

Parents' education as a determinant of educational childcare time

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Received: 20 September 2011 / Accepted: 28 August 2012 /
Published online: 19 October 2012
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Abstract We analyze the relationship between parents' education and the time devoted to childcare activities, with a focus on activities aimed at increasing the child's human capital. We use the sample of opposite-sex couples with children under age 18, from Spain (2002) and the UK (2000), included in the Multinational Time Use Study. By estimating a seemingly unrelated regressions tobit model, we find that mothers' education is associated with an increase in the time devoted to educational childcare by fathers in both Spain and the UK, while it is associated with an increase in the time devoted to educational childcare by mothers in Spain. We also find that fathers' education has no effect on the time devoted to educational childcare time by either parent. It seems that what really matters in determining the time devoted to educational childcare at the couple level is the educational level of the mother.

Keywords Childcare · Human capital · Education · Multinational time-use study

JEL Classification D13 · D64 · J13

Responsible editor: Alessandro Cigno

Electronic supplementary material The online version of this article (doi:10.1007/s00148-012-0443-7) contains supplementary material, which is available to authorized users.

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1 Introduction

Since Leibowitz's seminal work on parental childcare time and increased human capital of children (Leibowitz 1972, 1974, 1977), researchers have analyzed the relationship between parental time investment and child outcomes (Datcher-Loury 1988; Blau and Grossberg 1990; Cooksey and Fondell 1996; Han et al. 2001; Brooks-Gunn et al. 2002), with most of the existing research finding a positive relationship between them. Parents invest both material resources and time in raising their children (Becker 1964, 1981; Becker and Lewis 1973), and studying what factors (e.g., race, income, education) influencing the time parents devote to their children may be important for both parents and policymakers.

Among the factors influencing the time parents devote to their children, prior research has found a positive relationship between parents' education and parental childcare time (see Guryan et al. 2008). Thus, highly educated parents devote more time to their children than low-educated individuals, although the explanations for this positive gradient may differ. For instance, parents may see investing in their child's education as a luxury good, and thus highly educated parents may decide to invest more in their children compared to their low-educated counterparts. Also, highly educated parents may feel that market-purchased childcare options are poor substitutes for parental time, and thus they trade off their time with market-purchased childcare services.

This paper specifically studies the parent's education as it influences the time devoted to childcare activities. To that end, we use time-use data from two European countries included in the Multinational Time Use Study, Spain (2002) and the UK (2000), and we analyze the time that opposite-sex couples with children under age 18 devote to three types of childcare: basic childcare, educational childcare, and supervisory childcare. In our discussion, we particularly focus on the relationship between parents' education and the time devoted to educational childcare, that is to say childcare activities aimed at increasing the human capital of the child.¹ We acknowledge that failing to account for joint household decisions and joint provision of child care would be a critical failure that would affect the interpretation of the results. In our empirical analysis, we estimate a six-equation seemingly unrelated regression (SUR) model to take into account that the time one parent devotes to childcare activities may serve as a substitute for the time devoted by the other.

¹Previous research has shown a negative relationship between stress and brain development (e.g., Sapolsky 1996; Bremner and Vermetten 2001; Teicher et al. 2002) and between physical/emotional neglect and children's neurodevelopment and health (e.g., Anda et al. 2006; Dube et al. 2003; Edwards et al. 2003). Hence, the other two types of childcare (basic and supervisory childcare) may also influence children's human capital. However, in this paper, we focus on the educational childcare time of parents.

We find that mother's education is associated with an increase in the time devoted to educational childcare by fathers, in both Spain and the UK, and that mother's education is associated with an increase in the time devoted to educational childcare by mothers in Spain. Hence, it seems that what really matters in determining the time devoted to educational childcare at the couple level is the educational level of the mother. We also find that the time devoted to educational childcare by both members of the couple is complementary in both Spain and the UK. To the extent that there is positive assortative matching by education (Oppenheimer 1988; Mare 1991; Pencavel 1998; Lewis and Oppenheimer 2000; Blossfeld and Timm 2003), such complementarity implies that members of highly educated couples devote more time to educational childcare than their low-educated counterparts, as found in a prior research (Guryan et al. 2008).

Our contribution to the literature is threefold. First, we contribute to the existing research on childcare time, by focusing on the time devoted to educational childcare. Despite the existence of research on childcare time (Hill and Stafford 1974; Zick and Bryan 1996; Bianchi 2000; Hallberg and Klevmarken 2003; Gauthier et al. 2004; Sayer et al. 2004; Kimmel and Connelly 2007; Guryan et al. 2008; Kalenkoski et al. 2009), few papers have directly analyzed the time that couples specifically devote to activities aimed at increasing the human capital of the child. Second, we analyze two European countries with different welfare regimes (Esping-Andersen 1999) in an attempt to extract common patterns in the time devoted to educational childcare. Different effects of different factors may imply that national welfare regimes influence the time devoted to childcare activities. Third, our analysis at the couple level takes into account that the time one parent spends may serve as a substitute for the time of the other parent, providing specific evidence of the relationship between the total time devoted to childcare activities by both members of the couple. To the best of our knowledge, we are the first to empirically address the relationship between types of parental childcare.

The paper is organized as follows. Section 2 establishes the theoretical framework. Section 3 describes the data and the variables. Section 4 describes the empirical strategy, and Section 5 presents the main results. Section 6 sets out the main conclusions.

2 Theoretical framework

The New Home Economics theory, with its quality–quantity trade-off argument, provides a useful starting point for our theoretical framework (Becker and Lewis 1973; Becker and Tomes 1976; Willis 1987). In line with this theory, parents invest both material resources and time in raising their children, and parents may decide to have fewer children of higher “quality” by devoting more resources to them, including greater investments of parental time. Time investment in children is important for children's well-being and development (Leibowitz 1972, 1974, 1977; Datcher-Loury 1988; Blau and Grossberg 1990;

Cooksey and Fondell 1996; Han et al. 2001; Brooks-Gunn et al. 2002), and it is one possible mechanism through which culture, habits, and economic status are transmitted from generation to generation (Bowles 1972; Goldberger 1989; Dearden et al. 1997; Bisin and Verdier 2001; Dunn 2007; Anger and Heineck 2010; Loureiro et al. 2010; Pronzato 2012).

One of the questions many economists have studied during the recent decades is how the members of the household allocate their financial and time resources, leading to different economic theory approaches.² One alternative is based on models that take the view that the household is a place of conflict and cooperation, where we find intra-household bargaining models (e.g., Manser and Brown 1980; McElroy and Horney 1981; Lundberg and Pollak 1993) and collective models (Chiappori 1988, 1992, 1997; Browning et al. 1994; Browning and Chiappori 1998). While the former incorporate in a household model elements of cooperative game theory (e.g., the dictatorial, Nash and Kalay-Smorodinsky solutions), the latter assume that intra-household solutions are Pareto efficient. The second alternative is based on competitive marriage market models, such as those of Becker (1981), Grossbard-Shechtman (1984), and Choo and Siow (2006), where the standard assumption is that prospective spouses, when they meet in the marriage market, can make binding agreements about allocations in marriage. All these models incorporate the issue that joint family decisions can be derived from the sometimes divergent interests of males and females.

Focusing on investments parents make in their children, we consider the model developed by Cigno (2012) as the underlying theory.³ According to this model, a couple decides in period 1 whether to have children and what resources will be expended on their children (money and time). Each partner is endowed with capital (e.g., money, property) and human capital (e.g., years of schooling, job experience) at the time of the union formation, which means that parental characteristics (endowments) have influence on the resources each parent allocates to formal and informal education, as a specific activity of childcare. Furthermore, as shown in the model, the legal framework also has an influence on intra-household resource allocation decisions, including the time devoted to educational childcare.⁴

On the other hand, we also find prior research showing that initial endowments of children, defined as genetically inherited characteristics that are predetermined prior to the human capital accumulation process and are

²The first approach was developed by Samuelson (1956) and Becker (1974, 1981), and it is known as the “common preference” or “unitary” approach, under which family behavior can be rationalized as the outcome of maximizing a single utility function. A full review of theoretical models of the household can be found in Molina (2012).

³In many models of household behavior, children are considered to be “household public goods” that require parents’ financial and time resources. Alternative models explaining parents’ investments are those of Konrad and Lommerud (2000) and Peters and Siow (2002).

⁴Other examples showing the effects of the legal framework on marital investments are those of Brinig and Crafton (1994), Chiappori et al. (2002), and Wickelgren (2009).

rewarded directly or indirectly in labor and marriage markets (Behrman 1997), may influence parents' investments in children, including education. The economic theory of intra-household resource allocation suggests that parental investment could compensate for (Becker and Tomes 1976) or reinforce (Behrman et al. 1982) initial differences in endowments. Although empirical evidence has been found in favor of parents compensating for differences in initial endowments of children (Griliches 1979), the bulk of the empirical evidence points toward parents reinforcing such differences (Behrman et al. 1982; Rosenzweig and Schultz 1982; Rosenzweig and Wolpin 1988; Pitt et al. 1990; Behrman et al. 1994; Ayalew 2005; Datar et al. 2010).

In sum, initial endowments of children, parental characteristics, and the legal framework all influence the investments parents make in their children, including the amount of formal and informal education each parent allocates to each child.

3 Data: the Multinational Time Use Study

For the analysis of the time devoted to childcare activities, we use the Multinational Time Use Survey (MTUS). The MTUS is an ex-post harmonized cross-time, cross-national, comparative time-use database, coordinated by the Centre for Time Use Research at the University of Oxford. It is constructed from national randomly sampled time-diary studies, with common series of background variables and total time spent in 69 activities (Gershuny 2009). The MTUS provides us with information on individual time use, based on diary questionnaires in which individuals report their activities throughout the 24 h of the day. The advantage of time-use surveys over stylized questions, such as those included in the European Community Household Panel (ECHP), the BHPS, or the SOEP, where respondents are asked how much time they have spent, for example, in the previous week, or normally spend each week, on market work or housework, is that diary-based estimates of time use are more reliable and accurate than estimates derived from direct questions (Juster and Stafford 1985; Robinson 1985; Bianchi et al. 2000; Bonke 2005; Yee-Kan 2008).⁵

We restrict our sample to opposite-sex couples where both members of the couple report information on their time allocation decisions, allowing us to analyze the time devoted to children by both parents. We select Spain (2002) and the UK (2000) for the analysis. The reason for limiting the analysis to these countries is that these surveys include time-use information about

⁵Information on the variables and on how to access the data is available on the MTUS website: <http://www.timeuse.org/mtus>. See Fisher et al. (2011) for a full description of the MTUS documentation. We use version W58, release 1 (accessed in October 2010). The MTUS has been widely used across the social sciences (Gershuny 2000; Gershuny and Sullivan 2003; Gauthier et al. 2004; Guryan et al. 2008; Gershuny 2009; Gimenez-Nadal and Sevilla-Sanz 2011, 2012).

all the household members aged 10 or older, while most other time-use surveys (the USA, the Netherlands, and Norway, for instance) include time-use information for only one member of the household.

We also restrict the sample to opposite-sex couples with at least one child under age 18, since, with the information included in the MTUS, we cannot distinguish, a priori, whether the time devoted to childcare refers to household children or to non-household children. For instance, it could be the case that the respondent reports devoting time to childcare activities, including travel related to childcare, but there are no children in the household. In this situation, we could assume that the individual goes to his/her child's home to help, or we could assume that the individual goes to his/her neighbor's home to care for the non-household child. Thus, the only assumption we can make is that childcare activities refer to household children. We achieve a final sample of 1,527 couples for the UK and 4,499 couples for Spain.

The MTUS includes 69 activities, defined as the "primary" or "main" activity individuals were doing at the time of the interview. Thus, we are able to add up the time devoted to any activity of reference (e.g., paid work, leisure, TV watching) as primary activity. It is important to acknowledge that, in this paper, we study the time devoted to caring for children as "active care" since we exclude those activities that involve accompanying other individuals of the household without being "actively" involved. For instance, some individuals may report reading or watching TV as a main activity, while they report taking care of their children as a secondary activity. While these activities may be considered as "secondary" or "passive" childcare, we consider only primary childcare in this paper.⁶

We consider three types of childcare activities: *basic childcare*, *educational childcare*, and *supervisory childcare*.⁷ Basic childcare is defined as the time spent on the basic needs of children, including breastfeeding, rocking a child to sleep, general feeding, changing diapers, providing medical care (either directly or indirectly), grooming, and so on.⁸ We identify basic childcare with the time devoted to the activity "physical/medical care of children (main28)" of the MTUS. Educational childcare is defined as the time spent teaching children, reading to/with children, talking with children, helping children with homework, attending meetings at a child's school, and similar activities, and we identify this type of childcare with the activities "teach/help with homework (main29)" and "read to, talk or play with children (main30)" of the MTUS.

⁶For a review of the different dimensions of childcare, see Budig and Folbre (2004), Folbre and Bittman (2004), Bianchi et al. (2006), Guryan et al. (2008), and Sevilla-Sanz et al. (2010).

⁷Although we follow Guryan et al. (2008) for the classification of the different types of childcare, we are limited by the classification of childcare activities in the MTUS. Thus, we are able to consider only three categories of childcare (we do not analyze "travel childcare"), and "educational" childcare and "supervise" childcare are slightly different than that in Guryan et al. (2008).

⁸As in Guryan et al. (2008), time spent preparing a child's meal is included in "food preparation/cooking" (main18) in the MTUS, a component of non-market production.

Supervisory childcare involves attending a child's sporting event or dance recital, going to the zoo with children, and taking walks with children, that is, supervising children during their daily activities, and we identify this type of childcare with the activity "supervise, accompany, other childcare (main31)" in the MTUS.

3.1 Parental time use: descriptive evidence

We begin our data exploration by documenting the total time spent in childcare activities by various subgroups defined by gender and employment status. Table 1 presents means of time spent in basic childcare, educational childcare, and supervisory childcare by different demographic subgroups for the UK and Spain, measured in hours per day. It also shows the total time spent in childcare measured as the sum of the time devoted to the three types of childcare, as well as the difference between the UK and Spain in the time devoted to the reference childcare activity by the reference group of population, with a positive value meaning that individuals of the reference group devote more time to the childcare activity in the UK compared to Spain. Finally, Table 1 shows the p value of the cross-country difference, with a p value lower than 0.05 indicating that the cross-country difference is statistically significant at the 95 % level.

The average time spent in childcare for all mothers is 1.40 and 1.41 h per day in the UK and Spain, respectively. This total time in childcare activities is dominated by time spent in basic childcare (0.92 and 1.05 h per day in the UK and Spain, respectively). For the time devoted to educational childcare, mothers in the UK and Spain devote 0.41 and 0.26 h per day to such activities, respectively. Mothers with at least one child under the age of five in the UK and Spain spend an average of 2.53 and 2.78 h per day in childcare, with 1.74 and 2.26 h of those hours devoted to basic childcare, and 0.71 and 0.42 h per day devoted to educational childcare, respectively.

Mothers spend roughly twice as much time in child care as do fathers, a pattern which holds true for all subgroups. Among all fathers with children, average childcare is 0.60 and 0.57 h per day in the UK and Spain, respectively, compared to 1.40 and 1.41 h per day for mothers, respectively. For both, basic childcare consumes the largest amount of time spent in childcare, but fathers spend proportionately more of their childcare time in educational childcare.⁹

These patterns cannot be fully explained by the belief that fathers tend to specialize in market production and mothers tend to specialize in home production, because a gender gap persists within groups of working parents.

⁹Connelly and Kimmel (2010) found similar results for the USA using the American Time Use Survey. Hence, it seems that this pattern is replicated in other developed countries, and more research on this issue is needed. For instance, an interesting research question would be the underlying preferences for this empirical fact.

Table 1 Hours per day spent in childcare by various subgroups in the UK and Spain

	Basic childcare			Educational childcare			Supervisory childcare			Total childcare		
	The UK	Spain	Diff UK-Spain	The UK	Spain	Diff UK-Spain	The UK	Spain	Diff UK-Spain	The UK	Spain	Diff UK-Spain
All fathers (N total = 6,294)	0.32 (0.02)	0.31 (0.01)	0.02 (0.08)	0.25 (0.02)	0.22 (0.01)	0.03 (0.01)	0.03 (0.01)	0.04 (0.00)	-0.01 (0.11)	0.60 (0.03)	0.57 (0.02)	0.04 (0.02)
All mothers (N total = 6,294)	0.92 (0.04)	1.05 (0.02)	-0.14 (0.01)	0.41 (0.02)	0.26 (0.01)	0.15 (0.01)	0.07 (0.01)	0.09 (0.01)	-0.03 (0.15)	1.40 (0.05)	1.41 (0.03)	-0.01 (0.08)
Full-time working fathers	0.30 (0.02)	0.31 (0.01)	-0.01 (0.24)	0.24 (0.02)	0.22 (0.01)	0.02 (0.01)	0.03 (0.01)	0.04 (0.00)	-0.01 (0.08)	0.56 (0.03)	0.56 (0.02)	0.00 (0.02)
Full-time working mothers	0.57 (0.02)	0.80 (0.01)	-0.23 (0.94)	0.23 (0.02)	0.23 (0.01)	0.00 (0.01)	0.04 (0.01)	0.09 (0.00)	-0.04 (0.08)	0.85 (0.07)	1.12 (0.04)	-0.27 (0.08)
Non-full-time working fathers	0.53 (0.06)	0.33 (0.03)	0.20 (0.07)	0.33 (0.03)	0.24 (0.01)	0.08 (0.21)	0.03 (0.01)	0.04 (0.01)	-0.01 (0.13)	0.88 (0.13)	0.62 (0.08)	0.27 (0.08)
Non-full-time working mothers	1.05 (0.10)	1.23 (0.05)	-0.18 (0.06)	0.49 (0.06)	0.29 (0.04)	0.20 (0.04)	0.07 (0.01)	0.10 (0.01)	-0.02 (0.08)	1.61 (0.13)	1.61 (0.08)	0.00 (0.08)
Fathers with children under 5	0.65 (0.04)	0.69 (0.03)	-0.04 (0.44)	0.41 (0.03)	0.40 (0.01)	0.01 (0.70)	0.02 (0.01)	0.04 (0.01)	-0.02 (0.01)	1.09 (0.06)	1.14 (0.04)	-0.05 (0.49)
Mothers with children under 5	1.74 (0.05)	2.26 (0.03)	-0.52 (0.03)	0.71 (0.03)	0.42 (0.02)	0.29 (0.02)	0.08 (0.01)	0.11 (0.01)	-0.03 (0.06)	2.53 (0.06)	2.78 (0.03)	-0.26 (0.01)
(N total = 2,299)	0.07 (0.04)	0.04 (0.02)	0.03 (0.04)	0.04 (0.04)	0.02 (0.02)	0.02 (0.02)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.09 (0.09)	0.05 (0.05)	0.00 (0.05)

This table presents means of time spent in childcare activities by different demographic subgroups in the UK Time Use Survey (2000) and the Spanish Time Use Survey (2002). All time use measures are expressed in units of hours per day. Samples include all individuals living in a couple (married or cohabiting) with at least one child under the age of 18. Basic childcare includes the time devoted to “physical/medical care of children (main28)” of the MTUS. Educational childcare includes the activities “teach/help with homework (main29);” and “read to, talk or play with children (main30)” of the MTUS. Supervisory childcare includes the activity “supervise, accompany, other childcare (main31)” of the MTUS. Survey weights are used to represent each day of the week equally within subgroups. Diff UK-Spain measures the difference between the mean time devoted to the reference activity in the UK and Spain, with positive values meaning more time devoted to the activity in the UK. P value of the difference in parenthesis, with a p value lower than 0.05 indicating that the difference is statistically significant at the 95 % level

Full-time working mothers devote an average of 0.85 and 1.12 h per day to childcare activities in the UK and Spain, respectively, compared to 0.56 h per day among full-time working fathers in both countries. It is still the case that basic childcare consumes the largest amount of time spent in childcare by working parents, but working fathers do spend proportionately more of their childcare time in educational childcare. Non-full-time working mothers spend on average 0.76 and 0.49 more hours per day in childcare than their working counterparts in the UK and Spain, respectively. This difference is spread across basic childcare and educational childcare for the UK, while it is concentrated in basic childcare in the case of Spain.

Considering cross-country differences in the time devoted to the different types of activities, we observe that the time devoted by fathers to childcare activities in the UK and Spain is similar, since the differences are not statistically significant at standard levels. However, such variations are statistically significant in the case of mothers; while mothers in the UK devote 0.92, 0.41, and 0.07 h per day to basic, educational, and supervisory childcare, mothers in Spain devote 1.05, 0.26, and 0.09 h per day to these activities, respectively. As a result, mothers in the UK devote 0.14 and 0.03 fewer hours per day to basic and supervisory childcare, while they devote 0.15 more hours per day to educational childcare, compared to mothers in Spain. In the case of (full-time) working parents, we observe that, again, there are no differences between the UK and Spain for working fathers, given that the variations are not statistically significant. However, we find that working mothers devote 0.23 fewer hours per day to basic childcare, which leads to the finding that working mothers in the UK devote 0.27 fewer hours per day to total childcare compared to Spanish mothers, with such differences being statistically significant at standard levels.

For non-full-time working parents, we observe statistically significant differences, especially for mothers. Non-full-time working fathers in the UK devote 0.20 more hours to basic childcare compared to their Spanish counterparts, although this is not statistically significant at standard levels. However, in the case of mothers, we find that, compared to non-full-time working mothers in Spain, their counterparts in the UK devote 0.18 fewer hours per day to basic childcare, and 0.20 more hours per day to educational childcare, despite that there are no differences in the time devoted to total childcare across countries. Finally, restricting the analysis to parents with at least one child under age five, we observe that, for fathers, the differences are concentrated in the time devoted to supervisory childcare (e.g., fathers in the UK devote 0.02 fewer hours per day compared to Spanish fathers), while mothers in the UK devote 0.52 fewer hours and 0.29 more hours per day to basic and educational childcare, respectively, compared to their Spanish counterparts. These differences are statistically significant at standard levels.

In sum, while we do not find clear differences between fathers in the UK and Spain in the time devoted to the three types of childcare, we do find clear differences in the case of mothers: while mothers in the UK devote less time to basic childcare, they devote more time to educational childcare, compared to their Spanish counterparts, and such differences are consistent for the different

groups of population. This can be due to several factors. First, the two countries have different welfare systems. As argued by Gálvez-Muñoz et al. (2011), while the UK is classified in the group of countries with liberal systems, where state interventions are clearly subordinate to market mechanisms, Spain is included in the group of Mediterranean countries with a strong “familialism,” defined by the maintenance of intergenerational solidarity, weak institutional support for families, a dual labor market model, and limited female access to the labor market.

As a result, policies regarding the availability of public childcare services differ between the two countries, which may influence how mothers distribute their time across the different types of childcare. For instance, Boeri and Van Ours (2008) show that, at the time of the surveys, the percentage of children under age three using formal childcare facilities is 34 % in the UK and 5 % in Spain, indicating a significant difference in the availability of childcare services between the two countries. Given that children under age three are the most in need of basic childcare (e.g., breastfeeding, changing diapers, etc.), this could explain the differences between the two countries in the time devoted to basic childcare. In this vein, female labor force participation rates are lower in Spain than in the UK (Boeri and Van Ours 2008; Gálvez-Muñoz et al. 2011), which may be consistent with the idea that some Spanish mothers do not participate in the labor market because they cannot find public child care services for their infants, while prices of private childcare services are high (Borra 2010).

Second, the percentage of women with one or more children having part-time employment is very low in Spain, compared to that in the UK (Boeri and van Ours 2008), due to the inflexibility of the Spanish labor market (Fernández-Kranz and Rodríguez-Planas 2011), together with the fact that Spain has a split work schedule, typically consisting of 4–5 h of work in the morning, followed by a 2-h break, and another 3–4 h of work in the afternoon (see Fig. 1 in Gimenez-Nadal et al. 2010). Thus, many full-time working mothers are working during the evening when their children return home from school. However, in the case of the UK, most full-time working mothers have standard working schedules from 8:00/9:00 a.m. to 5:00/6:00 p.m. (EWCO 2010). This may affect the time that mothers devote to educational childcare. Rapoport and Le Bourdais (2007) show that hours worked in the evening have a negative effect on parents’ childcare time, while Connelly and Kimmel (2010) show that employed mothers in the USA with children under age 13 who work any nonstandard hours (hours outside the 8:00 a.m. to 6:00 p.m. range) record 31 fewer minutes of caregiving on the diary day.

Third, during the period of study, mothers in the UK had a slightly higher level of education compared to their Spanish counterparts, and, given the previously reported positive gradient between education and educational childcare time (Guryan et al. 2008), we can explain why mothers in the UK spend more time in educational childcare. By the year 2001, 27.7 % of women aged between 25 and 65 years of age had a university level of education, while this proportion is 23.2 % in the case of Spain, a 5-percentage-point difference.

3.2 Differences by education

Parents with different education levels spend substantially different amounts of time in educational childcare and in the other childcare activities in the case of Spain. Table 2 presents means of the time spent in basic, educational, and supervisory childcare by educational attainment, for the UK (panel A) and Spain (panel B). For each country and gender, we compare the time

Table 2 Hours per day spent in childcare activities by educational attainment

	Basic childcare	Educational childcare	Supervisory childcare
Panel A: the UK			
Fathers			
Primary education	0.34	0.24	0.03
Secondary education	0.32	0.27	0.03
University education	0.35	0.23	0.03
Difference university education-primary education	0.01	-0.01	0.00
<i>p</i> value difference	(0.86)	(0.88)	(0.83)
Mothers			
Primary education	0.88	0.34	0.07
Secondary education	0.94	0.42	0.05
University education	0.91	0.48	0.08
Difference university education-primary education	0.04	0.14	0.01
<i>p</i> value difference	(0.66)	(0.00)	(0.41)
Panel B: Spain			
Fathers			
Primary education	0.15	0.13	0.02
Secondary education	0.28	0.21	0.03
University education	0.50	0.30	0.06
Difference university education-primary education	0.35	0.17	0.04
<i>p</i> value difference	(0.00)	(0.00)	(0.00)
Mothers			
Primary education	0.75	0.14	0.05
Secondary education	0.96	0.23	0.10
University education	1.36	0.38	0.09
Difference university education-primary education	0.61	0.24	0.04
<i>p</i> value difference	(0.00)	(0.00)	(0.03)

This table presents means of time spent in childcare activities by different demographic subgroups in the UK Time Use Survey (2000) and the Spanish Time Use Survey (2002). All time use measures are expressed in units of hours per day. Samples include all individuals living in a couple (married or cohabiting) with at least one child under the age of 18. Basic childcare includes the time devoted to “physical/medical care of children (main28)” of the MTUS. Educational childcare includes the activities “teach/help with homework (main29),” and “read to, talk or play with children (main30)” of the MTUS. Supervisory childcare includes the activity “supervise, accompany, other childcare (main31)” of the MTUS. Survey weights are used to represent each day of the week equally within subgroups. Difference university education-primary education indicates the difference between highly and low-educated individuals in the time devoted to each childcare activity ($T_h - T_l$), where T_h and T_l refer to the time devoted to the childcare category by highly and low-educated individuals, respectively. *p* value difference indicates whether the difference is statistically different from zero

devoted to the reference childcare category by low (less than high school diploma) and highly educated (more than high school diploma) individuals, testing whether such variation is statistically significant. In the case of the UK, we observe no statistically significant differences in the time devoted to basic, educational, and supervisory childcare of fathers. For mothers, the only statistically significant difference is found in the time devoted to educational childcare, where highly educated mothers devote 0.14 more hours per day to such activities.

In the case of Spain, we find that both highly educated fathers and mothers devote more time to basic, educational and supervisory childcare than their low-educated counterparts, with such differences being statistically significant at the 95 % level. Highly educated fathers devote 0.35, 0.17, and 0.04 more hours per day to basic, educational and supervisory childcare, respectively, than their low-educated counterparts, while highly educated mothers devote 0.61, 0.24, and 0.04 more hours per day to basic, educational, and supervisory childcare, respectively, than their low-educated counterparts.

In summary, we find that there remains a large gender gap in childcare activities favoring fathers—fathers do less childcare than mothers—in the UK and Spain, concentrating on basic childcare, although fathers devote a disproportionate amount of their childcare time to educational childcare. This holds true independently of their employment status, which goes against the belief that fathers tend to specialize in market production and mothers tend to specialize in home production. Additionally, we find that highly educated mothers devote more time to childcare activities than their low-educated counterparts, in both the UK and Spain, which is consistent with results in existing studies such as those of Gauthier et al. (2004), Aguiar and Hurst (2007), and Guryan et al. (2008). However, we do find differences between these two countries, and while differences in childcare activities in the UK are explained mainly by differences in educational childcare, differences in Spain are explained by differences in basic, educational, and supervisory childcare. To what extent such difference between the two countries is explained by differences in the provision of public childcare services, on the one hand, or by the mothers' preferences, on the other, is worthy of analysis.¹⁰ Finally, we also find a positive gradient between fathers' education and childcare time in Spain, which is consistent with the evidence found in the USA (Aguiar and Hurst 2007).

¹⁰Only 2 % of childcare slots for children up to age three in Spain are publicly funded, with the lowest percentage in Europe (Carrasco and Rodriguez 2000). The Spanish institutional context improved somewhat in recent years with the implementation of certain family-friendly policies and, although the portion of GDP devoted by the government to gender equality policies has increased from 0.5 % in 1998 to 1.1 % in 2005, this is still the lowest in the European Union (EUROSTAT 2012). Such policies, at the time of the survey, included the “baby-check” (2,500 €), and the Spanish law *Ley para la igualdad efectiva de hombres y mujeres* 2007/3.

4 Empirical strategy and variables

We now analyze the time devoted to basic, educational, and supervisory childcare, aiming to explore factors influencing the time parents devote to their children. In this analysis, failing to account for joint household decisions and joint provision of childcare would affect the interpretation of the results, and thus we must consider that the time one parent spends in childcare activities may serve as a substitute for the time the other parent spends in the same activities. However, we cannot use either the individual's or partner's time in any specific childcare activity as an explanatory variable since it would lead to endogeneity problems. Thus, we estimate a SUR system on the time devoted to basic, educational, and supervisory childcare by both members of the couple (six equations), and where it seems more appropriate to estimate Tobit (Tobin 1958) regressions, given that time use is a non-negative dependent variable.¹¹

Although we estimate tobit models, there is some controversy regarding the selection of alternatives, as is the case of ordinary least squares (OLS) models. According to Stewart (2009), OLS models are preferred for use in the analysis of time allocation decisions, since the zeros in time-use data arise from a mismatch between the reference period of the data (the diary day) and the period of interest. As a result, the tobit model generates biased estimates in certain circumstances, while OLS models generate unbiased estimates in all situations. Foster and Kalenkoski (2013) compare the use of tobit and OLS models in the analysis of the time devoted to childcare activities and find that the qualitative conclusions are similar for the two estimation methods, although there are certain differences in the magnitudes and statistical significance of the estimates. We have alternatively estimated OLS models, where we maintain the correlation structure of the residuals, and we obtain consistent results. Although we obtain few differences in the significance of some coefficients, our qualitative conclusions are the same, in line with the findings of Foster and Kalenkoski (2013). Results are available upon request.

The statistical model is as follows. For a given household "i", let T_{bfi} , T_{efi} , and T_{sfi} represent the daily hours that the father reports performing basic, educational, and supervisory childcare, let T_{bmi} , T_{emi} , and T_{smi} represent the daily hours that the mother reports performing basic, educational, and supervisory childcare, let X_i be a vector of household and parents' characteristics, and let ε_{bfi} , ε_{efi} , ε_{sfi} , ε_{bmi} , ε_{emi} , and ε_{smi} be random variables that represent unmeasured factors. We suppose that there are latent variables (T_{bj}^* , T_{ej}^* , T_{sj}^* , for $j = m, f$) that linearly depend on X_i via a parameter (vector) β that determines the relationship between the independent vector X_i , on the one hand, and T_{bj}^* , T_{ej}^* , and T_{sj}^* , on the other. The observable variable (T_{bj} , T_{ej} ,

¹¹Examples of studies estimating SUR systems are those of Kalenkoski et al. (2005), Kimmel and Connelly (2007), Connelly and Kimmel (2009), and Gimenez-Nadal et al. (2010).

T_{sji} for $j = m, f$) is defined as being equal to the latent variable whenever the latent variable is above zero, and “0” otherwise:

$$T_{bji} = \begin{cases} T_{bji}^* & \text{if } T_{bji}^* > 0 \\ 0 & \text{if } T_{bji}^* \leq 0 \end{cases} \quad \text{where } T_{bji}^* = \beta X_i + \varepsilon_{bij}, \varepsilon_{bij} \sim N(0, \sigma^2) \quad (1)$$

$$T_{eji} = \begin{cases} T_{eji}^* & \text{if } T_{eji}^* > 0 \\ 0 & \text{if } T_{eji}^* \leq 0 \end{cases} \quad \text{where } T_{eji}^* = \beta X_i + \varepsilon_{eij}, \varepsilon_{eij} \sim N(0, \sigma^2) \quad (2)$$

$$T_{sji} = \begin{cases} T_{sji}^* & \text{if } T_{sji}^* > 0 \\ 0 & \text{if } T_{sji}^* \leq 0 \end{cases} \quad \text{where } T_{sji}^* = \beta X_i + \varepsilon_{sij}, \varepsilon_{sij} \sim N(0, \sigma^2) \quad (3)$$

for $j = m, f$. We allow for correlations at the household level in the unobserved determinants of the activities by allowing the error terms to be jointly normally distributed, with no restrictions on the correlation. This specification accounts for the time constraint that may require individuals to spend more time on one childcare activity and, therefore, less time on another, and that the time one parent spends on childcare may serve as a substitute for the time the other spends on the same childcare activities. We additionally assume that the error components are independent across households:

$$\begin{pmatrix} \varepsilon_{bf} \\ \varepsilon_{ef} \\ \varepsilon_{sf} \\ \varepsilon_{bm} \\ \varepsilon_{em} \\ \varepsilon_{bm} \end{pmatrix} \sim N \left(\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_{bf}^2 & \rho_{bfe f} \sigma_{bf} \sigma_{ef} & \rho_{bfs f} \sigma_{bf} \sigma_{sf} & \rho_{bfb m} \sigma_{bf} \sigma_{bm} & \rho_{bfe m} \sigma_{bf} \sigma_{em} & \rho_{bfs m} \sigma_{bf} \sigma_{sm} \\ \rho_{efbf} \sigma_{ef} \sigma_{bf} & \sigma_{ef}^2 & \rho_{efsf} \sigma_{ef} \sigma_{sf} & \rho_{efbm} \sigma_{ef} \sigma_{bm} & \rho_{efem} \sigma_{ef} \sigma_{em} & \rho_{efsm} \sigma_{ef} \sigma_{sm} \\ \rho_{sfbf} \sigma_{sf} \sigma_{bf} & \rho_{sfef} \sigma_{sf} \sigma_{ef} & \sigma_{sf}^2 & \rho_{sfbm} \sigma_{sf} \sigma_{bm} & \rho_{sfem} \sigma_{sf} \sigma_{em} & \rho_{sfs m} \sigma_{sf} \sigma_{sm} \\ \rho_{bmbf} \sigma_{bm} \sigma_{bf} & \rho_{bme f} \sigma_{bm} \sigma_{ef} & \rho_{bms f} \sigma_{bm} \sigma_{sf} & \sigma_{bm}^2 & \rho_{bmem} \sigma_{bm} \sigma_{em} & \rho_{bms m} \sigma_{bm} \sigma_{sm} \\ \rho_{embf} \sigma_{em} \sigma_{bf} & \rho_{eme f} \sigma_{em} \sigma_{ef} & \rho_{ems f} \sigma_{em} \sigma_{sf} & \rho_{embm} \sigma_{em} \sigma_{bm} & \sigma_{em}^2 & \rho_{emsm} \sigma_{em} \sigma_{sm} \\ \rho_{smbf} \sigma_{sm} \sigma_{bf} & \rho_{sme f} \sigma_{sm} \sigma_{ef} & \rho_{sms f} \sigma_{sm} \sigma_{sf} & \rho_{smbm} \sigma_{sm} \sigma_{bm} & \rho_{smem} \sigma_{sm} \sigma_{em} & \sigma_{sm}^2 \end{pmatrix} \right)$$

The X_i include standard partner and household characteristics (e.g., Hallberg and Klevmarken 2003; Kalenkoski et al. 2005, 2009; Kimmel and Connelly 2007; Connelly and Kimmel 2009; Gimenez-Nadal et al. 2010), such as father’s and mother’s age (and its square) and father’s and mother’s education, log of relative predicted wages of the partners (and its square), non-labor income, whether the youngest child in the household is under age five, or between 5 and 12 years, the number of household members, whether the father has good health or any disability (in the regressions of father’s childcare time), whether the mother has good health or any disability (in the regressions of mother’s childcare time), and whether the father/mother works in the labor market (full-time or part-time).¹² We have also included partner’s health and disability in the regressions as a robustness check, and results are consistent

¹²In this paper, we consider that labor participation decisions are exogenously given, despite existing evidence showing the endogenous relationship between childcare and labor participation decisions (e.g., Connelly 1992; del Boca 2002; Schøne 2004; del Boca et al. 2005; Kornstad and Thoresen 2007). Since we are simultaneously estimating six equations, we do not have sufficient variables in the dataset that can be used as instruments for labor participation decisions.

to the inclusion of these variables (results are available upon request). To the extent that partner's health and disability are not statistically significant overall, we rely on estimates that do not include these variables.

Regarding the educational level of the parents, there are three harmonized educational levels in the MTUS ("uncompleted secondary or less," "completed secondary," and "above secondary education"). We consider that parents have "primary education" if they are coded as having "uncompleted secondary or less," parents have "secondary education" if they are coded as having "completed secondary," and parents have "university education" if they are coded as "above secondary education." In our model, we consider husband's primary education and wife's primary education as our reference levels.

We also include predicted wages of the parents. The education of each partner likely has the greatest influence on the opportunity cost of time, but we include partners' predicted wages in order to control for differences in preferences, or in productivity, in the production of childcare between educational levels.¹³ For instance, higher-educated parents have a higher potential wage and a higher opportunity cost of time. To the extent that children are time-intensive, higher-educated parents who choose to have children may choose to have fewer children (the quality versus quantity argument, Becker and Lewis 1973) and spend more time with those they have (hence enhancing quality). The decision to have children may "select" parents differently, depending upon their opportunity cost of time. Hence, we include parents' wages as the relative wage of mothers versus the fathers' wages (using the mother's wage divided by the father's wage) as in Pollak (2005), which permits interpretation of the effect of changes in relative wage as a change in one's own "power" within the couple. *Ceteris paribus*, the greater the power that the mother exerts in household decision-making, the more sharing of unpaid household production time within couples is expected. However, the effects on caregiving time are theoretically ambiguous.

Hence, we define the partners' hourly wage ratio, defined as the log of the ratio of the mothers and fathers' predicted wages ($\text{Relative wage}_i = \log\left(\frac{\text{wife's predicted wage}_i}{\text{husband's predicted wage}_i}\right)$), where we sum the value "1" to the ratio in order to have all values for all couples, including those couples where the original ratio equals "0" or is negative.¹⁴ We include the squared term to allow for non-linear effects. We calculate predicted wages using samples of couples in the UK and Spain from the last wave of the ECHP survey, and the Heckman (1979) technique. The variables included in the employment and hourly wage

¹³Since Becker (1965), it has been assumed that the wage is the opportunity cost of the time devoted to household production. Accordingly, there is a large empirical literature on time use examining the impact of wages and income on time allocation, including Kalenkoski et al. (2005), Kimmel and Connelly (2007), Connelly and Kimmel (2009), and Bloemen et al. (2009).

¹⁴The minimum value of the original ratio is more than "−1", so we always have positive values of the transformed ratio, which holds real values of the logarithm for all couples.

equations are presented in [Appendix A in the Online Supplementary Material](#). We bootstrap the standard errors in order to obtain corrected robust standard errors.

The need for different kinds of childcare (basic, educational, and supervisory) is quite different at different ages. Infants require more basic childcare while those of school age require more educational childcare. Thus, controls for the composition of the household must be included. However, the surveys for the UK and Spain do not allow us to know the exact number of children in each age range, and thus the current specification only contains an indicator for the age of the youngest child. Given that we select couples with at least one child under age 18, the reference category is that the youngest child is between 13 and 17 years old, compared to couples where the youngest child is under age five, or between 5 and 12 years old. We also include the number of household members since, in households with more adults, some of them can take care of the children (e.g., grandparents, siblings etc.), allowing the parents to devote less time to childcare activities.

We control for non-labor income of the household since it is likely related to time use. Kalenkoski et al. (2005) find that the presence of any household income has a negative association with the time devoted to active childcare by mothers in the USA. Additional non-labor income may free up the mother to do more of the home production and caregiving (Kimmel and Connolly 2007), given that the relative price of childcare services decreases when there is additional non-labor income, which does not depend on the labor market participation of the mother. However, there is no direct information on non-labor income in the surveys. To compute the non-labor income for both the UK and Spain, we use the information on labor income of both members of the couple, on the one hand, and the total household income, on the other. In both surveys, personal labor income and household income are measured in earning intervals, and, for each survey, we first express personal labor income and household income by the mid-point of each interval.¹⁵ We then subtract from the total household income (defined by the mid-point of the interval) the sum of the labor income of the two members of the couple (also defined by the mid-point of the interval). If the difference is positive, we take the given value, while if the difference is null or negative, we set non-labor income to “0”.

Kalenkoski et al. (2005) find that, if women have any health limitation, they devote less time to the labor market, while Gimenez-Nadal et al. (2012a) find that health status has no effects on the time devoted to the labor market and childcare activities in the case of self-employed mothers. We include dummy variables to control for the health status of the respondent (fathers' health for fathers' time-use regressions, mothers' health for mothers' time-use regressions), with three dummy variables indicating whether the respondent

¹⁵See the readme files of each survey included in the web page of the Center for Time Use Research, CTUR (<http://www.timeuse.org>), to see what values are considered as earnings interval limits.

reports having a very good, good, or fair health compared to the reference health status of poor health. We also control for whether the respondent has any disability or long-term limiting health condition since disabilities may prevent individuals carrying out their daily activities, including childcare activities.

Finally, we control for the employment status of individuals. As has been shown in Table 1, non-full-time working mothers devote more time to childcare activities than their full-time working counterparts in both the UK and Spain, with such differences being spread across basic childcare and educational childcare for the UK, while being concentrated in basic childcare in the case of Spain. Thus, it seems that employment status is, at least for mothers, an important factor explaining the time devoted to childcare activities, and we include the father and mother's employment status. However, we cannot control for employment status by using the time devoted to the labor market during the time of the interview since that would introduce endogeneity problems; that is to say, the partner's time devoted to childcare depends on the time devoted to the labor market during the same day. In order to overcome this problem, we include two dummy variables, one for each parent, to control for whether the individual participates in the labor market (either part- or full-time) or not.¹⁶

Table 3 shows means and standard deviations of the explanatory variables. For the UK, fathers and mothers are 39.25 and 36.72 years old on average, respectively; 27 % of fathers and mothers have university level of education; the log of hourly wage ratio is 0.91; 40 % of the households have at least one child under age five and 41 % of the household have at least one child between 5 and 12 years old; non-labor income is £24,389; 45 % of husbands and wives report having very good health; 12 and 15 % of fathers and mothers, respectively, have a disability; and 89 and 70 % of fathers and mothers, respectively, participate in the labor market. For Spain, fathers and mothers are 42.08 and 39.49 years old, respectively, on average; 27 and 25 % of fathers and mothers, respectively, have university level of education; the log of hourly wage ratio is 0.97; 35 % of the households have at least one child under age five and 40 % of the households have at least one child between 5 and 12 years old; non-labor income is 15,304 €; 27 and 26 % of fathers and mothers report having very good health; 2 and 1 % of fathers and mothers, respectively, have a disability; and 94 and 54 % of fathers and mothers, respectively, participate in the labor market.

¹⁶Despite that we operationalize individuals' labor force participation using full time/part-time/no time employment status, rather than using hours of employment that day, we have also run robustness checks by including hours of work in the SUR system. We have estimated a six-equation SUR system on the time devoted by both members of the couple to basic childcare, educational childcare, and market work, for both the UK and Spain. Compared to our main results for educational childcare time, alternative estimates, including the time devoted to the labor market, are robust and are available upon request.

Table 3 Demographic characteristics of the samples

	The UK	Spain
Father's age	39.25 (8.05)	42.08 (7.29)
Mother's age	36.72 (7.57)	39.49 (6.86)
Father's secondary education	0.43 (0.49)	0.57 (0.50)
Father's university education	0.27 (0.44)	0.27 (0.44)
Mother's secondary education	0.43 (0.50)	0.57 (0.50)
Mother's university education	0.27 (0.44)	0.25 (0.44)
Relative predicted wages	0.91 (0.07)	0.97 (0.10)
Younger child 0–4	0.40 (0.49)	0.35 (0.48)
Younger child 5–12	0.41 (0.49)	0.40 (0.49)
N. of household members	4.08 (1.03)	4.03 (0.95)
Non-labor income	24.39 (16.75)	15.30 (40.57)
Father's fair health	0.13 (0.34)	0.15 (0.36)
Father's good health	0.38 (0.49)	0.54 (0.50)
Father's very good health	0.45 (0.50)	0.27 (0.44)
Mother's fair health	0.13 (0.33)	0.15 (0.36)
Mother's good health	0.40 (0.49)	0.55 (0.50)
Mother's very good health	0.45 (0.50)	0.26 (0.44)
Father disabled	0.12 (0.32)	0.02 (0.13)
Mother disabled	0.15 (0.35)	0.01 (0.11)
Father working	0.89 (0.31)	0.94 (0.25)
Mother working	0.70 (0.46)	0.54 (0.50)
Observations	1,527	4,499

Standard deviations in parenthesis. This table presents means of demographic and household characteristics of the samples of the UK Time Use Survey (2000) and the Spanish Time Use Survey (2002). Samples include all individuals living in a couple (married or cohabiting) with at least one child under the age of 18. Survey weights are used to represent each day of the week equally within subgroups. Non-labor income is measured in thousands of £/€. Dummy variables must be interpreted in percentage points, by multiplying by 100

5 Results for parents' education

Table 4 shows the results of estimating the SUR model on the time devoted to basic, educational, and supervisory childcare by mothers and fathers in the UK. We first find very few factors associated with changes in the time devoted to basic childcare; only the presence of young children in the household, the disability of mothers, and the employment status of the parents are associated with changes in the time devoted to basic childcare, with these associations being statistically significant at the 95 % level. Neither parents' education nor relative hourly wages are associated with the time devoted to such activities.

Regarding the time devoted to educational childcare, we find more factors affecting the time devoted to such activities, including the mother's education, non-labor income, the mother's health status, and the number of family members. For the relationship between educational childcare and parents' education, we find that, on the one hand, the main associations come from mother's education on father's time, with fathers whose partners have secondary and university education devoting 0.286 and 0.525 more hours per day, respectively, to educational childcare. On the other hand, we find that

Table 4 SUR estimates on the time devoted to childcare in the UK

	(2)		(3)		(4)		(5)		(6)	
	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers
	Basic childcare									
Respondent's age	-0.081 (0.083)	-0.034 (0.053)	-0.077 (0.071)	0.003 (0.072)	-0.133 (0.051)	0.064 (0.301)	-0.195** (0.172)	0.215* (0.205)	-0.195** (0.172)	0.215* (0.205)
Respondent's age squared	0.070 (0.102)	0.006 (0.071)	0.070 (0.128)	-0.014 (0.087)	0.175 (0.068)	0.121 (0.108)	0.182 (0.283)	0.064 (0.197)	0.182 (0.283)	0.064 (0.197)
Father's secondary education	-0.253 (0.165)	-0.025 (0.253)	-0.162 (0.183)	0.206* (0.154)	0.121 (0.161)	0.182 (0.521)	0.064 (0.203)	0.182 (0.283)	0.064 (0.197)	0.182 (0.283)
Father's university education	-0.237 (0.181)	0.155 (0.183)	-0.487** (0.134)	0.187 (0.159)	-0.202 (0.113)	0.160 (0.548)	0.182 (0.203)	0.182 (0.283)	0.160 (0.298)	0.182 (0.283)
Mother's secondary education	0.049 (0.274)	-0.127 (0.198)	0.286* (0.198)	-0.047 (0.247)	0.141 (0.164)	0.160 (0.548)	-0.026 (0.203)	0.160 (0.298)	-0.026 (0.203)	0.160 (0.298)
Mother's university education	0.189 (0.274)	-0.012 (0.198)	0.525** (0.198)	0.143 (0.247)	0.479 (0.164)	0.160 (0.548)	0.160 (0.298)	0.160 (0.298)	0.160 (0.298)	0.160 (0.298)
Relative predicted wages	-4.233 (148.489)	0.336 (148.489)	-6.309** (92.845)	(3.189)	14.906 (2.032)	11.233 (12.180)	11.233 (12.180)	11.233 (12.180)	11.233 (12.180)	11.233 (12.180)
Relative predicted wages squared	161.571 (148.489)	-10.184 (92.845)	250.255* (130.104)	79.226 (130.104)	-1426.641 (89.113)	-931.585 (885.498)	-931.585 (885.498)	-931.585 (885.498)	-931.585 (885.498)	-931.585 (885.498)
Younger child 0-4	2.863*** (0.311)	2.562*** (0.200)	1.650*** (0.200)	1.514*** (0.228)	0.708* (0.157)	0.500** (0.398)	0.500** (0.252)	0.500** (0.252)	0.500** (0.252)	0.500** (0.252)
Younger child 5-12	1.710*** (0.269)	1.190*** (0.162)	1.086*** (0.162)	0.832*** (0.217)	0.971** (0.134)	0.629*** (0.381)	0.629*** (0.234)	0.629*** (0.234)	0.629*** (0.234)	0.629*** (0.234)
N. household members	-0.018 (0.054)	-0.011 (0.044)	-0.025 (0.044)	-0.119*** (0.050)	0.232** (0.041)	0.153** (0.105)	0.153** (0.073)	0.153** (0.073)	0.153** (0.073)	0.153** (0.073)
Non-labour income	0.004 (0.004)	0.001 (0.003)	0.007** (0.003)	0.004 (0.003)	-0.002 (0.003)	0.005 (0.008)	0.005 (0.005)	0.005 (0.005)	0.005 (0.005)	0.005 (0.005)

Table 4 (continued)

	(1)		(2)		(3)		(4)		(5)		(6)	
	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers
	Basic childcare											
Respondent's fair health	0.565 (0.437)	0.040 (0.377)	0.090 (0.391)	0.542** (0.254)	0.090 (0.391)	0.542** (0.254)	-0.040 (0.667)	0.223 (0.414)	-0.040 (0.667)	0.223 (0.414)	-0.040 (0.667)	0.223 (0.414)
Respondent's good health	0.593 (0.440)	0.197 (0.372)	-0.149 (0.398)	0.598** (0.244)	-0.149 (0.398)	0.598** (0.244)	-0.131 (0.708)	0.449 (0.401)	-0.131 (0.708)	0.449 (0.401)	-0.131 (0.708)	0.449 (0.401)
Respondent's very good health	0.552 (0.444)	0.208 (0.375)	-0.088 (0.400)	0.754*** (0.248)	-0.088 (0.400)	0.754*** (0.248)	0.289 (0.689)	0.516 (0.405)	0.289 (0.689)	0.516 (0.405)	0.289 (0.689)	0.516 (0.405)
Respondent disabled	0.041 (0.185)	0.330** (0.146)	0.236 (0.176)	0.327*** (0.110)	0.236 (0.176)	0.327*** (0.110)	0.649* (0.352)	0.299 (0.190)	0.649* (0.352)	0.299 (0.190)	0.649* (0.352)	0.299 (0.190)
Father working	-0.917*** (0.264)	0.411** (0.179)	-0.397* (0.210)	0.093 (0.144)	-0.397* (0.210)	0.093 (0.144)	0.135 (0.438)	0.188 (0.246)	0.135 (0.438)	0.188 (0.246)	0.135 (0.438)	0.188 (0.246)
Mother working	0.319*** (0.116)	-0.577*** (0.104)	0.098 (0.107)	-0.354*** (0.093)	0.098 (0.107)	-0.354*** (0.093)	0.177 (0.251)	0.114 (0.151)	0.177 (0.251)	0.114 (0.151)	0.177 (0.251)	0.114 (0.151)
Constant	1.157 (3.032)	-0.668 (1.594)	2.895 (2.726)	-1.250 (1.524)	2.895 (2.726)	-1.250 (1.524)	-7.978 (9.344)	-3.958 (4.411)	-7.978 (9.344)	-3.958 (4.411)	-7.978 (9.344)	-3.958 (4.411)
R-squared	0.169	0.290	0.114	0.159	0.114	0.159	0.024	0.027	0.024	0.027	0.024	0.027
Observations	1,527	1,527	1,527	1,527	1,527	1,527	1,527	1,527	1,527	1,527	1,527	1,527

Robust standard errors in parentheses. Sample includes all individuals from the UK living in a couple (married or cohabiting) with at least one child under the age of 18. Survey weights are used to represent each day of the week equally. We include day of the week dummies (ref. Sunday) to control for the day of the week

* $p = 0.90$; ** $p = 0.95$; *** $p = 0.99$

father's university education is associated with a decrease in the time devoted to educational childcare by fathers, with highly educated fathers devoting 0.487 fewer hours per day to such activities. In light of these results, it seems that highly educated fathers devote less time to educational childcare, but to the extent that there is positive assortative matching by education (Oppenheimer 1988; Mare 1991; Pencavel 1998; Lewis and Oppenheimer 2000; Blossfeld and Timm 2003), highly educated fathers match highly educated mothers, and we find that fathers with university education matching mothers with university education still devote 0.04 more hours per day to educational childcare, compared to fathers with less than high school matching mothers with less than high school.

Additionally, it seems that the educational component influencing the time devoted by fathers to educational childcare is mother's time, which is not influenced by the educational level of either parent. Table 5 shows the correlations between the time partners devote to the different childcare categories, and we find that educational childcare time of parents is positively related. Thus, on the one hand, we find that fathers in a couple with highly educated mothers devote more time to educational childcare and, on the other, we find a positive association between parents' time, indicating that the greater the time devoted by the father to educational childcare, the greater the time also devoted by the mother to educational childcare. Thus, we find that highly educated mothers devote more time to educational childcare, given that education increases the time devoted by fathers, and at the same time the complementarity between parents' time leads to mothers devoting more time to such activities. Hence, the increased time on educational childcare of the fathers is what influences the time devoted to educational childcare by mothers, while mother's education does not have a direct impact on mother's educational childcare time.¹⁷

For the time devoted to supervisory childcare, we find that only certain factors affect the time devoted to such activities, including the presence of younger children, the number of family members, and whether the respondent is disabled. Neither parents' education nor relative hourly wages are associated with the time devoted to such activities.

Table 6 shows the results of estimating the SUR model on the time devoted to basic, educational, and supervisory childcare by mothers and fathers in Spain. In general, we find that mothers' education influences the time devoted by the parents to basic and educational childcare. First, in the case of basic childcare, fathers' and mothers' university education is positively associated

¹⁷An alternative specification including the partner's childcare time as explanatory variable shows that the time parents devote to each childcare activity is complementary, in both the UK and Spain, since the time devoted to each childcare activity (basic, educational, and supervisory childcare) by the partner has a positive and statistically significant association with the time devoted by the respondent to the same childcare activity.

Table 5 Correlation matrix of residuals

		Father			Mother		
		Physical childcare	Educational childcare	Supervisory childcare	Physical childcare	Educational childcare	Supervisory childcare
Panel A: The UK							
Father	Physical childcare	1.000				–	–
	Educational childcare	0.196	1.000			–	–
	Supervisory childcare	0.019	–0.002	1.000		–	–
Mother	Physical childcare	0.121	0.033	0.002	1.000	–	–
	Educational childcare	–0.039	0.147	–0.030	0.163	1.000	
	Supervisory childcare	–0.018	0.037	0.157	0.008	–0.005	1.000
Panel B: Spain							
Father	Physical childcare	1.000				–	–
	Educational childcare	0.159	1.000			–	–
	Supervisory childcare	0.065	0.013	1.000		–	–
Mother	Physical childcare	0.194	0.044	0.015	1.000	–	–
	Educational childcare	0.028	0.224	–0.003	0.075	1.000	–
	Supervisory childcare	0.013	–0.004	0.377	0.016	0.025	1.0000

Correlation matrix of residuals obtained from Tables 4 and 6. Sample includes all individuals living in a couple (married or cohabiting) with at least one child under the age of 18. Survey weights are used to represent each day of the week equally

with the time devoted by them to such activities. Father's university education is associated with an increase in the time devoted to basic childcare of 0.396 h per day for fathers, while mother's university education is associated with an increase in the time devoted to basic childcare of 0.744 and 0.429 h per day for fathers and mothers, respectively.

Regarding the time devoted to educational childcare, we find that the main associations come from mother's education on fathers' and mothers' times, with fathers whose partners have secondary and tertiary education devoting 0.329 and 0.756 more hours per day, respectively, to educational childcare, and mother's with university education devoting 0.904 more hours per day to such activities. Thus, as for the UK, we find that mother's education is what matters in determining the time devoted to educational childcare by the couple, which is also reflected in the positive association between parents' educational childcare times, shown in Table 5. Thus, we find that highly educated mothers devote more time to educational childcare and that there are complementarities between the times parents devote to educational childcare.

Table 6 SUR estimates on the time devoted to childcare in Spain

	(2)		(3)		(4)		(5)		(6)	
	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers
	Basic childcare		Educational childcare		Supervisory childcare					
Respondent's age	0.024 (0.044)	0.091** (0.041)	0.025 (0.047)	0.132*** (0.043)	0.017 (0.071)	0.101 (0.063)	0.017 (0.081)	0.101 (0.079)	0.017 (0.071)	0.101 (0.063)
Respondent's age squared	-0.068 (0.055)	-0.187*** (0.052)	-0.060 (0.058)	-0.180*** (0.056)	-0.010 (0.081)	-0.150* (0.079)	-0.010 (0.081)	-0.150* (0.079)	-0.010 (0.081)	-0.150* (0.079)
Father's secondary education	0.073 (0.106)	0.019 (0.085)	0.043 (0.123)	-0.172* (0.094)	-0.052 (0.185)	-0.015 (0.141)	-0.052 (0.185)	-0.015 (0.141)	-0.052 (0.185)	-0.015 (0.141)
Father's university education	0.396*** (0.132)	0.125 (0.115)	0.160 (0.151)	-0.075 (0.125)	0.288 (0.235)	0.139 (0.187)	0.288 (0.235)	0.139 (0.187)	0.288 (0.235)	0.139 (0.187)
Mother's secondary education	0.391*** (0.113)	0.197** (0.090)	0.329** (0.129)	0.408*** (0.103)	0.307 (0.207)	0.218 (0.147)	0.307 (0.207)	0.218 (0.147)	0.307 (0.207)	0.218 (0.147)
Mother's university education	0.744*** (0.146)	0.429*** (0.128)	0.756*** (0.170)	0.904*** (0.143)	0.349 (0.278)	0.164 (0.213)	0.349 (0.278)	0.164 (0.213)	0.349 (0.278)	0.164 (0.213)
Relative predicted wages	0.046 (0.541)	0.370 (0.527)	-1.877*** (0.571)	-0.816 (0.547)	0.308 (1.094)	0.186 (0.864)	0.308 (1.094)	0.186 (0.864)	0.308 (1.094)	0.186 (0.864)
Relative predicted wages squared	2.235 (19.373)	-7.419 (18.010)	82.314*** (19.114)	32.117 (19.888)	-12.411 (38.880)	-10.870 (31.766)	-12.411 (38.880)	-10.870 (31.766)	-12.411 (38.880)	-10.870 (31.766)
Younger child 0-4	2.523*** (0.149)	3.389*** (0.106)	2.205*** (0.163)	1.813*** (0.124)	0.821*** (0.193)	1.050*** (0.170)	0.821*** (0.193)	1.050*** (0.170)	0.821*** (0.193)	1.050*** (0.170)
Younger child 5-12	1.355*** (0.130)	1.621*** (0.081)	1.506*** (0.152)	1.406*** (0.110)	0.820*** (0.177)	1.098*** (0.156)	0.820*** (0.177)	1.098*** (0.156)	0.820*** (0.177)	1.098*** (0.156)
N. household members	-0.048 (0.036)	0.003 (0.031)	-0.085* (0.048)	-0.070* (0.036)	-0.055 (0.082)	0.085 (0.074)	-0.055 (0.082)	0.085 (0.074)	-0.055 (0.082)	0.085 (0.074)
Non-labour income	-0.056*** (0.015)	-0.014 (0.012)	-0.038** (0.017)	-0.019 (0.013)	-0.007 (0.027)	-0.049** (0.022)	-0.007 (0.027)	-0.049** (0.022)	-0.007 (0.027)	-0.049** (0.022)

Table 6 (continued)

	(1)		(2)		(3)		(4)		(5)		(6)	
	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers
	Basic childcare											
Respondent's fair health	-0.372*	(0.221)	0.084	(0.184)	-0.164	(0.237)	0.300	(0.231)	0.012	(0.322)	-0.269	(0.317)
Respondent's good health	-0.341	(0.217)	0.093	(0.177)	0.016	(0.224)	0.339	(0.223)	0.198	(0.302)	-0.106	(0.300)
Respondent's very good health	-0.331	(0.221)	0.137	(0.181)	-0.120	(0.230)	0.230	(0.227)	0.119	(0.316)	-0.059	(0.305)
Respondent disabled	-0.358	(0.394)	-0.191	(0.308)	-1.267***	(0.470)	-0.214	(0.347)	-0.127	(0.448)	-0.647	(0.560)
Father working	-1.034***	(0.224)	(0.218)	(0.188)	-0.744***	(0.241)	(0.094)	(0.191)	(0.367)	(0.357)	(0.179)	(0.299)
Mother working	0.400***	(0.062)	-0.603***	(0.054)	(0.092)	(0.074)	-0.366***	(0.060)	0.349***	(0.117)	(0.102)	(0.093)
Constant	-1.467	(0.937)	-2.892	(0.821)	-1.536	(1.015)	-4.927***	(0.855)	-4.641***	(1.655)	-5.788***	(1.309)
R-squared	0.202		0.412		0.101		0.095		0.011		0.026	
Observations	4,499		4,499		4,499		4,499		4,499		4,499	

Robust standard errors in parentheses. Sample includes all individuals from Spain living in a couple (married or cohabiting) with at least one child under the age of 18. Survey weights are used to represent each day of the week equally. We include day of the week dummies (ref. Sunday) to control for the day of the week

* $p = 0.90$; ** $p = 0.95$; *** $p = 0.99$

In sum, we find that, at the couple level, the educational factor that influences the time devoted to childcare activities, especially regarding educational childcare, is mother's education, with couples with highly educated mothers devoting more time to such activities. However, we find differences at the country level, and while mother's education influences the time devoted to educational childcare only in the UK, mother's education influences the time devoted to basic and educational childcare in Spain.¹⁸ Such differences may be due to a variety of factors.

First, each country has different social norms regarding the gender distribution of childcare. Gimenez-Nadal et al. (2012b) find that Mediterranean countries have a more traditional gender distribution of childcare time, compared to other European countries, which implies that the gender gap in childcare time favoring mothers is greater in Spain compared to the UK (Gálvez-Muñoz et al. 2011). Such differences in the gender distribution of childcare may make childcare time in Spain more reactive to changes in demographic characteristics of the mother, such as education, given that the relative weight of mothers' childcare compared to fathers' relative weight is greater in Spain (i.e., the share of childcare, defined as the time devoted to childcare by the father divided by the time devoted by the mother).

Second, the two countries have different welfare systems (Esping-Andersen 1990; Gálvez-Muñoz et al. 2011), which contribute to differences in policies for reconciliation of work and family life (Boeri and Van Ours 2008). The availability of public childcare services differs, with Spain having much less public childcare service available. Bettio and Plantenga (2004), examining only care-giving tasks and using data from the third wave of the ECHP, year 1996, group EU countries according to childcare provisions (both formal and informal) based on information from social childcare services, leave arrangements, and financial provisions (see their Table 3). The first group includes the Mediterranean countries (Spain, Italy, and Greece), which seem to delegate all the management of childcare to the family. These countries are characterized by a high index of informal care, with formal childcare arrangements being quite underdeveloped (see also Trifiletti 1999). However, the Anglo-Saxon countries are characterized by fairly extended collective agreements, growing

¹⁸The larger sample size in Spain may be driving greater statistical significance for regressions coefficients, leading to different results between countries. For this reason, we have estimated for the Spanish sample as if we had the same number of observations as in the British sample. To that end, we have built a random variable (uniform distribution) with values from 0 to 1, and sorted Spanish couples according to this value. Then, we have chosen the 1,527 couples with the lowest values of the random variable. The only difference with our main estimation is the association between mother's secondary education and the time devoted to *basic* and *educational childcare* by fathers, and *basic childcare* by mothers, that turns out to be non-statistically significant. To the extent that our conclusions are similar for Spain if we restrict the sample to the same number of observations as in the sample of the United Kingdom, we confirm that differences in results are due to differences between the countries, and not to different sample sizes.

in number, through which private care is publicly facilitated, although these arrangements do not substitute fully for informal childcare.

This distinction leads to Spanish parents relying more on own hours of childcare to raise each child, compared to parents in the UK, and hence the time devoted to childcare by each parent in Spain is more dependent on the other parent's childcare time. If we divide the hours parents devote to total childcare by the total fertility rate at the time of the surveys, we find that parents in Spain devote more time to childcare per child than parents in the UK. Considering total fertility rates for Spain and the UK at the time of the survey (e.g., 1.26 and 1.64 children in Spain and the UK, respectively, see EUROSTAT 2012), we observe that, overall, mothers and fathers in Spain devote 1.12 and 0.45 h per day to each child, while mothers and fathers in the UK devote 0.70 and 0.37 h per day to each child, respectively. In fact, looking at the correlation matrix of residuals, we observe that estimated correlations between basic, educational and supervisory childcare of parents are greater in Spain than in the UK (0.12 and 0.19 in the UK and Spain for basic childcare, 0.15 and 0.22 in the UK and Spain for educational childcare, and 0.16 and 0.38 in the UK and Spain for supervisory childcare, respectively). This would help to explain why mother's education has a greater effect on childcare time of couples in Spain compared to that in the UK.

Finally, we find it interesting that, for both the UK and Spain, there is a negative and positive statistically significant coefficient for the log of wage ratio and its square, respectively, on the time devoted by fathers to educational childcare, representing a u-shaped effect of mothers' power on the time devoted by fathers to educational childcare. The interpretation could be that, as mothers' power within the couple increases, the couple could be more likely to outsource educational childcare tasks, decreasing the time fathers devote to those activities. However, this effect turns to positive at some point, indicating that, as mothers' economic power increases, fathers may be liberated from their labor market responsibilities (e.g., fathers do not need to work so many hours in the labor market), and thus they are able to devote more time to their children, including educational tasks. On the other hand, we find no effect of women's relative power on their time devoted to educational childcare, consistent in the case of Spain with Sevilla-Sanz et al. (2010), who find that the time devoted to childcare by mothers is not affected by the relative earnings of the couple (see Table 8 in Sevilla-Sanz et al. 2010, pp. 166–167).

6 Conclusions

This paper studies the factors influencing parents' time devoted to childcare activities. To that end, we use time-use data from two European countries included in the Multinational Time Use Study, Spain (2002) and the UK (2000). We analyze the time that opposite-sex couples with children under 18 devote to three types of childcare: basic childcare, educational childcare, and

supervisory childcare. In our discussion, we focus on the relationship between parents' education and the time devoted to educational childcare, activities aimed at increasing the human capital of children. In our empirical analysis, we take into account that the time one parent spends on childcare activities may serve as a substitute for the time the other spends in the same activities, estimating a six-equation SUR tobit model.

We find that mother's education is associated with an increase in the time devoted to educational childcare by fathers in both Spain and the UK and that mother's education is associated with an increase in the time devoted to educational childcare by mothers in Spain. Hence, it seems that what really matters in determining the time devoted to educational childcare at the couple level is the educational level of the mother. We also find that the time both members of the couple devote to educational childcare is complementary in both Spain and the UK. In sum, we find that, at the couple level, the educational factor that influences the time devoted to childcare activities, especially educational childcare, is mother's education, with couples with highly educated mothers devoting more time to such activities. However, we find differences at the country level, and while mother's education only influences the time devoted to educational childcare in the UK, mother's education influences the time devoted to both basic and educational childcare in Spain. The extent to which the differences between the two countries are explained by differences in the provision of public childcare services, on the one hand, or by the mothers' preferences, on the other hand, is also worthy of analysis.

This paper will be of interest to both parents and policymakers, since studying how education influences the time parents devote to transferring human capital to their children is important. However, we must acknowledge some data limitations of our study. First, we cannot ascertain whether differences by education arise from different preferences, different productivities in the provision of childcare, or differences in the value of time, in spite of the analysis of the channel through which mother's education affects the time devoted to educational childcare is worthy of analysis. Unfortunately, no panels of time-use data are available at this moment, so we leave this issue for future research. Second, we only consider childcare reported as primary childcare as main activity, despite prior evidence showing that primary childcare cannot be equated with time that parents spend with their children (Folbre et al. 2005), and childcare reported as primary activity substantially under-reports total childcare time (Budig and Folbre 2004; Folbre and Bittman 2004; Bianchi et al. 2006). We leave the inclusion of passive childcare and its classification into basic, educational and supervisory childcare for future research.

Acknowledgements We are grateful for comments from participants at the conference of the International Association for Time Use Research (2011), the conference of the European Economic Association (2011), the Becker Conference on the Economics of the Household (2011), and the European Society for Population Economics (2012), as well as the financial support provided by the Spanish Ministry of Economy and Competitiveness (Project ECO2012-34828). Remaining errors are our sole responsibility.

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