who are part of a couple. Our analysis suggests that where there are differences in the stock of, or preference for, social interaction within the couple, then there are factors at play which will tend to harmonise the levels of social interaction through information sharing which reduces search costs or through cross-partner social interaction investments. However, where both partners exhibit common levels in the stock of, or preference for, social interaction the 'couple effect' is *unlikely* to make the balance of social interaction less equal and based on the factors analysed here (information sharing and cross-partner investment) the effect is likely to be small.[12] Indeed, where, for instance, the couple have children and the burden of childcare rests with one partner, though this reduces the carer's own social interaction investment, there may exist offsetting cross-partner investments in their social interaction from the non-carer. Hence, our theoretical model suggests, in addition to a positive correlation between the social interaction of members of the couple due to, say, positive assortative matching, there will also be a tendency towards a positive correlation where one partner has a higher stock of, or preference for, social interaction due to, say, negative assortative matching.

[12] In reality it seems likely that the 'couple effect' would be augmented by joint consumption synergies. Whilst explicit modelling of synergies is beyond the scope of the current study, we observe that if, for instance, joint consumption resulted in a reduction in price of a unit of social interaction, then this would boost the total level of social interaction for the couple meaning that the 'couple effect' may even be quite large in the case of couples with common high levels in the stock of, or preference for, social interaction. At the same time, the inclusion of synergies is unlikely to alter the harmonising influence of the 'couple effect' as observed here.

3 Data and Methodology

In order to explore the existence of a positive correlation between the social interaction of members of a couple from an empirical perspective, we use data drawn from the British Household Panel Survey (BHPS), a survey conducted by the Institute for Social and Economic Research comprising approximately 10,000 annual individual interviews. For wave one, interviews were conducted during the autumn of 1991. The same households are re-interviewed in successive waves - the latest available being 2008. Information is gathered relating to adults within the household, thereby providing detailed information on both the husband and wife within the household.[13]

Specifically, for the 1991 to 1995, 1997, 1999, 2001, 2003, 2005 and 2007 waves, husbands and wives were asked whether they were currently active in a range of clubs/groups, namely: a political party; trade unions; an environmental group; a parents'/school association; a tenants'/residents' group or neighbourhood watch; a religious group or church organisation; a voluntary services group; any other community or civic group; a social club/working mens' club; sports club; womens' institute/townswomen's guild; or any other group or organisation. Our focus on active membership follows Putnam (2000), p.58, who argues that:

> '...formal "card-carrying" membership may not accurately reflect actual involvement in community activities. An individual who "belongs to" half a dozen community groups may actually be active in none. What really matters from the point of view of social capital and civic engagement is not merely nominal membership, but active and involved membership.'

Hence, we use the responses to the series of questions on active club membership described above in order to proxy the social interaction of the husband and wife by constructing an index of the number of clubs that the husband is currently active in and an index of the number of clubs that the wife is currently active in. Each index runs from zero clubs to three plus clubs. The four point indexes are defined as follows, where the figures refer to the percentages in each category.

Number of clubs (NCLUBS)		
	HUSBAND	WIFE
0	51%	54%
1	31%	29%
2	12%	11%
≥ 3	6%	6%
OBSERVATIONS	18,492	

It is apparent that approximately 50% of husbands and wives are not an active member of any club, whilst only 6% of husbands and wives are active members of three or more clubs. The following provides a cross tabulation of the active club membership of husbands and wives, where clearly the most dominant category at 35% is for neither

[13] Our sample includes both married and co-habiting couples aged 18 to 65. Following the literature on household labour supply, see, for example, Hallberg (2003), we focus on heterosexual couples only, thereby omitting 0.58% of the observations.

member of the couple to be an active club member, followed by both individuals being an active member of 1 club. Only 1% of couples are active members of 3 or more clubs.

Number of clubs (NCLUBS)					
		HUSBAND			
		0	1	2	≥3
WIFE	0	35%	12%	4%	1%
	1	12%	14%	4%	2%
	2	3%	4%	3%	2%
	≥3	1%	2%	2%	1%

Our measure of social interaction based on club membership accords with that frequently used in the existing literature, see, for example, Putnam (2000), Glaeser *et al.* (2002) and Brown and Taylor (2009).

In order to jointly model the social interaction of husbands and wives, we specify a bivariate ordered probit model, see Greene and Hensher (2009), which allows for the joint modelling of two underlying unobserved continuous latent variables, $NCLUBS^{*WIFE}_{ct}$ and $NCLUBS^{*HUSBAND}_{ct}$, as follows:

$$NCLUBS^{*WIFE}_{ct} = \gamma_1 NCLUBS^{HUSBAND}_{ct-1} + \mathbf{X}^{WIFE\prime}_{ct}\boldsymbol{\phi}_1 + \mathbf{H}'_{ct}\boldsymbol{\pi}_1 + \varepsilon_{1ct} \tag{20a}$$

$$NCLUBS^{*HUSBAND}_{ct} = \gamma_1 NCLUBS^{WIFE}_{ct-1} + \mathbf{X}^{HUSBAND\prime}_{ct}\boldsymbol{\phi}_2 + \mathbf{H}'_{ct}\boldsymbol{\pi}_2 + \varepsilon_{2ct} \tag{20b}$$

What we do observe are the ordered dependent variables, $NCLUBS^{WIFE}$ and $NCLUBS^{HUSBAND}$, where the continuous latent variable is observed in discrete form through a censoring mechanism where the underlying latent variable is split into multiple categories defined as:

$$\left\{ \begin{matrix} NCLUBS^{WIFE}_{ct} = j \\ NCLUBS^{HUSBAND}_{ct} = k \end{matrix} \right\} \quad \text{if} \quad \left\{ \begin{matrix} \mu^{WIFE}_{j-1} < NCLUBS^{*WIFE}_{ct} \leq \mu^{WIFE}_{j} \\ \mu^{HUSBAND}_{k-1} < NCLUBS^{*HUSBAND}_{ct} \leq \mu^{HUSBAND}_{k} \end{matrix} \right\}$$

where there are $c = 1, 2, ..., C$ couples each comprising a husband and wife, and there are $t = 1, 2, ..., T$ time periods, and μ^{WIFE}_j and $\mu^{HUSBAND}_k$ thresholds ($j = 1, 2, ..., J$ and $k = 1, 2, ..., K$). We control for the husband's social interaction in the wife's social interaction equation and vice versa in order to explore whether direct effects of a spouse's level of social interaction exist. We lag the control for the level of social interaction of the spouse in order to mitigate against the possibility of reverse causality. Both ε_1 and ε_2 are white noise error terms, $\varepsilon_1, \varepsilon_2 \sim N(0, 0, \sigma^2_1, \sigma^2_2, \rho)$, which are correlated within couples, i.e.:

$$\begin{pmatrix} \varepsilon_{1ct} \\ \varepsilon_{2ct} \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1, \rho \\ \rho, 1 \end{pmatrix} \right]$$

where the covariance is given by $\sigma_{12} = \rho\sigma_1\sigma_2$. Hence, the correlation parameter is given as follows $\rho = \frac{\sigma_1\sigma_2}{\sigma_{12}}$. To allow for repeated observations over time, the standard errors are clustered by couples.

The vectors $\mathbf{X}^{WIFE}$ and $\mathbf{X}^{HUSBAND}$ contain wife and husband specific covariates and $\mathbf{H}$ contains household level characteristics common to both equations. The wife and husband specific characteristics that we control for in $\mathbf{X}^{WIFE}$ and $\mathbf{X}^{HUSBAND}$ are: being aged between 18 to 24, aged 25 to 34, aged 35 to 44, aged 45 to 54, aged 55 and above (the omitted category); the highest level of educational attainment, distinguishing between degree level, nursing or teaching qualification, Advanced (A) levels, General Certificate of Secondary Education (GCSEs), other educational qualifications and no educational qualifications (the omitted category);[14] being in good or very good health; an indicator for whether health limits daily activity; a binary indicator for whether he/she likes the neighbourhood; whether he/she has regular caring responsibilities either within or outside the household; a binary indicator for being solely responsible for household chores (grocery shopping, cooking, washing/ironing and cleaning);[15] labour force status, distinguishing between employment, self-employment, unemployment and being out of the labour force (the omitted category). The household level characteristics controlled for in $\mathbf{H}$ include: whether there are children aged 0 to 4; children aged 5 to 11; children aged 12 to 16; or children aged 16 to 18 in the household (where having no children is the reference category); the number of other adults in the household (excluding the husband and wife); the natural logarithm of household labour income; the natural logarithm of household non labour income; housing tenure to proxy household wealth, i.e. owning the home without a mortgage, owning the home with a mortgage and renting from the council. Controls are also included for region of residence (16 binary indicators) and year throughout the empirical analysis.

Table 1A provides the summary statistics for the sample associated with active club membership, where: the most populated age category, regardless of gender, is being aged between 35-44; the majority of individuals are in excellent or good health; females are more likely to be solely responsible for household chores and spend more time caring for others than males; and over 80% of households either own their home outright or on a mortgage.

We explore the robustness of our findings by also analysing an alternative measure of social interaction that allows for the intensity of social interaction over time, namely the frequency of the social interaction of husbands and wives. Such a measure, in contrast to the measure based on club membership, which is more commonly used in the existing literature, provides a time dimension to the social interaction activities. Specifically, we exploit the information available in the 1996, 1998, 2000, 2002, 2004, 2006 and 2008 waves of the BHPS, which relates to the frequency at which husbands and wives: attend leisure activity groups such as evening classes, keep fit, yoga etc; attend meetings for local groups/voluntary organisations; or do unpaid voluntary work. For each category, individuals are asked to indicate the frequency as follows: at least once a week; at least once a month; several times a year; once a year or less; or

[14] GCSE 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.

[15] We control for being responsible for household chores and caring responsibilities since time spent on such activities reduces time available for other activities including those involving social interaction. It should be acknowledged that some of the explanatory variables are arguably endogenous. Given that our aim is to explore the positive association between the social interaction of husbands and wives, rather than to establish causal relationships, such issues are not problematic in this context.

never/almost never.

We group these different types of social interaction into a single index for each spouse adopting a hybrid combination of the questions by generating an additive scale based upon Cronbach's alpha ranging from 0 to 4, where the scale of reliability for the frequency of social interaction has a value of 0.7. The frequencies at which social interaction is undertaken are defined as follows, where the figures indicate the percentages in each category:

Frequency of social interaction (FSOC)		
	HUSBAND	WIFE
0=never/almost never	58%	49%
1=once a year or less	26%	30%
2=several times a year	10%	12%
3=at least once a month	5%	7%
4=at least once a week	1%	2%
OBSERVATIONS	11,203	

In accordance with active club membership, it is apparent that the most populated category for husbands and wives represents the lowest level of frequency of social interaction, with the least populated category being social interaction on the most frequent basis, i.e. on a weekly basis. Again, we provide cross tabulations for the social interaction of husbands and wives. As found with the number of clubs, the most populated category, at 35%, is couples that 'never or almost never' undertake social interaction and around only 1% of couples engage in social interaction at least once a month.

Frequency of social interaction (FSOC)						
		HUSBAND				
		0	1	2	3	4
WIFE	0	35%	10%	3%	1%	0%
	1	15%	10%	3%	2%	0%
	2	5%	3%	2%	1%	0%
	3	2%	2%	1%	1%	1%
	4	1%	1%	0%	0%	0%

As with modelling the number of clubs, we estimate a bivariate ordered probit model, where there are two unobserved latent variables $FSOC^{*}{}^{WIFE}$ and $FSOC^{*}{}^{HUSBAND}$, as follows:

$$FSOC^{*WIFE}_{ct} = \lambda_1 FSOC^{HUSBAND}_{ct-1} + \mathbf{X}^{WIFE\prime}_{ct}\boldsymbol{\phi}_1 + \mathbf{H}'_{ct}\boldsymbol{\pi}_1 + \varepsilon_{1ct} \tag{21a}$$

$$FSOC^{*HUSBAND}_{ct} = \lambda_1 FSOC^{WIFE}_{ct-1} + \mathbf{X}^{HUSBAND\prime}_{ct}\boldsymbol{\phi}_2 + \mathbf{H}'_{ct}\boldsymbol{\pi}_2 + \varepsilon_{2ct} \tag{21b}$$

Again, what we do observe are the ordered dependent variables, $FSOC^{WIFE}$ and $FSOC^{HUSBAND}$, defined as:

$$\left\{ \begin{matrix} FSOC_{ct}^{WIFE} = q \\ FSOC_{ct}^{HUSBAND} = r \end{matrix} \right\} \quad \text{if} \quad \left\{ \begin{matrix} \mu_{q-1}^{WIFE} < FSOC_{ct}^{*WIFE} \leq \mu_{q}^{WIFE} \\ \mu_{r-1}^{HUSBAND} < FSOC_{ct}^{*HUSBAND} \leq \mu_{r}^{HUSBAND} \end{matrix} \right\}$$

where there are $c = 1, 2, ..., C$ couples each comprising a husband and wife, and there are $t = 1, 2, ..., T$ time periods, and μ_q^{WIFE} and $\mu_r^{HUSBAND}$ thresholds ($q = 1, 2, ..., Q$ and $r = 1, 2, ..., R$). The error structure is the same as that described above for modelling the number of clubs. Additional controls in $\mathbf{X}^{WIFE}$ and $\mathbf{X}^{HUSBAND}$ due to data availability in these waves of the BHPS are the frequency at which the individual: undertakes sport/swimming/walking; goes to the cinema/concerts/theatre or other live performances; and goes to the pub or meals out. These additional variables allow us to explore the relationship between social interaction and different types of leisure activities. As with modelling the number of clubs, we include the lag of the spouse's social interaction measure to reduce the potential for reverse causality. The other covariates are as defined above for Eqs. (20a) and (20b). Summary statistics associated with this sample are presented in Table 1B.

4 Results

In Table 2 we present the results relating to the joint modelling of the active club membership of husbands and wives. Specifically, in Table 2, we present the estimated coefficients and the regression diagnostics. The correlation in the error terms is positive and statistically significant thereby endorsing the joint modelling approach and suggesting that the social interaction of the wives and husbands are affected in the same way by unobserved factors.[16] In a similar vein, Jenkins and Osberg (2005), who explore the implications of leisure coordination, estimate multivariate probit models in order to investigate the interdependence between husbands' and wives' propensities to be active in a social group/working men's club, and in a sports club, and report positive correlations between these propensities. It is apparent that the number of clubs that the husband was an active member of in the previous wave has a positive and statistically significant influence on the number of clubs that the wife is an active member of in the current period.[17] This positive association is also apparent in modelling the current club membership of the husband.[18]

[16] A fixed effects logit framework with clustered standard errors at the household level would be a possible alternative modelling strategy. Such an approach, however, would not enable us to ascertain the dependence or otherwise, as indicated by the ρ parameters, in the husband and wife's propensities to engage in social interaction. In addition, the categories of the dependent variable would have to be collapsed to a binary outcome and there would be a potential loss of observations due to the omission of individuals with time invariant dependent variables.

[17] The importance of the joint modelling approach is apparent when comparing the estimates from the bivariate framework with that from estimating two separate ordered probit models for husbands and wives. For both measures of social interaction, the effect of the spouse's social interaction in the previous period is considerably higher within the separate ordered probit models suggesting that not allowing for the interdependence in social interaction within a couple may lead to overestimates of the effect of the spouse's social interaction.

[18] The panel structure of the data allows us to control for pre-existing levels of social interaction. Hence, in order to explore the robustness of the positive association between the husband's and wife's social interaction, we repeat the analysis including a lagged dependent variable in each equation in order to control for time invariant unobserved individual heterogeneity. The estimated coefficient on the lagged dependent variable in each equation is found to be positive and statistically significant. We find that the positive effect from the spouse's level of social interaction however remains statistically significant but is reduced in magnitude.

We will briefly comment on the other covariates before returning to the marginal effects associated with the focus of our interest, namely the measures of social interaction, i.e. active club membership. Our findings generally tie in with the existing literature. Active club membership is increasing in age for both husbands and wives as indicated by the pattern of the estimated coefficients on the age dummy variables, although the effect is less pronounced for husbands. Educational attainment is also positively and monotonically associated with club membership for both spouses, as is being in good or excellent health. The labour market status controls appear to follow a less distinct pattern with being employed or self-employed having an insignificant effect on club membership for wives relative to being out of the labour force, whereas being unemployed is inversely associated with club membership for wives. In contrast, for husbands, all of the labour force status controls are inversely associated with club membership relative to being out of the labour force. Responsibility for household chores only influences active club membership for husbands, whereas caring responsibilities are positively associated with club membership for both spouses. Such caring activities may, for example, be associated with social interaction such as volunteering activities. Having children aged 5 to 11 or 16 to 18 have a positive influence on club membership for wives, whereas having children aged 5 to 11 and aged 12 to 15 is positively associated with club membership for husbands. Finally, household labour income is positively associated with club membership for both husbands and wives, although household non labour income only has a positive effect on club membership for husbands.[19]

Tables 2A and 2B present the marginal effects associated with the estimates in Table 2. Table 2A presents the marginal effects of the wife's club active membership at $t-1$, evaluated at the mean, on the joint probability associated with the two dependent variables. For example, along the diagonal, the focus is on the effect of the wife's club active membership at $t-1$ on the probability that the current club membership of the husband and wife take the same value. Comparing the marginal effects presented in Tables 2A and 2B, it is apparent that the marginal effects associated with the husband's social interaction in $t-1$ are generally greater in magnitude than those associated with the wife's social interaction in $t-1$. With respect to Table 2A, the previous club membership of the wife has a relatively large inverse effect on the probability of both spouses currently being a member of no club. In contrast, previous club membership of the wife is positively associated with both spouses being a member of one, two and three or more clubs, although the sizes of the marginal effects diminish as the number of clubs increases. This pattern of marginal effects is mirrored in Table 2B, where the covariate of interest is the husband's club membership in the previous period. Evaluated at the mean, both the husband's and the wife's club membership in the previous period decrease the probability of both the husband and the wife being a member of no clubs in the current period by approximately 2 percentage points. This corresponds to around a 6% increase in the unconditional probability that both

[19] As expected, the effects of some of the covariates are found to be smaller here than in models when the spouse's social interaction is not included. This is particularly evident for explanatory variables such as education, age and having children in the two youngest age categories. Such findings highlight the importance of jointly modelling social interaction in this way for members of a couple and indicate that the effects of some variables such as education may have been overestimated for married individuals within the previous literature.

members of the couple are not active members of any club.[20]

In order to explore whether this positive association is influenced by the type of social interaction, we construct three club membership variables indicating the number of clubs the individual is a member of according to the following categories: 'political and social issues' (a political party; a trade union; or an environmental group); 'specific interest/community issues' (a parents'/school association; a tenants'/residents' group or neighbourhood watch; a religious group or church organisation; a voluntary services group; any other community or civic group); other groups (a social club/working men's club; sports club; women's institute/townswomen's guild; or any other group or organisation). We then repeat the analysis three times, with each of the three club membership variables specified as the dependent variable whilst controlling for the spouse's lagged membership in each of the three types of clubs. The findings are summarised in Table 3, where we present the estimated coefficients relating to the key covariates of interest, namely spouse's lagged club membership.[21] In Panel A, it is apparent that a statistically significant and positive association is found between membership of clubs related to political and social issues of the husband and wife. Furthermore, the effects of membership of the two other types of clubs are found to be statistically insignificant. In addition, the ρ parameter remains positive and statistically significant and is larger in magnitude than that presented in Table 2. Such findings accord with positive assortative matching whereby individuals with similar interests and preferences match but are also consistent with the 'couple effects' identified in our theoretical analysis. A similar pattern of results is found in Panel B when the dependent variable indicates membership of clubs associated with specific interest/community issues, with a relatively large and statistically significant ρ parameter indicating a strong degree of interdependence in modelling the membership of such clubs of husbands and wives. For the other clubs category, the pattern of results presented in Panel C is not so clear cut. A positive correlation is found between the membership of other types of clubs of husbands and wives, again supporting the notion of positive assortative matching and/or 'couple effects'. A positive relationship is also found between the wife's current membership of other clubs and the husband's lagged membership of clubs associated with specific interest/community issues. In contrast, an inverse association is found between the husband's current membership of other clubs and the wife's lagged membership of clubs associated with specific interest/community issues. Such findings may partly reflect the heterogenous nature of the other clubs category, which may also account for the estimated ρ parameter being smaller in magnitude for this model as compared to the models presented in Panels A and B.

In Table 4, we present the results relating to the frequency at which the husband and the wife engage in social interaction. It is apparent that, as with active club membership, the frequency at which the spouse engaged in social interaction in the previous period is positively associated with the frequency of current social interaction for both the husband and the wife.[22] As in Table 2, the correlation between

[20] This is found by comparing the marginal effect to the cross tabulation of couples' active club membership presented in Section III.

[21] The additional control variables, as in Table 2, are included in the set of explanatory variables, but, for brevity, are not presented in Table 3. The findings related to these variables accord with those in Table 2.

[22] It is possible that the level of social interaction - as measured by active club membership and the

the error terms is positive and statistically significant although smaller in magnitude than for active club membership, yet once again endorsing the joint modelling approach.

Before discussing the marginal effects associated with the frequency of social interaction, we comment briefly on the additional covariates in this model. It is interesting to note that the frequency at which the husband or wife engages in sport, swimming or walking and the frequency at which they go to the cinema or theatre are both positively associated with the frequency at which the husband and wife engage in social interaction. Such findings suggest that couples that engage in social interaction are also active in other areas.

The marginal effects associated with the estimated model presented in Table 4 are given in Tables 5A (relating to the wife's social interaction in $t-1$ evaluated at the mean) and Table 5B (relating to the husband's social interaction in $t-1$ evaluated at the mean). The pattern of the marginal effects on the joint probabilities associated with the husband and wife's frequency of current social interaction accords with that in Tables 2A and 2B relating to active club membership, with positive marginal effects apparent across the lead diagonal as we move from annual to weekly social interaction for both spouses. Evaluated at the mean, the frequency of the husband's social interaction in the previous period decreases the probability that both the husband and wife do not engage in social interaction in the current period by approximately 3 percentage points. This corresponds to around a 9% increase in the unconditional probability that both members of the couple never or almost never undertake social interaction.[23]

We repeat the analysis presented in Table 3 related to distinguishing between the type of social interaction. In the case of the frequency analysis, we explore two different types of activity, namely: attending leisure activity groups such as evening classes, keep fit and yoga; and attending meetings for local groups/voluntary organisations or doing unpaid voluntary work. The findings are summarised in Table 6, where, in Panel A, the frequency at which the individual attends leisure activity groups is specified as the dependent variable and, in Panel B, the frequency at which the individual engages in meetings for local groups/voluntary organisations or unpaid voluntary work is specified as the dependent variable. In Panel A, it is apparent that a positive and highly statistically significant association between the husband and wife's social interaction as measured by leisure activity groups is found, supportive of positive assortative matching and/or 'couple effects' (e.g., through a pronounced reduction in the search costs associated with these specific activities or cross-investment due to one partner's stock of, or preference for this type of social interaction) identified in the theoretical analysis. Interestingly, a less pronounced positive effect in terms of statistical significance is found

frequency of social interaction - in the previous time period may not necessarily be representative of an individual's level of social interaction. This may occur for a variety of reasons: for example, an individual may have just moved house or job. In order to explore the robustness of our findings, we replace the lagged measure of social interaction with the average level of social interaction measured over the previous waves as a time varying moving average. Our empirical findings are robust to using this measure and confirm the positive association between the husband's and wife's social interaction as well as endorsing the joint modelling approach.

[23] In order to explore the robustness of our findings, we also repeat the analysis splitting the sample into couples with and without children. Both the pattern and size of the marginal effects are very similar across both samples, with a positive correlation coefficient found for both samples.

for the effect of the spouse's participation in local groups/voluntary organisations and unpaid voluntary work on the frequency at which the individual engages in leisure activity groups. Furthermore, the estimated ρ parameter is considerably larger than that reported in Table 4. A similar pattern of results is evident in Panel B, although the ρ parameter is smaller in magnitude which may again reflect the heterogenous nature of the dependent variable in this case.

5 Conclusion

In this paper we have contributed to the existing microeconomic literature on social interaction by analysing the social interaction of couples. The existing literature has generally modelled social interaction from the perspective of an individual rather than within the context of a couple or family. Given that decisions regarding social interaction are often made within a household context, we have explored the potential interdependence between the social interaction of husbands and wives from both a theoretical and an empirical perspective.

Using a theoretical framework that we develop, based on Becker (1974), we show that where there are differences in the stock of, or preference for, social interaction within the couple, factors such as information sharing and cross-partner investment will tend to equalise levels of social interaction. However, where both partners exhibit common levels in the stock of, or preference for, social interaction the 'couple effect' is unlikely to make the balance of social interaction less equal. Indeed, for those with a common low stock of, or preference for social interaction, the effect is unlikely to be large. Hence, regardless of whether there is positive, negative or no assortative matching, the interplay between the members of the couple has a tendency towards correlated levels of social interaction.

Our empirical findings suggest interdependence between the extent of the social interaction of husbands and wives and endorse our joint modelling approach. To be specific, our empirical findings suggest that there is a positive association between the social interaction of husbands and wives as measured by active club membership and the frequency of the social interaction activities. Furthermore, we find that, for married couples, the role of some socio-economic characteristics such as education may have been overestimated in the existing literature. In addition, we find that this positive association is particularly pronounced across the same types of club membership or social activities.

Given the importance of social interaction for social and economic development, it is important to understand the determinants of such activities at the individual and household level. Our analysis therefore furthers our understanding of social interaction within the context of a couple and hopefully will serve to stimulate future research in this area.

References

Algan, Y. and Cahuc, P. (2010). Inherited trust and growth. *American Economic Review*, **100** (5), 2060–92.

Becker, G. S. (1965). A theory of the allocation of time. *Economic Journal*, **75**, 493–517.

— (1974). A theory of social interactions. *Journal of Political Economy*, **82**, 1063–1093.

Bentham, J. (1789). *Principles of Morals and Legislation*. Oxford: Clarendon.

Brown, S. and Taylor, K. (2007). Religion and education: Evidence from the national child development study. *Journal of Economic Behavior & Organization*, **63** (3), 439–460.

— and — (2009). Social interaction and children's academic test scores: Evidence from the national child development study. *Journal of Economic Behavior & Organization*, **71** (2), 563–574.

Glaeser, E. L., Laibson, D. and Sacerdote, B. (2002). An economic approach to social capital. *Economic Journal*, **112** (483), 437–458.

Greene, W. and Hensher, D. (2009). Modelling ordered choices, pages.stern.nyu.edu/ wgreene/DiscreteChoice/.../OrderedChoiceSurvey.pdf.

Hallberg, D. (2003). Synchronous leisure, jointness and household labor supply. *Labour Economics*, **10** (2), 185–203.

Hamermesh, D. S. (2000). *Togetherness: Spouses' Synchronous Leisure, and the Impact of Children*. NBER Working Papers 7455, National Bureau of Economic Research, Inc.

Iannaccone, L. R. (1998). Introduction to the economics of religion. *Journal of Economic Literature*, **36** (3), 1465–1495.

Jenkins, S. and Osberg, L. (2005). Nobody to play with? implications of leisure coordination. In D. Hamermesh and G. Pfann (eds.), *The Economics of Time Use*, Amsterdam: Elsevier.

Knack, S. and Keefer, P. (1997). Does social capital have an economic payoff? a cross-country investigation. *The Quarterly Journal of Economics*, **112** (4), 1251–88.

Marshall, A. (1962). *Principles of Economics*. London: Macmillan, 8th edn.

Michael, R. T. and Becker, G. S. (1973). On the new theory of consumer behavior. *Swedish Journal of Economics*, **75**, 378–396.

Putnam, R. (2000). *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon and Schuster.

Table 1A: Summary Statistics - Sample for Number of Clubs

	WIFE		HUSBAND	
	MEAN	STD	MEAN	STD
No. of clubs partner active member (t-1)	0.7226	0.8832	0.6952	0.8854
WIFE/HUSBAND specific covariates				
Aged 18-24	0.0479	0.2135	0.0173	0.1302
Aged 25-34	0.2570	0.4370	0.1931	0.3947
Aged 35-44	0.2918	0.4546	0.2865	0.4521
Aged 45-54	0.2567	0.4368	0.2735	0.4458
Degree	0.1149	0.3189	0.1344	0.3411
Teaching or Nursing	0.2427	0.4287	0.2862	0.4520
A level	0.0986	0.2981	0.1133	0.3170
O level	0.2230	0.4163	0.1584	0.3652
Other qualification	0.0969	0.2959	0.0735	0.2610
Excellent or good health	0.7059	0.4557	0.7268	0.4456
Health limits daily activity	0.1326	0.3391	0.1126	0.3161
Employee	0.6434	0.4790	0.6726	0.4693
Self employed	0.0514	0.2208	0.1637	0.3700
Unemployed	0.0157	0.1242	0.0406	0.1973
Solely responsible for household chores	0.2106	0.4078	0.0038	0.0614
Likes current neighbourhood	0.9099	0.2862	0.8891	0.3139
Hours spent caring (0=none, 7=100+)	0.4596	1.2329	0.2805	0.9616
Number cared for outside family (0, $\geq$3)	0.1902	0.5063	0.1234	0.4241

Household covariates	MEAN	STD
Number of adults (other than husband or wife)	1.4111	0.7517
Children aged 0-4	0.1797	0.3839
Children aged 5-11	0.2758	0.4469
Children aged 12-15	0.1861	0.3892
Children aged 16-18	0.0481	0.2140
Log household labour income	11.9375	1.8286
Log household non labour income	10.5371	4.0935
Home owned outright	0.1786	0.3829
Home owned on a mortgage	0.6542	0.4756
Home rented	0.0842	0.2778
OBSERVATIONS	18,492	

Table 1B: Summary Statistics - Sample for Frequency of Social interaction

	WIFE		HUSBAND	
	MEAN	STD	MEAN	STD
Frequency partner social interaction $(t-1)$	0.6411	0.9079	0.8219	1.0124
WIFE/HUSBAND specific covariates				
Frequency undertakes sport/swim/walking	2.5441	1.6716	2.4756	1.6974
Frequency goes to cinema/concerts/theatre	0.9986	0.7356	1.1106	0.8203
Frequency goes to pub or meal out	2.4955	0.9941	2.6575	1.0853
Aged 18-24	0.0392	0.1940	0.0146	0.1201
Aged 25-34	0.2278	0.4194	0.1695	0.3752
Aged 35-44	0.3070	0.4613	0.2955	0.4563
Aged 45-54	0.2631	0.4403	0.2728	0.4454
Degree	0.1456	0.3527	0.1588	0.3655
Teaching or Nursing	0.2829	0.4504	0.3278	0.4694
A level	0.1087	0.3113	0.1125	0.3160
O level	0.2004	0.4003	0.1466	0.3537
Other qualification	0.0853	0.2794	0.0612	0.2398
Excellent or good health	0.7239	0.4471	0.7494	0.4334
Health limits daily activity	0.1431	0.3502	0.1121	0.3155
Employee	0.6559	0.4751	0.6916	0.4619
Self employed	0.0490	0.2159	0.1611	0.3677
Unemployed	0.0144	0.1190	0.0266	0.1609
Solely responsible for household chores	0.2489	0.4324	0.0041	0.0639
Likes current neighbourhood	0.9229	0.2667	0.9115	0.2841
Hours spent caring (0=none, 7 = 100+)	0.4965	1.2791	0.3176	1.0188
Number cared for outside family (0, $\geq$3)	0.1504	0.3575	0.1906	0.4953

Household covariates	MEAN	STD
Number of adults (other than husband or wife)	1.4277	0.7723
Children aged 0-4	0.1725	0.3779
Children aged 5-11	0.1775	0.3821
Children aged 12-15	0.1475	0.3546
Children aged 16-18	0.0579	0.2336
Log household labour income	12.5766	1.2160
Log household non labour income	11.2023	3.9342
Home owned outright	0.1976	0.3982
Home owned on a mortgage	0.6530	0.4760
Home rented	0.0686	0.2529
OBSERVATIONS	11,203	

Table 2: Bivariate Ordered Probit Model - Number of Clubs Wife/ Husband is an Active Member

	WIFE		HUSBAND	
	COEF	T STAT	COEF	T STAT
No. of clubs partner active member $(t-1)$	0.1334	(9.67)	0.1141	(8.31)
WIFE/HUSBAND specific covariates				
Aged 18-24	-0.6478	(10.27)	-0.1535	(2.06)
Aged 25-34	-0.4787	(9.55)	-0.2260	(4.97)
Aged 35-44	-0.2974	(6.34)	-0.1515	(3.53)
Aged 45-54	-0.1406	(3.71)	-0.0391	(1.12)
Degree	0.8528	(14.47)	0.5922	(10.60)
Teaching or Nursing	0.5711	(12.34)	0.4894	(11.11)
A level	0.4503	(8.13)	0.3821	(7.24)
O level	0.3429	(7.42)	0.2877	(6.12)
Other qualification	0.1991	(3.72)	0.1676	(2.68)
Excellent or good health	0.0697	(2.78)	0.1104	(4.18)
Health limits daily activity	0.0639	(1.77)	-0.0279	(0.67)
Employee	-0.0326	(1.04)	-0.1122	(2.30)
Self employed	0.0674	(1.27)	-0.1843	(3.37)
Unemployed	-0.1817	(2.23)	-0.1302	(2.21)
Solely responsible for household chores	0.0295	(1.04)	-0.3530	(2.14)
Likes current neighbourhood	0.2830	(6.61)	0.4667	(10.82)
Hours spent caring (0=none, 7 = 100+)	0.0255	(1.30)	0.0158	(1.32)
Number cared for outside family (0, ≥ 3)	0.1543	(6.29)	0.1329	(4.72)
Household covariates				
Number of adults	-0.0602	(3.33)	-0.0220	(1.21)
Children aged 0-4	0.0191	(0.63)	-0.0545	(1.90)
Children aged 5-11	0.3087	(11.63)	0.0887	(3.35)
Children aged 12-15	0.0255	(0.89)	0.0825	(3.00)
Children aged 16-18	0.1562	(3.50)	0.0238	(0.54)
Log household labour income	0.0761	(4.89)	0.0866	(5.40)
Log household non labour income	0.0041	(1.00)	0.0168	(3.92)
Home owned outright	0.0866	(1.50)	0.0772	(1.30)
Home owned on a mortgage	0.0488	(1.02)	-0.0067	(0.13)
Home rented	-0.1196	(1.99)	-0.0756	(1.15)
CONTROLS	Region (16) and year (10) dummies			
Chi Squared (53); p value	970.50; p=[0.000]			
ρ; Chi Squared (1) $corr(\varepsilon_1, \varepsilon_2)$; p value	ρ=0.2764; 491.43; p=[0.000]			
OBSERVATIONS	18,492			

Note: T statistics are based upon clustered couple effects over time.

Table 2A: Marginal Effects - Number of Clubs Wife Member of $(t-1)$

		Dependent variable = no. Clubs wife active member			
		0	1	2	3
Dependent variable = no. clubs husband active member	0	-0.0224	-0.0129	-0.0047	-0.0019
	1	0.0113	0.0036	0.0004	-0.0004
	2	0.0073	0.0052	0.0021	0.0008
	3	0.0037	0.0041	0.0023	0.0015

Notes: (i) Marginal effects correspond to the model in Table 2; (ii) Number of clubs wife member of $(t-1)$ is measured at the mean.

Table 2B: Marginal Effects - Number of Clubs Husband Member of $(t-1)$

		Dependent variable = no. Clubs husband active member			
		0	1	2	3
Dependent variable = no. clubs wife active member	0	-0.0242	-0.0163	-0.0058	-0.0023
	1	0.0124	0.0050	0.0007	-0.0003
	2	0.0077	0.0050	0.0024	0.0009
	3	0.0040	0.0050	0.0027	0.0017

Notes: (i) Marginal effects correspond to the model in Table 2; (ii) Number of clubs husband member of $(t-1)$ is measured at the mean.

Table 3: Bivariate Ordered Probit Model - Number of Clubs Wife/ Husband is an Active Member by type of Club

PANEL A: POLITICAL/SOCIAL ISSUES	WIFE		HUSBAND	
	COEF	T STAT	COEF	TSTAT
No. of 'political/social issues' clubs partner active member $(t-1)$	**0.2602**	**(4.97)**	**0.2764**	**(5.34)**
No. of 'specific interest/community issues' clubs partner active member $(t-1)$	-0.0300	(0.80)	0.0192	(0.71)
No. of other clubs partner active member $(t-1)$	0.0155	(0.47)	0.0533	(1.78)
CONTROLS	As in Table 2			
Chi Squared (57); p value	364.25; $p = [0.000]$			
ρ; Chi Squared (1) $corr(\varepsilon_1, \varepsilon_2) = 0$; p value	ρ=0.3161; 132.98; $p = [0.000]$			
PANEL B: SPECIFIC INTEREST/COMMUNITY ISSUES	WIFE		HUSBAND	
	COEF	T STAT	COEF	TSTAT
No. of 'political/social issues' clubs partner active member $(t-1)$	0.0089	(0.23)	-0.1132	(2.14)
No. of 'specific interest/community issues' clubs partner active member $(t-1)$	**0.3341**	**(13.02)**	**0.0192**	**(12.07)**
No. of other clubs partner active member $(t-1)$	-0.0172	(0.80)	0.0093	(0.35)
CONTROLS	As in Table 2			
Chi Squared (57); p value	926.09; $p = [0.000]$			
ρ; Chi Squared (1) $corr(\varepsilon_1, \varepsilon_2) = 0$; p value	ρ=0.3481; 407.68; $p = [0.000]$			
PANEL C: OTHER CLUBS	WIFE		HUSBAND	
	COEF	T STAT	COEF	TSTAT
No. of 'political/social issues' clubs partner active member $(t-1)$	0.0226	(0.61)	0.0309	(0.64)
No. of 'specific interest/community issues' clubs partner active member $(t-1)$	0.0792	(2.94)	-0.0778	(3.73)
No. of other clubs partner active member $(t-1)$	**0.1279**	**(5.93)**	**0.1577**	**(6.95)**
CONTROLS	As in Table 2			
Chi Squared (57); p value	629.73; $p = [0.000]$			
ρ; Chi Squared (1) $corr(\varepsilon_1, \varepsilon_2) = 0$; p value	ρ=0.2974; 425.79; $p = [0.000]$			
OBSERVATIONS	18,492			

Note: T statistics are based upon clustered couple effects over time.

Table 4: Bivariate Ordered Probit Model - Frequency Wife/ Husband Social Interaction

	WIFE		HUSBAND	
	COEF	T STAT	COEF	T STAT
Frequency partner social interaction $(t-1)$	0.1471	(9.29)	0.1328	(8.99)
WIFE/HUSBAND specific covariates				
Frequency undertakes sport/swim/walking	0.1675	(17.62)	0.1352	(11.93)
Frequency goes to cinema/theatre	0.2806	(14.18)	0.2449	(11.95)
Frequency goes to pub or meal out	-0.0446	(2.92)	0.0309	(1.95)
Aged 18-24	-0.2598	(3.08)	-0.1409	(1.29)
Aged 25-34	-0.2671	(4.82)	-0.1356	(2.42)
Aged 35-44	-0.1129	(2.22)	-0.0139	(0.28)
Aged 45-54	-0.0832	(1.81)	-0.0028	(0.07)
Degree	0.6762	(10.68)	0.5342	(8.46)
Teaching or Nursing	0.5246	(9.86)	0.4773	(8.52)
A level	0.3143	(5.03)	0.2874	(4.39)
O level	0.2749	(4.98)	0.1951	(3.17)
Other qualification	0.1940	(2.70)	0.0500	(0.66)
Excellent or good health	0.0691	(2.18)	0.1001	(2.89)
Health limits daily activity	-0.0129	(0.30)	0.0434	(2.19)
Employee	-0.1597	(4.37)	-0.1457	(2.21)
Self employed	0.1076	(1.52)	-0.0411	(0.56)
Unemployed	-0.3387	(3.41)	-0.1021	(1.04)
Solely responsible for household chores	0.0623	(1.99)	-0.2152	(0.98)
Likes current neighbourhood	0.1605	(2.94)	0.2407	(3.56)
Hours spent caring (0=none, 7 = 100+)	-0.0003	(0.02)	0.0434	(2.76)
Number cared for outside family (0, $\geq$3)	0.1546	(3.48)	0.1082	(2.19)
Household covariates				
Number of adults	-0.0135	(0.67)	0.0443	(2.18)
Children aged 0-4	-0.0233	(0.51)	-0.0068	(0.18)
Children aged 5-11	0.0327	(0.58)	0.0173	(0.52)
Children aged 12-15	0.0289	(1.17)	0.0618	(1.74)
Children aged 16-18	0.0941	(1.52)	0.0196	(0.36)
Log household labour income	0.0442	(2.80)	0.0288	(1.91)
Log household non labour income	-0.0015	(0.31)	0.0003	(0.05)
Home owned outright	0.0529	(0.79)	0.0506	(0.77)
Home owned on a mortgage	-0.0089	(0.16)	-0.0487	(0.83)
Home rented	-0.1290	(1.66)	-0.1218	(1.57)
CONTROLS	Region (16) and year (6) dummies			
Chi Squared (54); p value	2,129.88; p=[0.000]			
ρ ; Chi Squared (1) $corr(\varepsilon_1, \varepsilon_2) = 0$; p value	$\rho = 0.1762$; 127.43; p=[0.000]			
OBSERVATIONS	11,203			

Note: T statistics are based upon clustered couple effects over time.

Table 5A: Marginal Effects - Frequency Wife Social Interaction $(t-1)$

		Dependent variable = frequency wife social interaction				
		0	1	2	3	4
Dependent variable = frequency husband social interaction	0	-0.0204	-0.0141	-0.0055	-0.0029	-0.0008
	1	0.0106	0.0052	0.0014	0.0004	-0.0001
	2	0.0057	0.0045	0.0018	0.0010	0.0002
	3	0.0033	0.0033	0.0016	0.0010	0.0003
	4	0.0008	0.0011	0.0007	0.0005	0.0002

Notes: (i) 0=never/almost never; 1=once a year or less; 2=several times a year; 3=at least once a month; and 4=at least once a week; (ii) Marginal effects correspond to the model in Table 5; (iii) frequency of wife's social interaction $(t-1)$ is measured at the mean.

Table 5B: Marginal Effects - Frequency Husband Social Interaction $(t-1)$

		Dependent variable = frequency wife social interaction				
		0	1	2	3	4
Dependent variable = frequency husband social interaction	0	-0.0300	-0.0140	-0.0046	-0.0021	-0.0005
	1	0.0122	0.0028	0.0002	-0.0002	-0.0002
	2	0.0093	0.0048	0.0016	0.0007	0.0001
	3	0.0064	0.0044	0.0018	0.0010	0.0002
	4	0.0022	0.0020	0.0010	0.0007	0.0002

Notes: (i) 0=never/almost never; 1=once a year or less; 2=several times a year; 3=at least once a month; and 4=at least once a week; (ii) Marginal effects correspond to the model in Table 5; (iii) frequency of wife's social interaction $(t-1)$ is measured at the mean.

Table 6: Bivariate Ordered Probit Model - Frequency Wife/ Husband Social Interaction by type of Activity

PANEL A: LEISURE GROUPS	WIFE		HUSBAND	
	COEF	T STAT	COEF	TSTAT
Frequency partner goes to leisure groups $(t-1)$	**0.1762**	**(10.27)**	**0.1520**	**(10.26)**
Frequency partner goes to local groups/voluntary groups $(t-1)$	0.0341	(2.83)	0.0312	(2.81)
CONTROLS	As in Table 5			
Chi Squared (53); p value	2,441.86; $p = [0.000]$			
ρ; Chi Squared (1) $corr(\varepsilon_1, \varepsilon_2) = 0$; p value	$\rho = 0.2706$; 390.96; $p = [0.000]$			
PANEL B: LOCAL GROUPS/VOLUNTARY GROUPS	WIFE		HUSBAND	
	COEF	T STAT	COEF	TSTAT
Frequency partner goes to leisure groups $(t-1)$	0.0470	(2.48)	0.0443	(2.58)
Frequency partner goes to local groups/voluntary groups $(t-1)$	**0.1517**	**(9.84)**	**0.1348**	**(9.64)**
CONTROLS	As in Table 5			
Chi Squared (53); p value	629.73; $p = [0.000]$			
ρ; Chi Squared (1) $corr(\varepsilon_1, \varepsilon_2) = 0$; p value	$\rho = 0.2005$; 101.17; $p = [0.000]$			
OBSERVATIONS	11,203			

Note: T statistics are based upon clustered couple effects over time.