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by

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The vertical transmission of time use choices

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Abstract

The present paper analyzes intergenerational correlations in leisure time use between parents and their adult children in order to gain an understanding of the importance of genetics and early childhood learning mechanisms in preference formation. Data from the British Household Panel Survey (BHPS) is used to regress time use choices of children on the behavior of their parents after the former have left to form their own household.
A principal component analysis on eight time use items reveals two identifiable components, associated with personal leisure time use outside the home, and voluntary work. Estimations find substantial and significant correlations for both components, but suggest that the variance in filial behavior explained by the variance in parental behavior is limited, ranging from 17% to 32% for personal leisure time use, and from 2% to 7% for voluntary work. Moreover we provide evidence that direct transmission of parental preferences to their children accounts for roughly 20% of the observable similarity between the two generations. These results are robust to a wide array of robustness checks, including changes in estimation technique, model specification, and data restrictions, and suggest that these correlations can be ascribed to preference transmission from parental to filial generation rather than to coordination between generations. Aside from adding to the growing economic literature on preference transmission models, it also provides empirical support for the strong impact of non-parental sources of preferences formation, voiced particularly in models of dual inheritance.

Keywords: *intergenerational transmission of preferences, preference dynamics, time use, relative importance*

JEL classification: J13, J22

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1. Introduction

Based on the extensive empirical literature investigating the mobility of income, socio-economic status, education, and occupation across generations (see, e.g., the review by Black & Devereux, 2011), economic research has more recently turned to the analysis of this phenomenon in the realm of preferences, attitudes, and traits. This development is additionally fuelled by the increasing theoretical interest in endogenous preference dynamics (cf. Bisin & Verdier, 2001; Witt, 2001). Studying the transmissions of preference endowments from parents to their children is seen as one possibility to depart from axiomatic preference theory and thus open the "black box" of subjective preferences which has so far governed most analysis in economics (Bisin & Verdier, 2001; Dohmen, Falk, Huffman, & Sunde, forthcoming). While few would dispute that parental genes and educational effort leave their mark in the preference structure and behavioral repertoire of their children, evidence on the strength of this effect is still scarce. Yet, the strength of this vertical transmission effect is, of course, indicative of the spill-over effects to the next generation that can be gained from policy measures influencing parental behavior.

Interestingly, the relative importance of vertical (and horizontal) channels in human behavioral acquisition has also captured substantial attention in the field of evolutionary biology, residing under the label of "dual inheritance theory". This line of research usually puts a strong emphasis on the unique social learning capabilities of modern man, and thus on the horizontal aspects of preference transmission.[1] In fact, it has repeatedly been argued that man's particular adaptation for these learning mechanisms give rise to the elaborate cultural forms of human social organization that extend well beyond the social structures found among other animals (cf. Tomasello, Kruger und Ratner 1993; Tomasello 1999; Cordes 2004). Based on biologically evolved learning mechanisms, cultural evolution is seen as a second, robust system of inheritance, operating under different transmission rules than genetic inheritance (Henrich & McElreath, 2007). Within this system a wide variety of social learning strategies have been identified, including state-based, frequency-dependent, and model-based biases (cf. Rendell, Fogarty, Hoppitt, Morgan, Webster, & Laland, 2011).

The importance attached to horizontal transmission mechanisms in this line of research is usually derived from two sources. First, from the empirical observation that this form of behavioral acquisition is widespread among humans (cf. Henrich & McElreath, 2007). Second, from a spectrum of theoretical work generally predicting that under most conditions selection favors social transmission in environments which vary over space and time(Henrich & Boyd, 1998; Nakahashi, 2007; Wakano & Aoki, 2007; Kendal, Giraldeau, & Laland, 2009). More recently experimental evidence suggests that (at least to some) conforming with the decisions of a majority is an important driver of choices (Efferson, Lalive, Richerson, McElreath, & Lubell, 2008), and that frequency information is as important to individual choices as information on the average success rate of different options (McElreath, Bell, Efferson, Lubell, Richerson, & Waring, 2008).

[1] While imitative learning is a capacity not limited to modern *Homo sapiens* (cf. Whiten, Horner, & de Waal, 2005; Whiten, 2005), the extent, frequency, and fidelity of this transmission channel in man are unparalleled among other species (cf. Tomasello, 1999a; 1999b).

Yet, in particular the relationship between vertical transmission (i.e. from parent to offspring), and horizontal transmission (via social learning) in observable behavior, has so far received little attention in empirical research. Evidence on this relationship is usually drawn from empirical results in behavioral genetics, indicating that non-family environment accounts for roughly 50% of phenotypic variance among individuals (cf. Plomin, DeFries, McClearn, & McGuffin, 2008, Ch. 16). Moreover, this literature suggests that conditional on genetic transmission, parent-offspring transmission generally accounts for less than 5% of this variation (cf. Harris, 1995).

However, research in behavioral genetics usually deals with traits, like IQ and personality, or (psycho-) pathologies, like depression and addiction, and thus offers limited insights into manifest everyday behaviors. It therefore rarely reflects the importance of horizontal and vertical transmission channels in domains, which are commonly associated with the expression of particular cultural traits, like language, social institutions or behavioral traditions, e.g. in consumption and time-use choices.[2] In what follows, we therefore set out to evaluate the relative importance of parent-offspring transmission for a number of day-to-day behaviors, and use these results to infer the relative importance of vertical and horizontal transmission channels. More precisely, we employ an econometric strategy, common in the estimation of intergenerational persistence (cf. Duncan, Kalil, Mayer, Tepper, & Payne, 2005; Black, Devereux, & Salvanes, 2005; Wilhelm, Brown, Rooney, & Steinberg, 2008) to analyze parental influences on several time use choices in an extensive data set from Great Britain.

This paper thus adds to the scarce literature estimating intergenerational inertia in the context of attitudes, preferences or time allocation decisions (see also section 2.). It extends the analysis beyond the presentation of point estimates,[3] because they do not necessarily imply a quantitative importance of the estimated effects (cf. Kruskal & Majors, 1989; Johnson & LeBreton, 2004; Grömping, 2007). In the present contribution partial R^2 values are therefore calculated in order to obtain an estimate of the substantive effect of parent-off-spring transmission.

Analyzing time use patterns is interesting from a more general economic perspective, as well. Recently, a number of authors have called for a rehabilitation of time use within the discipline, arguing that time-use choices are an important aspect of individual well-being (Frank, 1999; Kahneman & Krueger, 2006), and may present a more comprehensive measure of preferences than purchasing behavior alone (Dow & Juster, 1985; Krueger, Kahnemann, Schkade, Schwarz, & Stone, 2009). Moreover, it has been suggested that decisions on time allocation may seriously affect human capital development (Mancini, Monfardini, & Pasqua, 2011), and that particularly in modern affluent societies time, rather than money,

[2] Noteable exceptions are the studies by Lykken, Bouchard, McGue, & Tellegen (1993), Waller, Lykken, & Tellegen (1995), and Hur, McGue, & Iacono (1996) who find that heritability in leisure time use averages between 40 and 50 percent.

[3] To the best of our knowledge the only other paper that looks at substantive importance in this context is the one by Waldkirch, Ng, & Cox (2004).

may be the decisive constraint (Steedman, 2001; 2007). For these reasons alone, analyzing time use patterns seems justified.[4]

The remainder of the paper follows a common structure. Related literature is discussed in the following section. Section 3. presents the data set and provides some descriptive statistics, while empirical strategy and model specification are discussed in section 4. Results are presented in section 5., and potential pit-falls and limitations are extensively analyzed and commented in the commencing section 6. Finally, section 7. concludes.

2. Related Literature

Aside from the aforementioned literature on cultural learning and social transmission that has inspired this contribution, our research is linked to a vast strand of empirical literature prevalent in economics.[5] Indeed, a substantial amount of attention, both in economics and in other social sciences, has been devoted to the mobility of economic outcomes, attitudes, and behaviors across generations.[6] In general this literature reports that there is substantial intergenerational persistence across most of these outcomes, suggesting that individual traits and behavior, but also educational, occupational, and economic success are to a considerable part pre-determined by the corresponding parental characteristics. Since we are interested in the relative explanatory importance of parental-offspring transmission in shaping observable behaviors, this research connects more closely to two minor streams within this line of work. It connects to the ongoing investigation into the transmission of attitudes, preferences, and habits, as well as to the few contributions analyzing the intergenerational persistence of time allocation and time use preferences.

Empirically analyzing similarities between parents and their children with respect to attitudes and preferences is a very recent phenomenon. Mulligan (1998) was among the first to report that there is considerable correlation in time-averaged consumption between parental and filial households. In this study intergenerational elasticities of household consumption ranged between 0.54 and 0.59 for OLS, and between 0.65 and 0.71 for IV estimations (Mulligan, 1998, p. 195). Waldkirch, Ng, & Cox (2004)

[4] An additional, yet rather practical, advantage of using time use data instead of expenditures arises from the fact that in standard data sets the latter is usually assessed at the level of the household, whereas the prior pertains to the level of the individual. It is thus not necessary to follow the theoretically and empirically questionable assumption that preferences and their motivational foundations are expressed unbiased at the household level, a fact that has been repeatedly criticized in demand analysis (cf. Thomas, 1990; Browning & Chiappori, 1998; Browning, Chiappori, & Lechene, 2006). The present analysis therefore focuses on the individual as the unit of analysis. This may be particularly appropriate in the analysis of intergenerational linkages in time-use choices, because children are likely to observe differences in time allocation between their parents.

[5] It, naturally, also connects to the literature in behavioral genetics. However, since data and methods tend to differ substantially between behavioral genetics and economic analysis, we emphasize the latter. An excellent introduction to behavioral genetics, including a summary of recent findings, can be found in the book by Plomin, DeFries, McClearn, & McGuffin (2008).

[6] The extensive literature in this field is excellently surveyed in Solon (1999) and Black & Devereux (2011). An illuminating introduction is provided in Bowles, Gintis, & Groves (2005).

extend these findings, by disentangling between different sources of similarity. Using data from the Panel Study of Income Dynamics (PSID), they find that intergenerational persistence in consumption choices is driven by two sources: similarities in preferences and similarities in income between parents and their off-spring. The point estimates they report are of similar size as the ones presented by Mulligan (1998). However, they also make the effort to assess the quantitative importance of the independents decomposing explained variance. Their results show that the variance in parental behavior accounts for roughly 30% of the variance in off-spring behavior in total food, nonfood and weighted consumption. We follow this contribution by estimating indices of relative importance for parental behavior based on decompositions of model R^2. Similarly, Collado, Ortuño-Ortín, & Romeu (2012) demonstrate that the spatial distribution of surnames can be linked to spatial patterns of consumption among Spanish regions, which they interpret as the indication for important kin-based mechanisms of preference acquisition.

Others have provided evidence for the intergenerational transmission of stock ownership (Chiteji & Stafford, 1999), of participation in pension and retirement plans (Gouskova, Chiteji, & Stafford, 2010), in the use of alcohol, cigarettes and drugs (cf. Gurling, Grant, & Dangl, 1985; Loureiro, Sanz-de-Galdeano, & Vuri, 2010), as well as for norms regarding fertility (cf. Fernández & Fogli, 2009), or working hard (Lindbeck & Nyberg, 2006). Moreover, substantial influence of parental behavior has also been reported for fundamental preferences, such as risk and trust attitudes (Dohmen, Falk, Huffman, & Sunde, forthcoming), and altruism (Wilhelm, Brown, Rooney, & Steinberg, 2008).

Intergenerational mobility in time use and time allocation has been subject to fewer analyses. Most of these studies focus on labor supply decisions (cf. Del Boca, Locatelli, & Pasqua, 2000; Fernández, Fogli, & Olivetti, 2004; Farré & Vella, 2007; Kawaguchi & Miyazaki, 2009; Fernández & Fogli, 2009), or domestic work time (Alvarez & Miles, 2008). Most closely related to our work are the studies by Cardoso, Fontainha, & Monfardini (2010), and Mancini, Monfardini, & Pasqua (2011), who investigate the correlations in leisure time allocation between parents and their children.[7] Cardoso, Fontainha, & Monfardini (2010) analyze parental effects on adolescents time allocation decisions across three different activities: studying and reading, socializing, and watching TV. Applying a double hurdle model to data from France, Germany, and Italy they find that parents' behavior affects both adolescents' participation, as well as activity duration conditional on participation. Mancini, Monfardini, & Pasqua (2011) extend these findings focusing on Italian children between six and 15 years of age. Both studies clearly indicate that a child's time allocation is not independent from similar decisions of her parents. However, in both studies the analysis is confined to children still living in their parents' household. Therefore, only limited conclusions can be drawn on the sustainability of such behavioral patterns, since children could as well react to parental pressure. Such pressure, naturally, dissipates when children leave to form their own household. Additionally, only the latter study disentangles between imitative short run behavior (e.g. a child reading because the parents are currently reading) and its long run counterpart (i.e. the effect of each parent's average reading time on offspring choices). Yet some of

[7] Bianchi, M., Robinson, & Milkie (2006) also report positive correlations between parents' (predominantly mothers') and children's time use in the United States regarding fitness, watching TV, housework, and reading. However, they confine their analysis to unconditional, raw correlations.

these behaviors may be joint activities in the household (e.g. watching TV) increasing the difficulty in assigning the behavior to preferences in time use regarding certain activities. For instance, the decision of a child to watch TV may be motivated by a preference for this activity or by the drive to spend time with its mother, who happens to be watching TV at that moment. For these reasons, the present analysis is confined to the comparison of parents and their children, no longer living together in the same household.

Like most other studies from this line of work, we share the methodological problem of distinguishing between genetic and non-genetic sources of parent-off-spring similarity. A number of solutions to this problem have been poposed in the literature, ranging from instrumental variable estimation, to adoptee and twin studies (cf. Sacerdote, 2002; 2010). Due to data restrictions, however, none are feasible for the present study. We are thus confined to the analysis of their combined effect. However, we address problems of parent-off-spring coordination, using an instrumental variable approach (see section 6.).

3. Data, Sample Selection, and Descriptives

The data used in this contribution stem from the British Household Panel Survey (BHPS), a longitudinal survey of individuals and their families living in the United Kingdom. [8] Its objective is to trace economic and social changes in a representative sample of roughly 5,000 British households, amounting to about 20,000 individuals. Data are collected annually since 1991, and collection is carried out by the by the Economic and Social Research Council's UK Longitudinal Studies Centre (ESRC) and the Institute of Social and Economic Research at the University of Essex (Taylor, Brice, Buck, & Prentice-Lane, 2010). Each adult member (aged 16 or older) of the survey households is re-interviewed in each wave. Interviews cover various areas of the respondent's life, ranging from household composition, income and labor force participation, education, health behavior, to social values and political attitudes. Children enter the survey when reaching the age of 16, and are followed if they split-off from the original household to form their own. Additionally, family ties between survey members are also reported, such that it is possible to identify child-parent dyads for individuals who have left the parental household before onset of the survey. Correspondingly, we construct a data set of parents and their children satisfying the following conditions: (1) parents must be part of the BHPS for at least a single observation; (2) children must be observed at least once after having split off from the parental household, and must be identified as a child to another panel participant; (3) each parent must be at least 16 years older than her corresponding child.[9] For the sake of clarity we will reserve the term "split-off" for children who have left the parental household.

Tables 1. and 2. present summary statistics of the resulting data set with respect to parent-split-off dyads. Some information is available for 3,700 parents and for 3,569 split-offs, or 1.51 split-offs per

[8] An extensive discussion of the BHPS can be found in Taylor, Brice, Buck, & Prentice-Lane (2010).

[9] In the total data set .08 percent (i.e. seven in absolute numbers) of the parent-child dyads violate this condition, with the age difference being less than 13 years for only a single observation. While teenage pregnancies are not utterly uncommon in Great Britain (Department for Education, 2011), it seems prudent to exclude these observations since their frequency exceeds official statistics by a factor 10.

parent and 1.57 parents per split-off. For a majority of split-offs (57.19%) we have information on two parents, whereas for a majority of parents (60.76%) there is information for a single split-off only. Since comprehensive information on intra-household ties is provided in the BHPS, it is possible to identify parent-split-off dyads that are not based on biological parenthood. For 191 split-offs the data set contains information on choices and behaviors of a stepparent or adopter, explaining why for four split-offs there is information on more than two parental units. Including stepparents accounts for the variety of family constellations in modern-day UK, and thus reflects the diversity of parental role model influences during children's formative years.[10]

INSERT TABLES 1 AND 2 ABOUT HERE

Similar to other studies (cf. Waldkirch, Ng, & Cox, 2004) there are substantial differences between the sub-population of split-offs (henceforth: filial generation) and the sub-population that consists of their parents (henceforth: parental generation). Table 3. reports selected summary statistics of major socio-economic variables for these two. Little surprising, individuals from the parental generation are on average older, wealthier, and report poorer health than subjects from the filial generation. More of them are married or live in stable relationships, which is also reflected in the observation that their average household size is bigger, that more of them carry responsibility for dependent children, and that total expenditures are higher. Note that, while male-female composition of the filial generation is roughly balanced, there is a majority of almost 60% females (i.e. mothers) in the parental generation. To some extent this observation is due to the fact that lone parenthood up to today is an overwhelmingly female phenomenon (cf. Office for National Statistics, 2011). Indeed, for 75% of split-offs with information on a single parent only, as presented in Table 2., this parent is female. It is also apparent that the number of individiuals and the average number of observations per individual differ substantially between parental and filial generation. Socio-demographic variables can on average be observed for almost all individuals from the parental generation, with almost eight observations per individual, whereas such information is provided only for about 1,600 individuals from the filial generation. For the latter the average time series of observation per individual is about 3.5, suggesting a substantial gap in information between parental and filial generation in the data.

INSERT TABLE 3. ABOUT HERE

Time-use data are available biannually in the BHPS starting 1996, and amounting to 7 potential time series observations per individual. Time-use for various activities is measured on a 5-point ordinal scale, where a value of one implies that the respondent never or almost never executes an activity, and a value of five implies that the respondent executes this activity at least once a week.[11] The specific question used to illicit time-use patterns goes as follows: "*We are interested in the things people do in their leisure time, I'm going to read out a list of some leisure activities. Please […] tell me how frequently you do each one...*". Values are obtained by asking to respondents to sort themselves into one of the five

[10] All results presented in the following sections remain unaffected when explicitly excluding stepparent-child dyads from the analysis.

[11] Note that the original coding in the BHPS differs, with high numbers indicating low frequency of behavior. This order was reversed to facilitate an easy interpretation of coefficients.

categories. Activities asked range from physical exercising and leisure activities like going to the cinema or the theatre, to involvement in voluntary work and attendance at local group meetings. They thus encompass a wide area of the respondents' non-working life. Table 4. presents the summary statistics for the eight time-use categories considered in this contribution.[12]

INSERT TABLE 4. ABOUT HERE

Distribution of activities seems comparable between the parental and the filial generations. On average individuals from both generations regularly go out for lunch or a drink, and practice sports rather often. On the other hand participation in unpaid voluntary work is a scarce phenomenon, as is the attendance of local group and voluntary organizations meetings. Absolute frequencies, however, differ considerably between the two generations, with the filial generation showing higher frequencies of behavior for most activities, except voluntary work and attendance at local group meetings. These differences likely suggest an influence of life cycle effects on the frequency of these behaviors. That is, it is little surprising that younger, healthier individuals, who are less often responsible for dependent children, are more able and inclined to participate in activities outside the home.

4. Empirical Strategy and Model Specification

While measuring frequency of activities using an ordinal scale may ease the burden of assessment for the respondent and thus reduce measurement error, it introduces substantial challenges in the estimation of intergenerational elasticities, as well as in assessing the variance in the outcome measures that is attributable to specific predictor variables. While marginal contributions of each predictor can easily be assessed in models for categorical dependent variables, presentation of these results is a cumbersome exercise as these effects need to be estimated for each outcome category separately. Additionally, decomposing model R^2 into contributions from the different regressors (cf. Grömping, 2007), becomes untenable, because no comparable measure of fit is available for such estimation techniques (cf. Long & Freese, 2006).

In order to address both problems the method followed here is first to examine time-use choices of the respondents in order to detect a subset of characteristics that capture the information scattered across the eight items, and then perform further analysis on this subset. While this method certainly leads to a loss in information, it is not uncommon in the literature on the heritability of leisure time choices (cf. Lykken, Bouchard, McGue, & Tellegen, 1993; Hur, McGue, & Iacono, 1996).

[12] In the BHPS five additional time use categories are available. For different reasons they were not considered in this contribution. "Working in the garden" requires the respondent to own or rent a property with a garden, such that non-execution of said activity may also be an effect of selection. "Visit friends/relations or have them visit you" was asked in a single survey wave only, and may thus is problematic because very little observations are available for parents and split-offs. Finally, "Attend leisure activity groups such as evening classes, keep fit, yoga etc" and "Do DIY, home maintenance or car repairs" were not considered because they seemed to mix up a wide variety of very different activities potentially blurring the parent-split-off associations.

4.1. Reducing dimensionality in the dependents

Using the entire sample provided in the BHPS, we conduct a principal component analysis (PCA) with Varimax rotation on the eight time use items.[13] Aside from reducing the number of dependents, and thus contributing to clarity of the presentation of results, principal component analysis offers the additional benefit that the component scores are provided in a form that allows for the application of linear estimation techniques. A caveat of this form of data aggregation is its assumption of distributional normality in the variables used, which is obviously violated in the discretely coded time-use items. While it has been suggested that the method is robust to violations of the normality assumption, particularly in exploratory applications (cf. Tabachnick & Fidell, 2007), we additionally estimate principal components based on polychoric correlations (Kolenikov & Angeles, 2009). Since results do not depend on the applied correlation measure, we resort to reporting the results obtained from the "standard" PCA.

Two components are extracted with an eigenvalue exceeding the critical threshold of unity. These components explain 47.5% of the variance.[14] An examination of the Kaiser-Meyer-Olkin measure of sampling adequacy suggested that the sample was factorable ($kmo = .6751$). Table 5. presents the component loadings and the unexplained variances for the eight time-use measures. When confining the analysis to loadings at least as big as .30, a simple interpretation of the components suggests itself. The two items relating to commitment in voluntary organizations, and local group movements load on component 2, suggesting that this component captures information from these domains. All other items load on component 1, which can be interpreted as personal leisure time activity, other than voluntary work.

Insert TABLE 5. ABOUT HERE

Note however, that despite an apparently sufficient commonality in items, unexplained variance across most items is high. Hence, caution is advised when relying on results from estimation using component scores alone. Therefore, these models are corroborated with estimations using each time-use choice separately.

4.2. Estimation strategy and variable importance

As it can be suspected that early childhood learning is an important channel of preference transmission across generations, it would be ideal to compare current split-off behavior to parental behavior at a time when split-offs were in their formative years. Since such data is not available, we have to resort to

[13] Since the prime interest here is to aggregate the information scattered across time use items into a smaller number of dimensions, principal component analysis is better suited than factor analysis, as the latter is confined to the analysis of covariance between items, whereas the prior considers all variance in the observed items (Tabachnick & Fidell, 2007). Note, however, that results do not differ substantially when using factor analysis, instead.

[14] Note that the explained variance will be underestimated when using "standard" PCA on ordinal variables (Kolenikov & Angeles, 2009). The respective, unbiased value for the polychoric principal component analysis is 53.48%.

an estimation strategy common in the literature on intergenerational transmission (cf. Wilhelm, Brown, Rooney, & Steinberg, 2008), and use contemporaneous parental behavior as a proxy for parental behavior at the time of split-off rearing. Indeed, intra-individual correlation across time is surprisingly high. The correlation between current and two-year-lagged component scores amounts to .70 for the first, and .54 for the second component. The corresponding correlation for a 12-year-lag is still at .54 for the first component and .29 for the second.[15]

To assess whether there is any intergenerational correlation in leisure time use, the estimated model corresponds to:

$$c_{i,t} = \alpha + \boldsymbol{\beta}' \boldsymbol{X}_{i,t} + \delta c_{i,t}^{p} + \varepsilon_{i,t} \quad (1)$$

where $c_{i,t}$ is the factor score of split-off i in period t, and $\boldsymbol{X}_{i,t}$ represents a vector of socio-economic characteristics for the same individual at the same point in time, and varies with the specification considered. Correspondingly, $c_{i,t}^{p}$ is the behavior of that split-off's parent at the same survey wave. The coefficient of interest δ specifies the intergenerational elasticity of leisure time use, and $\varepsilon_{i,t}$ is the idiosyncratic error term clustered over individuals. Three specifications of $\boldsymbol{X}_{i,t}$ are considered. A baseline where $\boldsymbol{X}_{i,t}$ is empty. A second specification including the variables presented in Table 3. of section 3, and a final one additionally accounting for year, regional, and generation specific effects, as well as controlling for the type of household in which the respondent lives. This final specification will be referred to as the "full model".

Since we are interested in the explanatory importance of parent-off-spring transmission for time use allocation, we use the results from these estimations to calculate simple measures of substantive importance by decomposing model R^2. This is necessary because the explanatory importance of regressors does not necessarily correspond to the size and statistical significance of their estimated coefficients (cf. Kruskal & Majors, 1989; Johnson & LeBreton, 2004; Grömping, 2007). While at least three different meanings of variable importance are distinguished in the literature (cf. Achen, 1982), we ascribe to the one common in behavioral research, emphasizing the explanatory, rather than the predictive aspects of regression analysis, and define variable importance as "the amount of the criterion variance explained by the regression equation that is attributable to each predictor variable" (Johnson & LeBreton, 2004: 239).

More precisely, two measures of variable importance are considered: (a) squared zero-order correlations (ZOC), describing the explanatory ability of the regressor, when all other variables are ignored, and (b) usefulness (USE), defined as the increase in model R^2 that is associated with adding the criterion to the rest of the model.[16] Since ZOC captures the variance in split-off behavior that can be explained by parental behavior as the sole predictor, it is an indication of intergenerational similarity in outcomes, independent of their source. As intergenerational similarities in time allocation choices can arise from a variety of direct (i.e. preference transmission) and indirect channels (e.g. through income,

[15] Matrices of inter-temporal correlation coefficients for the two components can be obtained from the author upon request.

[16] For a more thorough discussion of these measures see also Johnson & LeBreton, 2004; Grömping, 2006.

education, etc.), as well as other sources that are less transmission-specific (e.g. living in the same neighborhood) ZOC presents an upper bound estimate of the explanatory importance of parental behavior for filial choices. USE on the other hand describes the variance in off-spring decisions explained by parental behavior above and on top of the one explained by other independents. In this sense it is a lower bound measure for the importance of the direct channel, i.e. preference transmission, alone, as it specifies the additional explanatory value of parental behavior exceeding the one that can be ascribed to other sources. While both measures have drawn repeated criticism, particularly because the partial R^2 values they produce do not sum up to model R^2, and the USE indicator is also susceptible to multicollinearity (cf. Kruskal, 1987; Johnson & LeBreton, 2004), they are nevertheless highly informative in assessing the general importance of parents to off-spring time allocation, and to differentiate between the importance different transmission channels. To get an impression of the reliability of the obtained point estimates of variable importance we estimate their variability using bootstrapped confidence intervals. We do so by resampling 1000 times with replacement from the available data, and re-estimating relative importance indices for each sample.

5. Results

Table 6. presents the results for the cross-sectional model specified in equation (1) for both components of the PCA. The dependent variable in Columns (1) to (3) is the filial score of component one, i.e. personal leisure time activities outside the home. In Columns (4) to (6) the dependent is the filial score of component two, that has been argued to incorporate voluntary work. The explanatory variable of interest is the parental component score ($c_{i,t}^{p}$), which is specified in the first row for all estimations. Standard errors are robust and correct for potential correlation within individuals.

INCLUDE TABLE 6. ABOUT HERE

Coefficients for a baseline specification containing parental behavior, only, are given in Column (1) and (4). These results show that on average filial behavioral frequency increases linearly in parental frequency, suggesting that children's time use preferences are strongly related to parental preferences. Estimates for the intergenerational elasticity of voluntary work are similar in size and significance to the intergenerational elasticity estimates reported by Wilhelm, Brown, Rooney, & Steinberg (2008) for secular giving in the US. Note that the marginal effect of parental behavior is substantially bigger for leisure time activities than for voluntary work, which indicates that the propensity to engage in voluntary work may be much less determined by parental behavior than other leisure time activities. This is also reflected in adjusted R^2 values, which are equivalent to ZOC for these estimations. The variance in parental behavior explains roughly 17% of variance in filial behavior for leisure time activities, but only 2% in voluntary work. Since, δ captures the direct combined effects of genetic and non-genetic channels of parent-off-spring transmission, these results suggest that overall parental influence in these domains is limited, thus also indicating a strong impact of horizontal transmission mechanisms on these behaviors. Note that, explained variance in our models is much below the measure of 30% to 60%, reported in prior behavioral genetic research (cf. Lykken, Bouchard, McGue, &

Tellegen, 1993; Waller, Lykken, & Tellegen, 1995). While for voluntary work more recent estimates from twin studies also report very little impact of vertical transmission channels (both genetic and non-genetic) on individual behavior (Son & Wilson, 2010), the difference for general leisure time activity may arise from a variety of sources. One reason may be that we compare parents to children, rather than children of different genetic similarity, and thus cannot account for the effects of genetic recombination of parental genes, or for potential emergenetic effects (cf. Lykken, Bouchard, McGue, & Tellegen, 1993).

In Columns (2) and (4) we extend these estimations by adding exogenous controls, which have been found to be related with leisure time use before (cf. Robinson & Godbey, 1997). Corresponding to results from the prior literature we find a significant and substantial effect of socio-demographics, like age, sex or self-rated health on time use. However, some of our results differ from the previous literature. Particularly surprising is the strong negative association between educational attainment and the dependents. Note however, that most prior results rely on US data, and use raw correlational measures rather than conditional correlations. Moreover, when analyzing each time use category separately it becomes apparent that this result is primarily driven by a strong negative association between higher educational attainment and being regular spectator at live sports events, whereas for most other categories educational measures are not significantly different from zero.

More importantly, these estimations show that the positive correlation between parental and filial behavior remains strong and significant. This is also the case when estimating the full model specification. While for both dependents adding socio-economic characteristics improves model fit, as evidenced by reductions in the Bayesian Information Criterion (BIC) and increases in adjusted R^2, it is striking that these additional variables capture variance in general leisure activities much better than in voluntary work. This may be due to the fact that the number of people actually engaged in voluntary work is comparatively small, indicating a two-step rather than a single step decision. For this reason the results for voluntary work should be treated with caution.

Note also, that the coefficient of intergenerational elasticity drops markedly when including further socio-economic controls, suggesting that intergenerational similarities in time use allocation are to a substantial part mediated by similarities in these characteristics. This interpretation is clearly corroborated by the usefulness indicator, suggesting that in the full model the variance explained by parental behavior above the one explained by other split-off characteristics is about 2% for general leisure time activities, and 1.5% for voluntary work. However, as the usefulness indicator is susceptible to multicollinearity, its absolute size offers little concrete information on the importance of one predictor as compared to the others in the model. For this reason we calculate relative usefulness $\frac{USE_j}{\sum_{j=1}^{k} USE_j}$ of variable $j = 1, \dots, k$. It simply denotes the relative importance of variable j compared to other regressors measured by their unique contribution to model R^2. In Table 6. variable j is parental behavior. These values suggest that the explanatory power of the direct channel of preference transmission from parent to child is substantial. In the full model it accounts for almost 18% of total usefulness for leisure time activities and almost 23% for voluntary work. These results suggest that the direct transmission of preferences from parents to their children accounts for roughly one fifth of the overall similarity between the two generations. This is quite remarkable, given that most socio-

economic variables that influence time allocation, have been found to be subject to intergenerational transmission as well (cf. Black & Devereux, 2011).

INCLUDE TABLE 7. ABOUT HERE

Table 7. explores whether the significant relation between parental and filial behavior can also be observed when analyzing each time use category separately. The first column presents the δ-coefficients from a set of linear estimations. The second column presents the same coefficients when estimated in an ordered probit framework. The set of controls corresponds to the one from our full specification. Results show that the significant positive relationship between parental and filial behavior holds for each individual time use category as well. Note that coefficients, ZOC values, and USE measures are considerably below the ones obtained from the estimations on component scores. However, in order to obtain comparable measures of variable importance we had to treat the dependents as if they were continuous, ignoring the fact that the error structure will differ from the one assumed by a linear approach (McKelvey & Zavoina, 1975). While this is sometimes perceived permissible if the dependent takes on five or more different values (Torra, Domingo-Ferrer, Mateo-Sanz, & Ng, 2006), it necessarily affects the observed variance in both parental and filial behavior, and thus our measures of variable importance. Caution is thus advised when taking the estimates at face value. Nevertheless, these results clearly show that the significant relationship between parental and filial leisure time allocation reported in Table 6. is not an effect of the PCA.

6. Limitations and sensitivity

The results from the previous section suggest a statistically significant and quantitatively nonnegligible effect of parental behavior on split-off preferences across a wide range of activities. This effect is independent of split-off income, wealth and a host of other socio-demographic variables.[17] In order to assess the sensitivity of these results, and to scrutinize some of the underlying assumptions, estimations are modified in various ways.

A first problem in the previous estimation may arise from the fact that each parent is separately matched to the split-off, thus treating current behavior of (potentially) joint parental units as independent observations. It is, however, likely that at least some activities are coordinated by couples, such that parental behavior will be correlated. In fact, recent estimates from the U.S. and the Netherlands suggest that cohabiting couples spent between 60 and 70 percent of their non-working, non-sleeping leisure time together (Voorpostel, Van der Lippe, & Gershuny, 2009), and that joint activity is particularly likely for entertainment purposes, such as going to a restaurant, visiting friends, or going to the cinema (Kalmijn & Bernasco, 2001). Correspondingly, activity timing has been found to be

[17] In order to check whether this correlation indeed is specific for parents and their children, number of estimations were performed, substituting parental behavior by the behavior of random person from the parental generation observed at the same year (see also Waldkirch, Ng, & Cox, 2004). Doing that we find no significant correlation in behavioral frequency between split-offs and non-parents for the components or any of the eight activity categories. Results can be obtained upon request.

strongly interdependent between spouses (Hallberg, 2003), suggesting that accounting for the behavior of both parental units independently may implicitly and unnecessarily assign higher weights to individuals for which we have observations for more than one parent. In order to check, whether estimations are sensitive to this weighting scheme, the exercise from the previous section was repeated matching each split-off to a single (and biological) parent, only. Column (1) of Table 8. presents the results for the estimations of the full model for general leisure time activities where for split-offs with more than one parent only paternal behavior is considered. Since for most single-parent split-offs information is only available for the mother, focusing on paternal behavior may be problematic with respect to comparability between the two sub-populations. For this reason Column (2) presents the same estimations focusing on maternal behavior for multiple-parent split-offs.[18] The corresponding results for estimations on voluntary work are given in Table 9. Results, however, suggest that the implicit weighting matrix leaves the estimates largely unaffected, since δ-coefficients are robust to this peculiarity of the data.

INCLUDE TABLE 8. AND TABLE 9. ABOUT HERE

Another issue of data treatment refers to our use of its panel dimension. While we exploit this additional information to control for autocorrelation within individuals, the concern arises that treating repeated measures from the same individual as if it was cross-sectional data introduces another weighting-based bias. Since we conjecture that the correlation between parental and filial behavior we observe in the data is driven by preference transmission from parent to child, it seems reasonable to assume that transmission channels close or become severely limited after the child has split off to form her own household. That is, that vertical transmission (through genetics and education) is largely completed by the time children leave their parents household. Since we only consider parent-child dyads following split-off, measuring the same dyad repeatedly over time will bias the estimation, as it considers information that is – at least partly – redundant. In order to assess how severely this problem affects our results, full models were re-estimated including a single observation per dyad, only. Columns (3) Table 8. and Table 9. present the δ-coefficients from these estimations, where for individuals for whom more than one observation was available, only the last observation was used.[19] With this change in data structure we still find a strong positive relationship between parental and filial behavior for leisure time activity. However, the coefficient of parental behavior is no longer significant in the estimation on voluntary work. The latter result could indicate that parental previous results were indeed biased upwards in previous estimations. Note, however, that the applied data restrictions imply a substantial loss of information. Compared to the baseline estimation more than 85% of the observations cannot be accounted for, when limiting analysis to a single observation per dyad. Moreover, measurement error in both parental and filial behavior is likely to be substantially more pronounced under these conditions. Given, that the coefficient is still in the range of prior estimates and significance

[18] As behavioral transmission through genetics and social learning has been argued to be sensitive to differences in sex between parent and child (Martin & Ruble, 2004), we follow the common praxis in the literature on intergenerational transmission of traits (cf. Duncan, Kalil, Mayer, Tepper, & Payne, 2005) and focus on same sex dyads as well. Results do not differ substantially from the ones presented in Table 6. They are available upon request.

[19] Similar results were obtained when using the first or any random observation in between.

is just below conventional standards, we recommend to treat the result as suggestive, at best. Particularly, because F-statistics indicate problems of model fit in general.

While the previous problems may be specific to data treatment in this contribution, a more common source of error, well-known from the literature on intergenerational earnings transmission, is the lifecycle bias (cf. Mazumder, 2005; Black & Devereux, 2011). It describes the distortion of estimates that may arise when the outcome variable is sensitive to the individual's age (and stage in the lifecycle), and parents and split-offs are observed at different stages across the life-cycle. When measuring parental and filial behavior at the same point in time, as in the present case, we need to assume that current parental behavior can be considered a good proxy for past parental behavior, such that the effects measured are not driven by contemporaneous shocks, but by genetic or social transmission of preferences. Yet while the analysis of temporal stability, presented in section 4., suggested rather stable behavioral patterns across time, casual observation of the descriptives gives rise to the suspicion that life-cycle effects may nevertheless contribute to the frequency by which an action is executed. Hence it may be suspected that $c_{i,t}^{p}$ as specified in equation (1) is subject to measurement error, biasing estimations of δ.[20] In order to determine the impact of lifecycle bias on the estimates presented in Table 6. models are re-estimated using the inverse of the parent-split-off age difference as analytical weight for each observation. These estimations are presented in Column (4) of Table 8. for personal leisure time activities and in Table 9. for voluntary work. They show that despite the potential influence of lifecycle effects on the frequency of leisure activities, results are largely unaffected, by this change.[21]

Additionally, other parental characteristics, especially income, have been found to be associated with observable filial behavior (Waldkirch, Ng, & Cox, 2004). This will be a particularly virulent phenomenon if parental income or wealth allows for unobservable monetary or quasi-monetary transfers to the filial generation. For instance, split-offs may inhabit property owned by their parents, allowing them to save on rent, and thereby freeing additional resources available for consumption or leisure activities. In these cases, estimations as suggested in equation (1) may be plagued with omitted variable bias. To ensure that the correlation of filial and parental behavior is orthogonal to other parental characteristics, the full set of socio-economic controls is inserted for the parental generation, as well. The δ coefficients from these exercises are presented in Columns (5) of Table 8. and Table 9. for leisure time use and voluntary work respectively. They show high resemblance to the results from the previous section, suggesting that omitted variable bias may be limited in our estimations.

Another, particularly worrying issue when measuring parental and filial behavior at the same point in time refers to the effects of reverse causality. In fact, it is not unlikely that parents and their split-off

[20] While the general agreement in the literature holds that lifecycle sensitivity of outcome variables biases intergenerational elasticities towards zero (cf. Mazumder, 2005), Wilhelm, Brown, Rooney, & Steinberg (2008: 2148) argue that this is only the case if the direct effect of measurement error overshadows potential effects arising from cross-correlations among the other independents.

[21] While it is undisputable that this assessment of the bearing of lifecycle bias on the estimations is tentative, it is nevertheless informative. Strong lifecycle bias should be reflected in substantial deviations of the δ-coefficients from the ones in the base estimation, once age differences between parent and split-off are taken into account. This is not the case.

children coordinate at least some of their leisure activities, or that there is an influence from other temporary sources that affect both parents and their children simultaneously (such as the wider family environment). A simple way to investigate causality is to use an instrumental variable approach. It allows to separate current parental behavior (possibly endogenous) from parental behavior guided by characteristics that cannot be caused by joint shocks, i.e. characteristics that are exogenous to split-off behavior. Table 10. repeats the estimations from Table 6. using parental race and education attainment as instruments for parental time use preferences. Previous research has applied a similar set of instruments for the estimation of intergenerational transmission in attitudes (Dohmen, Falk, Huffman, & Sunde, forthcoming). Recall that both race and educational attainment dummies have been found to be significantly correlated with the dependents for children. Additional estimates using the entire BHPS sample also suggest a significant influence of these characteristics on time use choices.[22] Since parental education is usually completed by the time activity coordination between parents and children in domains like restaurant dining or voluntary work is a realistic possibility, these characteristics can plausibly assumed to be exogenous to split-off behavior or attitudes. The same holds, naturally, for race.

INSERT TABLE 10. ABOUT HERE

Judging from the first stage R^2- and F-statistic, instruments are sufficiently strong and valid. Also Hansen's J statistic indicates that the exclusion criterion is met. Again results support the initial evidence, suggesting a strong link between parental and filial time use preferences. However, caution is advised when interpreting the size of the 2SLS estimates, as Kleibergen-Paap rank LM tests of weak identification indicate up to 25% maximal size bias of the coefficient. Note also, that second stage centered R^2 values, i.e. ZOC, are somewhat below the ones from the original OLS estimation. While this is little surprising, given that by IV estimation we essentially limit the variability of the instrumented regressors, it is noteworthy that at the explanatory power of overall parental behavior is still substantial, at least for leisure time activities. In general, IV estimates clearly show that the significant correlation between parental and filial behavior is not driven by simultaneity or reverse causality. They thus corroborate the findings from the original OLS estimations.

As a final point of interest let us return to the panel property of the available data. Note that directly controlling for time-invariant, unobserved heterogeneity is tempting, but unfeasible. Since we are ultimately interested in whether a split-off with a time use frequency that is - conditional on the observables - relatively high, has a parent for whom the same holds true, controlling for unobserved heterogeneity using unit dummies would invariably soak up this relationship. It is thus more instrumental to look at parent-split-off correlations in the individual-specific intercept. In a final step we therefore run fixed effects estimations, regressing time use components in the entire BHPS sample on the set of controls specified for the full model, but excluding parental behavior, as specified by the following equation:

$$c_{i,t} = \vartheta + \gamma \boldsymbol{X}_{i,t} + v_i + u_{i,t} \quad (2)$$

[22] Available from the author upon request.

where $\boldsymbol{X}_{i,t}$ is identical to equation (1), and the term ν_i denotes the individual and unobserved, time-invariant effect. Similar to Waldkirch, Ng, & Cox (2004) this effect is in a second step regressed on the time-invariant effect of the individual's parent ν_i^p. Naturally, only parent-split-off dyads can be considered for whom we have a minimum of two observations each. Furthermore, as ν_i is time-invariant only one observation per individual is used in the second step estimation, resulting in exactly 200 observations. Table 11. presents the results for this exercise.[23] They again suggest significant and strong relation between parental and filial preferences in time allocation choices. It is noteworthy, that while the coefficients of intergenerational elasticity are surprisingly similar to the ones from the full model IV estimation, the explained variance is substantially higher, amounting to 32% for personal leisure activities and 7% for voluntary work. Note however, that these intercepts are estimated using very few time observations per individual (see also Table 3.), such that their precision and consistency is likely to be weak (Baltagi, 2008: 12). Additionally, they contain information from all unobserved sources, and can therefore not simply be assigned solely to parental influences. Therefore these estimates should be taken as supportive and suggestive evidence.

INSERT TABLE 11. ABOUT HERE

7. Conclusions

The present paper scrutinizes intergenerational linkages in time-use choices between parents and their children, exploiting time-use information from a comprehensive data set from the UK. In particular, we investigate whether parental time-use choices among a wide array of leisure activities, is correlated with the activity of their children, after the latter have left to form their own households. In order to deal with data constraints the estimation strategy follows Wilhelm, Brown, Rooney, & Steinberg (2008) where current parental behavior is used as a proxy to parental behavior at the time when children were in their formative years.

Generally, our results suggest a statistically significant and quantitatively non-negligible positive association between parental behavior and split-off preferences across a wide range of activities. This effect is independent of split-off income, wealth and a host of other socio-demographic variables. Furthermore, it is robust to a substantial number of changes in data structure, estimation strategy, and in the population considered. More importantly, we also estimate the relative importance of overall parent-split-off transmission, as well as, for the specific channel of direct preference propagation, using simple measures of R^2 decomposition. These estimates suggest that the overall influence of vertical transmission channels for these behaviors is limited. They range from 17% to 32% for personal leisure time activities, and from 2% to 7% for voluntary work. While we have to acknowledge that these estimates cannot capture certain forms of recombinatory and emergenetic effects, we nevertheless

[23] Similar estimates for each time use category range from .1594 for doing unpaid voluntary work to .5424 for going to a concert, theatre or live performance. All are significant at the 5% level. They are available from the author upon request.

suggest that our results support the relative importance of social learning mechanisms, which has been stressed, amongst others, in the literature on human learning biases (cf. Henrich & Boyd, 2007).

Our results also suggest that direct transmission of parental preferences to their children accounts for roughly 20% of the observable similarity between the two generations. While this may appear modest recall that many other factors also contribute to this observed similarity. Aside from sources that may have little to do with family membership, like living in the same area, a substantial amount of indirect effects are likely to play a role here. Particular intergenerational similarities in socio-economic characteristics like income, working hours, or educational attainment can be expected to contribute to correspondence in parent-split-off choices. All of these items have been found to contribute to leisure time allocation in this, as well as in previous research (cf. Robinson & Godbey, 1997/2000). As all of these similarities have a transmitted component as well (cf. Black & Devereux, 2011), we consider it rather surprising that direct transmission can be accounted for almost one fifth of observed similarity.

In essence our results contribute to the growing literature on the intergenerational transmission of attitudes and preferences. While they support the general finding from this stream of literature that parental preferences are important determinants of the behavior of their children, they also qualify these results suggesting that parental influence, at least in the domain of leisure time allocation, may be limited. This finding is in line with a wide array of theoretical and experimental research in biology, investigating cultural and social learning strategies, and their relative importance (cf. Richerson & Boyd, 2005; Efferson, Lalive, Richerson, McElreath, & Lubell, 2008; McElreath, Bell, Efferson, Lubell, Richerson, & Waring, 2008). By alluding to the role of non-family based influences on behavior, this paper also contributes to a more recent effort in economics aiming to simultaneously assess several channels of attitude transmission (Dohmen, Falk, Huffman, & Sunde, forthcoming).

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Appendix

Table 1. Number of split-offs per adult

Number of children per adult	Frequency	Percent
1	2,248	60.76
2	1,073	29.00
3	316	8.54
4	48	1.30
5	9	0.24
6	5	0.14
9	1	0.03
Total	**3,700**	**100.00**

Table 3. Number of adults per child

Number of adults per child	Frequency	Percent

1	1,524	42.70
2	2,041	57.19
3	4	0.11
Total	**3,569**	**100.00**

Table 3. Descriptives: Socio-economic characteristics for parental and filial generation (UK, 1991-2008)

Variable	Mean (SD)/Percent	Individuals	$\overline{T}$	Coding
Age (SD)				Age in years
Parental generation	49.17 (12.20)	3476	8.016	
Filial generation	30.36 (12.05)	1724	3.561	
Male				1 – male, 0 – female
Parental generation	40.37	3481	9.858	
Filial generation	49.65	3380	3.375	
Nonwhite				1 – nonwhite, 0 – white
Parental generation	5.39	3309	10.034	
Filial generation	7.17	3147	3.427	
Responsible adult				1 – responsible for a child
Parental generation	27.58	3455	8.044	under 16 years of age, 0 –
Filial generation	18.35	1723	3.562	otherwise
Self-rated health (SD)				Self-rated health over
Parental generation	2.25 (.98)	3448	7.550	past 12 months: 1
Filial generation	2.08 (.88)	1680	3.408	(excellent) to 5 (very poor)
Married/in stable relationship				1 – currently married or
Parental generation	79.78	3476	8.016	in stable relationship; 0 –
Filial generation	53.86	1724	3.560	otherwise
Widowed				1 – currently widowed; 0
Parental generation	8.03	3476	8.016	–otherwise
Filial generation	0.96	1724	3.560	
Divorced/Separated				1 – currently
Parental generation	10.56	3476	8.016	separated/divorced; 0 –
Filial generation	4.89	1724	3.560	otherwise
Primary education				Highest educational
Parental generation	14.26	3285	7.835	attainment primary level:
Filial generation	14.97	1651	3.523	1 – yes; 0 – no
Secondary education				Highest educational
Parental generation	26.35	3285	7.835	attainment secondary
Filial generation	43.34	1651	3.523	level: 1 – yes; 0 – no
University degree				Highest educational
Parental generation	27.38	3285	7.835	attainment university
Filial generation	30.34	1651	3.523	degree: 1 – yes; 0 – no
Household size (SD)				Number of members
Parental generation	3.90 (1.44)	3700	8.257	currently living in the
Filial generation	2.86 (1.67)	1766	3.578	same household
Weekly working hours (SD)				Average weekly working

Parental generation	22.49 (19.58)	3364	7.762	hours (paid work) over
Filial generation	25.09 (18.90)	1693	3.510	past 12 months
Log total expenditure (SD)				Average monthly real
Parental generation	3.25 (.65)	3282	7.517	household expenditure
Filial generation	2.89 (.90)	1638	3.446	
Income from interest				Received more than £100
Parental generation	17.79	3226	7.003	from dividends/interest
Filial generation	10.6	1593	3.251	last year: 1 – yes; 0 – no
Income from interest				Received more than £100
Parental generation	17.79	3226	7.003	from dividends/interest
Filial generation	10.6	1593	3.251	last year: 1 – yes; 0 – no

$\bar{T}$: Average time series observations per individual

Table 4. Descriptives: Time-use for parental and filial generations (UK, 1996-2008)

Variable	Parental generation Mean (SD)	Filial generation Mean (SD)
Play sport/go walking/ go swimming	3.294 (1.757)	3.761 (1.598)
Go to watch live sport	1.693 (1.171)	1.929 (1.214)
Go to the cinema	1.990 (1.019)	2.750 (1.097)
Go to a concert, theatre or other live performance	1.946 (0.920)	2.121 (0.948)
Have a meal in a restaurant, cafe or pub	3.303 (1.062)	3.707 (0.956)
Go for a drink at a pub or club	3.059 (1.510)	3.880 (1.300)
Attend meetings for local groups/ voluntary organizations	1.697 (1.279)	1.514 (1.125)
Do unpaid voluntary work	1.562 (1.195)	1.409 (1.017)
Individuals	**2623**	**1230**
$\bar{T}$	**3.615**	**2.083**

$\bar{T}$: Average time series observations per individual
Coding: 1 (never/almost never); 2 (Once a year or less); 3 (Several times a year); 4 (At least once a month); 5 (At least once a week)

Table 5. Nonrotated component loadings and unique variances (UK, 1996-2008)

	Component 1 Loading	Component 2 Loading	Unexplained Variance
Play sport/go walking/ go swimming	.3028	-.0199	.7928
Go to watch live sport	.3260	-.0647	.7541
Go to the cinema	.4503	-.1308	.5166
Go to a concert, theatre or other live performance	.4313	.0616	.575
Have a meal in a restaurant, cafe or pub	.4309	-.1619	.5411
Go for a drink at a pub or club	.3974	-.2919	.5124
Attend meetings for local groups/ voluntary organizations	.1870	.6541	.2595
Do unpaid voluntary work	.1863	.6597	.2487
Eigenvalue	**2.25329**	**1.54656**	
Number of observations		**36340**	

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able 6. Intergenerational coefficients (UK, 1996-2008): OLS Results

	Personal leisure time activities			Voluntary work		
	(1)	(2)	(3)	(4)	(5)	(6)
Parental component score ($c^{p}_{i,t}$)	.3796***	.2081***	.1611***	.1174***	.1051***	.1059***
	(.0237)	(.0230)	(.0223)	(.0234)	(.0250)	(.0245)
Age (in years)		.0353***	.0324***		-.0128***	.0011
		(.0045)	(.0091)		(.0045)	(.0102)
Male		-.1017	-.1855***		.0337	.0491
		(.0725)	(.0683)		(.0813)	(.0755)
Self-rated health		.1385***	.1384***		-.0044	.0006
		(.0351)	(.0336)		(.0464)	(.0402)
Income (log)		.4636***	.3329***		-.2123**	-.2069*
		(.1285)	(.1154)		(.1079)	(.1114)
Income squared (log)		-.0477***	-.0341***		.0143	.0128
		(.0101)	(.0093)		(.0093)	(.0096)
Responsible adult		.5182***	-.0183		-.0703	-.0523
		(.0885)	(.1172)		(.1137)	(.1375)
Nonwhite		.3752**	.4601***		.0212	.0548
		(.1691)	(.1763)		(.1051)	(.1159)
Weekly working hours		-.0042*	-.0062***		.0061***	.0053**
		(.0022)	(.0023)		(.0022)	(.0023)
Primary education		-.1846	-.1489		-.1166	-.1020
		(.1656)	(.1636)		(.0895)	(.0946)
Secondary education		-.4746***	-.3778***		-.3562***	-.2709***
		(.1378)	(.1356)		(.0899)	(.0865)
University degree		-.4919***	-.3712***		-.6298***	-.5729***
		(.1413)	(.1404)		(.1075)	(.1096)
Wave dummies	No	No	Yes	No	No	Yes
Regional dummies	No	No	Yes	No	No	Yes
Generation dummies	No	No	Yes	No	No	Yes
Household type dummies	No	No	Yes	No	No	Yes
Additional variables	No	Yes	Yes	No	Yes	Yes
Constant	-.7608***	-2.3435***	-1.9067***	.1380***	1.5569***	1.2443
	(.0387)	(.4811)	(.4930)	(.0344)	(.3706)	(.9727)

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Observations	3386	3169	3113	3386	3169	3113
Individuals	1097	1053	1040	1097	1053	1040
F-statistic	255.97	41.80	24.15	25.10	5.84	4.20
Adjusted R^2	.1684	.3541	.4163	.0195	.0667	.0948
ZOC ($c_{i,t}^p$)	.1684	.1664	.1671	.0195	.0203	.0202
95% CI [LB; UB]		[.1417; .1915]	[.1433; .1916]		[.0110; .0331]	[.0094; .0342]
USE ($c_{i,t}^p$)	.1684	.0375	.0226	.0195	.0149	.0149
95% CI [LB; UB]		[.0266; .0494]	[.0139; .0312]		[.0071; .0259]	[.0062; .0261]
$\frac{USE_j}{\sum_{j=1}^{k} USE_j}$	1	.2258	.1766	1	.2634	.2290
BIC	10955.31	9577.369	9349.55	10675.52	9944.931	9845.122

Notes: clustered standard errors in parentheses; ***, coefficient significantly different from zero at the 1% level; **, coefficient significantly different from zero at the 5% level; *, coefficient significantly different from zero at the 10% level; Additional variables include: income from investment dummies (three dummies denoting below £100, between £100 and £1000, and above £1000, base outcome is no income from investment); marital status dummies denoting whether the respondent currently lives in a stable relationship, is widowed, or divorced or separated (base outcome is single).

Table 7. Intergenerational coefficients for single time use categories (UK, 1996-2008)

Activity	Coef. $c_{i,t}^p$ OLS	Coef. $c_{i,t}^p$ ordered probit	Observations (individuals)	Adjusted R^2: OLS	ZOC ($c_{i,t}^p$) OLS	USE ($c_{i,t}^p$) OLS	$\frac{USE_j}{\sum_{j=1}^{k} USE_j}$
Play sport/go walking/ go swimming	.0914*** (.0179)	.0832*** (.0160)	3140 (1043)	.3515	.1103	.0089	.0701
Go to watch live sport	.1193*** (.0262)	.1135*** (.0241)	3137 (1042)	.1695	.0188	.0105	.0839
Go to the cinema	.1518*** (.0243)	.1742*** (.0291)	3139 (1043)	.2369	.0712	.0173	.2196
Go to a concert, theatre or other live performance	.1898*** (.0244)	.2496*** (.0312)	3136 (1041)	.2435	.0850	.0295	.2255
Have a meal in a restaurant, cafe or pub	.1273*** (.0216)	.1592*** (.0278)	3136 (1042)	.1739	.0527	.0195	.1844
Go for a drink at a pub or club	.0909*** (.0164)	.1148*** (.0204)	3134 (1043)	.3938	.1029	.0111	.0923
Attend meetings for local groups/ voluntary organizations	.0665*** (.0220)	.0790*** (.0244)	3135 (1043)	.0626	.0083	.0059	.1226

Do unpaid voluntary work	.0977*** (.0242)	.1255*** (.0278)	3128 (1043)	.0705	.0158	.0130	.2218

Notes: clustered standard errors in parentheses; ***, coefficient significantly different from zero at the 1% level; all coefficients are taken from estimations of the full model.

Table 8. Intergenerational coefficients on restricted dyads (UK, 1996-2008): Personal leisure time activities

	One parent only (father)	One parent only (mother)	Single observation per dyad	Age- difference weights	Parental characteristics
	(1)	(2)	(3)	(4)	(5)
Parental factor score ($c_{i,t}^{p}$)	.1818*** (.0260)	.1699*** (.0250)	.1325** (.0518)	.1565*** (.0226)	.1578*** (.0237)
Observations	1838	2016	424	3113	2622
Individuals	894	1003	424	1040	957
F-statistic	21.72	22.32	5.56	23.87	16.04
Adjusted R^2	.4114	.4054	.3594	.4051	.4399
BIC	5742.059	6312.421	1512.234	9405.553	8209.584

Notes: clustered standard errors in parentheses; ***, coefficient significantly different from zero at the 1% level; **, coefficient significantly different from zero at the 5% level; *, coefficient significantly different from zero at the 10% level, all estimations are taken from the full model

Table9. Intergenerational coefficients on restricted dyads (UK, 1996-2008): Voluntary work

	One parent only (father)	One parent only (mother)	Single observation per dyad	Age- difference weights	Parental characteristics
	(1)	(2)	(3)	(4)	(5)
Parental factor score ($c_{i,t}^{p}$)	.1096*** (.0279)	.1121*** (.0267)	.0652 (.0501)	.1092*** (.0249)	.0756*** (.0253)
Observations	1838	2016	424	3113	2622
Individuals	894	1003	424	1040	957
F-statistic	3.74	3.88	1.47	4.09	3.16
Adjusted R^2	.0867	.0860	.0547	.0950	.1054
BIC	5962.911	6416.682	1570.233	9779.177	8584.291

Notes: clustered standard errors in parentheses; ***, coefficient significantly different from zero at the 1% level; **, coefficient significantly different from zero at the 5% level; *, coefficient significantly different from zero at the 10% level, all estimations are taken from the full model

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Table 10. Intergenerational coefficients (UK, 1996-2008): IV Results

	Personal leisure time activities			Voluntary work		
	(1)	(2)	(3)	(4)	(5)	(6)
Parental component score ($c^{p}_{i,t}$)	.5957***	.4423***	.4016***	.2395***	.2255***	.2054***
	(.0846)	(.1144)	(.1251)	(.0706)	(.0773)	(.0661)
Age (log)		.0237***	.0180		-.0156***	.0009
		(.0078)	(.3429)		(.0048)	(.0106)
Male		-.1345*	-.2035***		.0193	.0282
		(.0769)	(.0731)		(.0822)	(.0762)
Self-rated health		.1166***	.1195***		-.0124	-.0070
		(.0382)	(.0370)		(.0450)	(.0394)
Income (log)		.3944***	.2939***		-.2321*	-.2165*
		(.1225)	(.1124)		(.1206)	(.1183)
Income squared (log)		-.0411***	-.0307***		.0158	.0135
		(.0100)	(.0091)		(.0100)	(.0100)
Responsible adult		.4395***	-.0077		-.0937	-.0747
		(.0992)	(.1210)		(.1138)	(.1403)
Nonwhite		.0492	.1234		.0100	.0291
		(.2187)	(.2280)		(.1048)	(.1141)
Weekly working hours		-.0038	-.0052**		.0063***	.0052**
		(.0023)	(.0025)		(.0023)	(.0023)
Primary education		-.1713	-.1407		-.0827	-.0723
		(.1735)	(.1710)		(.0907)	(.0945)
Secondary education		-.3649**	-.2802*		-.3051***	-.2261**
		(.1575)	(.1541)		(.0949)	(.0890)
University degree		-.3384**	-.2803		-.5547***	-.5131***
		(.1740)	(.1697)		(.1177)	(.1140)
Wave dummies	No	No	Yes	No	No	Yes
Regional dummies	No	No	Yes	No	No	Yes
Generation dummies	No	No	Yes	No	No	Yes
Household type dummies	No	No	Yes	No	No	Yes
Additional variables	No	Yes	Yes	No	Yes	Yes
Constant	-.9373***	-2.0508***	-1.5512***	.1585***	1.6823***	1.0617**
	(.0718)	(.4699)	(.5120)	(.0361)	(.4218)	(.4788)

Observations	3345	3132	3076	3345	3132	3076
Individuals	1080	1037	1024	1080	1037	1024
Second stage F-statistic	49.49	35.66	20.88	11.50	5.32	4.11
Centered R^2	.1143	.3137	.3809	.0018	.0539	.1005
First stage F-statistic	83.08	31.75	18.00	63.54	10.38	5.86
First stage centered R^2	.1144	.2788	.3114	.1018	.1244	.1549
Hansen J-statistic ($p <$)	.3205	.6245	.6038	.2540	.2826	.2633

Notes: clustered standard errors in parentheses; ***, coefficient significantly different from zero at the 1% level; **, coefficient significantly different from zero at the 5% level; *, coefficient significantly different from zero at the 10% level; Additional variables include: income from investment dummies (three dummies denoting below £100, between £100 and £1000, and above £1000, base outcome is no income from investment); marital status dummies denoting whether the respondent currently lives in a stable relationship, is widowed, or divorced or separated (base outcome is single).

Table 11. Relationship between parental and filial individual-specific intercepts

	Personal leisure time activities	Voluntary work
	(1)	(2)
Parental fixed effect (v_i^p)	.4583***(.0515)	.2343*** (.0670)
Constant	-1.0598***(.0788)	.0494 (.0655)
Observations	200	200
F-statistic	79.28	12.23
R^2	.3166	.0702

Notes: The dependent is the filial fixed effect. Robust standard errors in parentheses; ***, coefficient significantly different from zero at the 1% level; **, coefficient significantly different from zero at the 5% level; *, coefficient significantly different from zero at the 10% level

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