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We investigate the time investment in cognitive and non-cognitive childcare activities by parents with different educational attainment. In a second step we also investigate this effect for three different child age cohorts. Past research shows that the degree of success in the labour market is highly connected to the individual's cognitive and non-cognitive skills. We compare evidence based on Multinational Time Use Study (MTUS) for five countries: France, Netherlands, Spain, United Kingdom and United States of America in order to identify any systematic pattern. The results indicate that the educational gradients for cognitive and non-cognitive childcare activities are overall positive with respect to the level of education. Furthermore, the results seem to be consistent with the technology of skill formation. They indicate a concave function between time investment and the age of the child for cognitive childcare activities and a decreasing function for non-cognitive childcare activities.

Keywords: Time allocation, cognitive skills, non-cognitive skills, intergenerational transmissions, human capital, technology of skill formation

JEL classification: I21, J13

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Introduction

The puzzle of why intergenerational transmissions[2] of education and income are so strong is a constant ongoing debate among researchers. A substantial body of research has indicated that both nature and nurture influences the intergenerational transmissions (Turkheimer et al. 2003; Black et al. 2005; Björklund et al. 2006; Cunha et al. 2006; Black and Devereux 2010). One important piece of this puzzle is to study the parents' time allocation into cognitive and non-cognitive childcare activities. Analyzing time use data we investigate the association of parents' educational level on these two different childcare activities: First, by aggregating all children into one cohort, and later by dividing the children into different age-cohorts. We conduct robustness checks for all the individuals in our sample by the gender of the parent, but also by dividing the samples into subgroups of working and non-working. For each subsection the results are presented for parents, mothers and fathers separately. It is important to note that our results indicate patterns and associations rather than a causal relationship.

There is a growing interest within economics concerning how a child's well-being and development affects labour market outcomes later in life. Several theoretical and empirical studies focus on this mechanism. A useful separation of child well-being is to divide it into three domains[3]: child's health, child's cognitive development and child's social and emotional development. While many economists have started to investigate children's health and labour market outcomes (see Case and Paxson 2010; Currie 2009 for a literature review), other researchers focus on the child's cognitive development and how that affects the return to schooling and future earnings (Carneiro et al. 2003; Nordin 2008). Recent studies, like Lindqvist and Vestman (2011), try to account for both the cognitive and social/emotional development of the child and its implications on their labour market outcomes.

Cognitive skills are traditionally measured as the IQ of an individual, however are thus difficult to measure. Within the field of economics, non-cognitive development/skills refer to abilities such as motivation, social skills, persistence, patience and emotional stability of the individual. These skills are derived from the concept of the concept of the social and emotional development of the child. According to Heckman et al. (2006), non-cognitive skills are mainly affected and nourished during earlier stages of childhood and parents play a significant role in its development. The cognitive variable in our study is constructed from parent's time investment in specific childcare activities, such as teaching and showing the

[2] Intergenerational transmission is the transfer of individual abilities, behavior and/or outcome from parents to their children.

[3] These three domains are not mutually exclusive. There is a close interaction between them (Waldfogel 2004).

child how to perform tasks directly involved in learning. The non-cognitive skills variable includes time investment from parents on a range of childcare activities such as physical and medical care of the child, feeding, changing diapers, toilet training, dressing but also telling stories, conversation, playing social games like Monopoly and Risk, performing sporting activities and so on. The separation into cognitive and non-cognitive skills is not perfect, since non-cognitive activities could involve some form of cognition. However, this separation is in line with past research (Duncan et al. (2007); Borghans et al. 2008; Lindqvist and Vestman 2011).

Recent literature within the field of economics, such as Heckman et al. (2006), Grönqvist and Vlachos (2008), Grönqvist et al. (2010) Nordin (2008), Lundborg et al. (2009) and Lindqvist and Vestman (2011) try to disentangle the effects of cognitive and non-cognitive skills[4] in relation to different labour market outcomes. A major part of this literature uses military enlistment data for individuals between the ages of 18 and 19. However, evidence suggests that cognitive and non-cognitive skills are developed at a much younger age (Cunha et al. 2006). Following Cunha and Heckman's (2007) theoretical framework, two important factors concerning skill formation emerge: the age of the child and the parents' willingness to invest in the child's skill formation. It is also imperative to keep in mind that it is vital to capture both mother's and father's time investment in the child, because the intergenerational transmissions of education are influenced by both parents. Therefore, when conducting a study that deals with time investment on childcare the focus should be on the total household if the aim is to capture intergenerational transmission of education.

Using the Multinational Time Use Study (MTUS) database, we analyze the following countries: France, Netherlands, Spain, UK and US.[5] Our dependent variables (cognitive and non-cognitive childcare activities) are regressed on the following control variables: parents' level of education, hours worked by the parent, number of children, the age of the youngest child and the gender of the parent. In a second step we divide the samples into three different child age cohorts in order to capture the time investment during children's upbringing and analyse the pattern between parents' level of education and investment on the childcare activities.

4 We will not make any distinction between skills and ability.

5 The countries selected in this paper are based on the following factors: i.) Only surveys from OECD members have been included that are not restricted due to data availability policy ii.) Only surveys harmonized in such a detailed level so that it is possible to create cognitive and non-cognitive childcare variables have been included. iii.) Only surveys that were collected during the five year period of 1998-2003 are included.

Our results indicate that the educational gradients for cognitive and non-cognitive childcare activities are overall positive and increasing with respect to the level of education, which is consistent with existing literature (Rosenzweig & Wolpin 1994). This may be one reason why the intergenerational transmissions of education and income are high. Moreover, when dividing the sample into different child age cohorts the results indicate that time investment in cognitive childcare by parents is a concave function of the age of the child. However, non-cognitive childcare time investments by parents display a decreasing function between level of education and the age of the child. This finding is consistent with the theoretical framework of technology of skill formation as formulated by Cunha and Heckman (2007). Furthermore, as the educational gradient level increases more parental time is invested in their children's non-cognitive childcare activities, irrespective of sample, gender and age cohort of the child.

The paper contributes to the existing literature on several levels. First, it investigates the association between parents' level of education and time investments on cognitive and non-cognitive childcare. Second, we exploit the age of the child to show the pattern of time investment of parents on our two childcare variables. Third we increase the external validity of our findings by making a cross-national comparison. Furthermore, this paper contributes to the small but growing empirical literature on the technology of skill formation.

Parental time investment and childcare activity

One of the pioneering theoretical studies in economics concerning child development is the work by Becker and Tomes (1986)[6]. They assume that parents cannot invest in their children's endowments; however they can invest in their schooling which in turn increases their future earnings. However, Becker and Tomes (1986) present a single period model where the age of child at the point of investment in the child's human capital is not important. Thus, a lump sum investment in the child at the age of 17 is equally effective as smoothing the investment during the child's upbringing. An important result of their theoretical framework is that capital markets are the major cause of the relatively high intergenerational transmission that is

[6] However, the conceptual work was started by Ben-Porath (1967), with inputs such as child's ability and school quality. This work was carried on and improved by Liebowitz (1974), which conditional on parent's investment on children at home, analyzed how the child's cognitive skills are affected by time investment on the childcare activities reading and or playing.

apparent in most developed economies.[7] Cunha and Heckman (2007) argue that parents' can in fact invest and increase their child's endowment to a certain degree, as shown in psychological and cognitive research (Cunha et al. 2006; Todd and Wolpin 2003; Turkheimer et al. 2003; Cunha et al. 2010). They further suggest that the stage at which the investment in the child's human capital is made also matters (i.e. there are several critical time periods). According to them the skill formation of a child critically depends on the investments in the early preschool period (see Heckman et al. 2006 for a detailed overview). Ramey and Ramey (2010) further emphasize that children with age-appropriate cognitive, social and emotional skills have a greater probability to experience early and continued school success.

Previous findings show that mothers spend a substantially greater amount on time on childcare as compared to fathers (Bianchi et al. 2000; Sayer et al. 2004a). This is explained in terms of social norms that perceive childcare as typically a woman's responsibility. However, recent literature shows that there is a growing convergence between father's and mother's time investment on childcare. Bryant and Zick (1996) show that the historical trend that mothers spend more time on childcare than fathers has changed, in terms of fathers now spending more time with their children. Using Australian time use data Craig (2006) investigates Australian parents in order to detect gender differences in total childcare time. The results show that motherhood involves more time alone with children and a greater overall responsibility for managing children. This is also evident when the mother works full time.[8] Meanwhile fathers tend to allocate more time on flexible childcare activities such as playing and teaching which is also supported by Guryan et al. (2008). In another study, Averette et al. (2006) find that paternal care for young children is no better or worse than any other type of arrangements (such as center care, family day care or care performed by relatives). However, children with paternal childcare in the early stages of life, seemed to have slightly worse cognitive outcomes than those with non-paternal childcare. In a study with US data Guryan et al. (2008), analyze how parents allocate time to four different childcare types[9], conditional on employment status. One important result of their study is that parents with high income and education seem to regard childcare as an investment in the children's human capital, and therefore devote more time towards childcare activities. This

[7] Capital markets are the major cause for high intergenerational transmissions, because poor families have often difficulties financing investments in children due to their credit constraint (Becker and Tomes 1986).

8 However, studies such as Baydar et al. (1999), shows that working compared to non-working mothers allocate less time to childcare. Furthermore, Connelly and Kimmel (2009) show that mothers invest less time on childcare as the child gets older.

9 Total childcare, basic childcare, recreational childcare and educational childcare.

result is also confirmed by Sepahvand et al. (2011); Sayer et al. (2004a, 2004b) and Rosenzweig and Wolpin (1994).

Family structure, i.e. single or two-parent families, has an impact on how much time is allocated towards children. Hofferth (2001) finds that single-mother families allocate approximately one-third less time on childcare than two-parent families. One explanation for the difference in time investment is that single-parent families are under greater time constraints than two-parent families (Sandberg and Hofferth 2001).

Research has found that employment status has a negative, but small, effect, on the time that is allocated towards childcare (Bianchi 2000). However, Hofferth (2001) shows that the difference tends to affect mainly passive supervision rather than time spent on direct engagement with children. In two-parent families the change in working hours of one of the parents can affect the time spent on childcare by the other parents. Hallberg and Klevmarken (2003) found, with Swedish data, that the variation in the wife's working hours has no effect on the husband's childcare time. The reverse is found in a study by Kitterød and Pettersen (2006). In contrast to the above literature, Joesch and Spiess (2006) find that the employment status of the mother does not explain the cross-country differences in the mean number of hours mothers reported looking after children.

Some literature (like Hofferth 2001 and Sayer et al. 2004a) shows that the age of parents is associated with the amount of time spent with children. Sayer at al. (2004a) show that parents aged 25-34 allocate the highest amount of time towards childcare activities as compared to younger and older parents. They argue that the reason behind this finding has to do with selection; older parents are more likely to have planned the birth and thereby may be inclined to invest more time in childcare compared to younger parents.

Previous findings in economics have emphasized that skills are multidimensional. The focus has been mainly on skills acquired through reading, writing or doing math. However, recently there is a greater focus on the non-cognitive childcare activities and skill formation. In the recent studies by Cunha and Heckman (2007); Butler et al. (2009) and Lindquist and Vestman (2011) the child's skills such as social skills have also been included while discussing educational attainment and labour market outcomes.

Modeling parental investment on childcare

There are many factors that influence parents' decision to invest time in their child's cognitive and non-cognitive skills. Parents may invest time in their child for altruistic reasons. They could also choose to invest time in their child because they prefer to have a well behaved child, which results in increasing parents' own utility. Furthermore, parents' time investment in their child could also be related to more traditional reasons, which implies that an investment in time would result in increased human capital of the child and future earnings.

In order to capture the parents' time investment in their children's abilities, cognitive and non-cognitive childcare activities will be regressed upon a set of education dummy variables (which can also be regarded as a proxy variable for income) but also a set of control variables. Following earlier research on parental time use (Bryant and Zick 1996; Sayer et al. 2004a; Guryan et al. 2008) the following control variables for parents' time allocation are included in this study given their documented importance: the number of children, the age of the youngest child, the couple status, the gender of the parent, hours worked, age and age squared. For a discussion about the connection between previous research and the control variables used in this study, see section *Parental time investment and childcare activity.*

The dependent variables cognitive and non-cognitive skills are constructed by parents' investment on cognitive and non-cognitive childcare activities. The cognitive variable consists of time use activities that are related to parents' time investment towards learning, while the non-cognitive variable is related to care and socializing. The estimations in this paper are based on OLS regressions with robust standard errors, following a large body of literature (Price 2008; Guryan et al. 2008; Brown and Dunn 2011; Gershuny 2012; Foster and Kalenkoski 2012).

Cognitive and non-cognitive childcare activities

The *cognitive variable* captures time investment in activities related to the learning process of the child, such as teaching and showing the child how to perform different tasks that involve learning and stimulating the child's cognitive skills. For instance, time investment in helping the child with school work. It is crucial to understand why time investment in activities related to the learning process (i.e. reading, writing and counting) is closely connected to

cognitive skills such as memory, concentration and reflection. Furthermore, as the child learns to read and write, her cognitive skills develop and improve.

Memory, as one part of the cognitive ability of a child, is developed and improved through reading and writing. When a child devotes time to reading, writing and/or counting, she gets familiarized with words and numbers which help to improve and develop the memory capacity of the child. Therefore, time investment by parents in these activities helps to intensify the development of cognitive skills. (Snow et al. 1995)

Another aspect is concentration, which is for how long and to what extent the child can focus on one activity without being distracted by her surroundings. Krampen (2008) shows that when helping or teaching the child to perform a specific task (such as picture-book reading when the child is young), the child's concentration would increase. For instance, by parents sitting down with the child and helping her to write, the child increases her concentration through focusing on distinguishing between words and letters to be able to make sense of a sentence. This example provides a good overlap to the third aspect of cognitive ability, i.e. reflection.

According to Neuman and Roskos (1997) making sense of a sentence involves understanding symbols and reflecting upon them. Therefore, a child without the ability to understand symbols would not be able to create sentences by using different forms of letters and words. Thus, investing time in tasks directly involving learning, the parent would not only develop and improve the memory and concentration of a child, but also the ability to reflect.

The term non-cognitive skills is used extensively in economic literature, other disciplines use terms more related to the characteristics of the child as her temperament, for instance the mood or sensitivity (MacClowry 1995; Deal et al. 2005) or social-cognitive skills (Forrester 1995). The term non-cognitive skills, independent of definition, refers to those individual abilities, considered "personality characteristics", which are acquired during childhood and adolescence. It has long been assumed that non-cognitive skills are endowed genetically. However, this perception has changed with time (Coneus and Laucht 2008; Cunha et al. 2006). Research shows that non-cognitive skills in an individual are mainly determined through interactions during the child's upbringing and the stimulus in her surroundings.

The *non-cognitive variable*[10] is constructed from parents' time investment on a range of different childcare activities, such as physical and medical care of the child, feeding, changing

10 In order to check the robustness of our non-cognitive results, we have excluded the basic element of childcare (meaning activities such as: physical and medical care of the child, feeding, changing diapers, toilet training and dressing). Despite doing this the pattern of our result do not change.

diapers, toilet training and dressing. But also telling stories, conversation, playing social games like Monopoly and Risk, participating in sport activities and so on. It should be noted that the non-cognitive skill variable refers to activities that do not *directly* relate to the memory, concentration and reflection (i.e. cognitive ability) of the child. Instead, the activities in the non-cognitive variable are assumed to increase skills such as persistence, motivation, emotional stability, social competence, outgoing character, independence, power of initiative, patience and time preferences etc.

It is crucial to understand the link between time investment in early child activities (such as feeding, changing diapers, toilet training, dressing, etc.) and non-cognitive skills. Bretherton (1992) provides argument that small children need to feel secure, needed and nurtured in their early stages of childcare, which would increase their self-esteem later in life.[11] Moreover, research has pointed out that the investment in these basic childcare activities must be followed up by (at a later stage of childhood) activities that encourage the child to interact with others to experience other perspectives. This implies that activities such as playing have a vital role as Trawick-Smith and Dziurgot (2011) also point out.[12] In other words, the assumption is that increased time in the basic childcare activities would increase the non-cognitive skills of the child (such as self-esteem and emotional stability) which impacts the labour markets outcomes when the child has become an adult.

According to Leslie (1987) a fundamental trace of human development is the ability to pretend and understand pretense in others. In other words, to pretend and/or do as others do, develops the non-cognitive skills of a child such as social skills. This ability can be encouraged and developed through parents investing time in activities such as playing games, telling stories and having a conversation with the child.

The activities included in cognitive and non-cognitive childcare for each selected country is described by Table A2 in the Appendix. The education variable is divided into three categories as specified by MTUS during the harmonization process and is based on International Standard Classification of Education (ISCED), developed by UNESCO: not completed upper secondary (edu1), completed upper secondary (edu2) and above upper secondary (edu3). Edu1 includes all those persons that have not completed or have less than upper secondary education, edu2 includes those who have completed their upper secondary education and edu3 consists of those who have an education above upper secondary. The

11 A more detailed discussion can be found in Forrester (1995) where Piaget's notion of egocentrism in early childhood is discussed. Piaget's notion of egocentrism implies that since small children only see the world from their own perspective, their needs have to be fulfilled in order for the child to develop healthfully.
12 For a further discussion about the effect of playing and non-cognitive skills, see Vygotsky (1978).

classification for each selected country and a more detailed categorization of the education variables used in this study can be seen in Table A1 in the Appendix.

The data used in this study allow us, due to its gender-ratio, to conduct an analysis separately for each gender. Moreover, to test whether parents are essential in the long-term development of skill formation (Cunha and Heckman 2007), the effect of parents (fathers and mothers) are scaled down at different child age cohorts. The following age cohorts have been used: *Age1* = children between 0-4 years, *Age2* = children between 5-11 years and *Age3* = children between 12-17 years. This will enable us to detect if there are heterogeneous age effects. This can shed more light on whether or not parents' education attainment can influence skill formation even during child's adolescence, and hence might suggest that these abilities are not totally determined at a young age.

Understanding Time Use Data

The analysis in this study is based on MTUS which is a harmonized cross sectional data set.[13] Table 1 provides survey information for the selected countries (France, Netherlands, Spain, UK and US) in this study; such as the sample size, response rate, survey year, time interval for each given time use activity and the number of diary days. The countries included are those that could separate the childcare variable into cognitive and non-cognitive childcare. We only consider the respondents between the ages of 21 and 55 with at least one child under age 18 and with a complete 24-hour time diary.

Different countries have conducted their surveys during different periods. Table 1 also shows information on the time interval for each given time use activity that is filled in by the respondents. The point estimates of each country cannot be comparable in a cross country fashion, due to institutional differences when it comes to education, childcare, parental leave and market-labour conditions. However, the pattern of the results is comparable across countries and consistent as shown below in our empirical result section. For instance, in the US and the UK there exists a more liberal welfare state where market solutions are prevalent. While countries like Spain and France are categorized as more conservative welfare state, where market solution are not as dominating as in liberal welfare states (Esping-Andersen 1990).

13 For a detailed information see Fisher et al. (2012).

Table 1: Survey information

Country	Number of observations	Response rate %	Number of diary days	Survey year	Time interval minutes
France	15 441	88,3	1	1998/99	10
Netherlands	15 428	37	7	2005	15
Spain	46 774	86.0	1	2002/03	10
UK	11 667	45.0	2	2000/01	10
US	45 496	57	1	2003	Free

Notes: Table 1 illustrates the technical information for each survey in the selected countries. The samples are restricted to include only individuals between the ages of 21 and 55 with at least one child under the age of 18 present in the household. Furthermore, the samples include only individuals who had completed time diaries (i.e. 1440 minutes). The time intervals are for each given activity that is filled in by the respondent in the diary.

The descriptive analysis is shown for cognitive and non-cognitive childcare activities in all countries and the samples are Full, Working and Non-Working. The categories are Parent, Fathers and Mothers and the three different educational attainments are uncompleted, completed and above upper secondary school.

According to studies by Bryant and Zick (1996) and Sayer et al. (2004a), the gender of the parent has a major influence on the time invested in the child. These findings indicate that mothers invest significantly larger amount of time on their children than fathers. This fact is also supported in table 2. For instance, British mothers in the Full sample invest on average almost 38 minutes more per day on non-cognitive activities compared to fathers (the corresponding difference for cognitive activities is 1.63 minutes per day).

According to Becker (1991), an individual's time investment in the household is strongly related to the specialization that takes place within the household, i.e. market work status. The obvious pattern should be that employed individuals have less time to invest in the household than unemployed. This is supported by comparing table 3 and table 4, as indicated through the clear pattern between the Working and Non-Working samples. The French non-working parents invest on average 40 minutes more per day on non-cognitive activities compared to the French working parents (this is also confirmed by the corresponding cognitive childcare). This pattern is also evident for French non-working mothers (and fathers), as they on average invest 37 minutes (8 minutes) more on their child's non-cognitive skills than working mothers (fathers).

Table 2: Descriptive statistics for the full sample

Full sample

	France		Netherland		Spain		UK		US	
	Cognitive	Non-cognitive	Cognitive	Non-cognitive	Cognitive	Non-cognitive	Cognitive	Non-cognitive	Cognitive	Non-cognitive
Parent										
Minutes	5.54	42.83	3.14	61.48	3,28	52,57	2.73	56.33	6.70	71.83
Ratio %	11.5	88.5	4.9	95.1	5.9	94.1	4.6	95.4	8.5	91.5
Obs	4906	4906	4319	4319	12824	12824	5733	5733	18408	18408
Fathers										
Minutes	2.77	20.64	1.78	41.01	2,00	30,61	1.79	34.23	4.12	49.75
Ratio %	11.8	88.2	4.2	95.8	6.1	93.9	5.0	95.0	7.7	92.3
Obs	2313	2313	1946	1946	5905	5905	2425	2425	7493	7493
Mothers										
Minutes	8.02	62.63	4.26	78.26	4,38	71,32	3.42	72.52	8.47	86.99
Ratio %	11.4	88.6	5.2	94.8	5.8	94.2	4.5	95.5	8.9	91.1
Obs	2593	2593	2373	2373	6919	6919	3308	3308	10915	10915
Parent: *Edu1*										
Minutes	5.40	40.45	1.98	45.83	1,97	39,27	1.98	52.18	5.76	54.09
Ratio %	11.8	88.2	4.1	95.9	4.8	95.2	3.7	96.3	9.6	90.4
Obs	749	749	560	560	2287	2287	1904	1904	1860	1860
Parent: *Edu2*										
Minutes	5.16	38.07	3.68	57.90	3,21	49,59	2.55	57.46	5.71	60.85
Ratio %	11.9	88.1	6.0	94.0	6.1	93.9	4.3	95.7	8.6	91.4
Obs	2337	2337	1792	1792	7361	7361	2311	2311	4965	4965
Parent: *Edu3*										
Minutes	6.10	49.91	2.98	69.19	4,41	69,07	3.95	59.81	7.27	79.39
Ratio %	10.9	89.1	4.1	95.9	6.0	94.0	6.2	93.8	8.4	91.6
Obs	1820	1820	1967	1967	3176	3176	1518	1518	11583	11583

Note: **Table 2** shows descriptive statistics in terms of average minutes per day for the Full sample; for the groups *Parent*, *Fathers* and *Mothers*; and the three different educational attainments: *Edu1*, *Edu2* and *Edu3*. Furthermore, the number of observations and the ratio for cognitive and non-cognitive is presented for each sample.

Table 3: Descriptive statistics for the working sample

Working

	France		Netherland		Spain		UK		US	
	Cognitive	Non-cognitive	Cognitive	Non-cognitive	Cognitive	Non-cognitive	Cognitive	Non-cognitive	Cognitive	Non-cognitive
Parent										
Minutes	4.57	33.43	2.55	55.87	2,45	43,09	2.50	45.69	5.43	61.87
Ratio %	12.0	88.0	4.4	95.6	5.4	94.6	5.2	94.8	8.1	91.9
Obs	3774	3774	3549	3549	8855	8855	4398	4398	14503	14503
Fathers										
Minutes	2.66	19.91	1.81	37.81	1,98	30,76	1.88	32.88	3.83	48.88
Ratio %	11.8	88.2	4.6	95.4	6.0	94.0	5.4	94.6	7.3	92.7
Obs	2077	2077	1827	1827	5300	5300	2186	2186	6877	6877
Mothers										
Minutes	6.90	49.99	3.34	75.03	3,16	61,48	3.11	58.35	6.88	73.58
Ratio %	12.1	87.9	4.3	95.7	4.9	95.1	5.1	94.9	8.6	91.4
Obs	1697	1697	1722	1722	3555	3555	2212	2212	7626	7626
Parent: *Edu1*										
Minutes	4.40	22.95	1.59	37.33	1,35	23,90	1.74	38.08	2.96	35.92
Ratio %	16.1	83.9	4.1	95.9	5.4	94.6	4.4	95.6	7.6	92.4
Obs	425	425	434	434	1258	1258	1261	1261	1134	1134
Parent: *Edu2*										
Minutes	4.23	28.07	2.71	50.51	2,04	37,35	2.16	46.11	4.36	50.65
Ratio %	13.1	86.9	5.1	94.9	5.2	94.8	4.5	95.5	7.9	92.1
Obs	1848	1848	1393	1393	4971	4971	1841	1841	3803	3803
Parent: *Edu3*										
Minutes	5.04	43.01	2.67	64.88	3,75	63,16	3.72	52.51	6.16	69.41
Ratio %	10.5	89.5	3.9	96.1	5.6	94.4	6.6	93.4	8.1	91.9
Obs	1501	1501	1722	1722	2626	2626	1296	1296	9566	9566

Note: **Table 3** shows descriptive statistics in terms of average minutes per day for the Working sample; for the groups *Parent*, *Fathers* and *Mothers*; and the three different educational attainments: *Edu1*, *Edu2* and *Edu3*. Furthermore, the number of observations and the ratio for cognitive and non-cognitive is presented for each sample.

Table 4: Descriptive statistics for the non-working sample

Non-Working

	France		Netherland		Spain		UK		US	
	Cognitive	Non-cognitive	Cognitive	Non-cognitive	Cognitive	Non-cognitive	Cognitive	Non-cognitive	Cognitive	Non-cognitive
Parent										
Minutes	8.79	74.09	5.86	87.31	5,14	73,73	3.50	91.36	11.40	108.84
Ratio %	10.6	89.4	6.3	93.7	6.5	93.5	3.7	96.3	9.5	90.5
Obs	1132	1132	770	770	3969	3969	1335	1335	3905	3905
Fathers										
Minutes	3.71	27.05	1.26	90.25	2,18	29,29	0.96	46.61	7.40	59.46
Ratio %	12.1	87.9	1.4	98.6	6.9	93.1	2.0	98.0	11.1	88.9
Obs	236	236	119	119	605	605	239	239	616	616
Mothers										
Minutes	10.13	86.50	6.71	86.77	5,68	81,72	4.05	101.12	12.14	118.08
Ratio %	10.5	89.5	7.2	92.8	6.5	93.5	3.9	96.1	9.3	90.7
Obs	896	896	651	651	3364	3364	1096	1096	3289	3289
Parent: *Edu1*										
Minutes	6.70	63.30	3.33	75.12	2,73	58,07	2.46	79.83	10.13	82.46
Ratio %	9.6	90.4	4.2	95.8	4.5	95.5	3.0	97.0	10.9	89.1
Obs	324	324	126	126	1029	1029	643	643	726	726
Parent: *Edu2*										
Minutes	8.67	75.89	7.07	83.68	5,63	75,06	4.09	101.91	10.14	94.27
Ratio %	10.3	89.7	7.8	92.2	7.0	93.0	3.9	96.1	9.7	90.3
Obs	489	489	399	399	2390	2390	470	470	1162	1162
Parent: *Edu3*										
Minutes	11.13	82.38	5.20	99.49	7,56	97,25	5.27	102.43	12.58	126.72
Ratio %	11.9	88.1	5.0	95.0	7.2	92.8	4.9	95.1	9.0	91.0
Obs	319	319	245	245	550	550	222	222	2017	2017

Note: **Table 4** shows descriptive statistics in terms of average minutes per day for the Non-Working sample; for the groups *Parent*, *Fathers* and *Mothers*; and the three different educational attainments: *Edu1*, *Edu2* and *Edu3*. Furthermore, the number of observations and the ratio for cognitive and non-cognitive is presented for each sample.

Furthermore, tables 2-4 also presents average minutes per day invested on the child's cognitive and non-cognitive skills conditional on the level of education of the parent. The essential feature is that time investment on both cognitive and non-cognitive childcare increases as the level of education of the parent increase. For instance, the Spanish working parent invests on average around 24, 37 and 63 minutes per day on non-cognitive childcare as their level of education increases (the corresponding values for cognitive childcare are 1.35, 2.04 and 3.75 minutes per day). Therefore, the highest educated Spanish working parents invest on average almost 39 minutes more per day on their child's non-cognitive skills compared to the lowest educated group (the corresponding values for cognitive childcare is 2.4 minutes).

One important piece of information is how large proportion of the time spent on childcare is constituted by cognitive and non-cognitive activities, in order to detect any systematic patters. For instance, in the Full sample British parents allocate on average 4.6 percent of their time to cognitive childcare activities, as shown by table 2. Independent of which group we look at (parent, fathers, mothers, etc.) in the full sample, almost the same proportion is invested in cognitive and non-cognitive childcare activities but with more relative time devoted to non-cognitive childcare. This pattern is evident for table 3 and 4 (Working and Non-working) as well. One interpretation is that there is a systematic pattern in the behavior of the parents when it comes to how large proportion of childcare that is devoted to cognitive and non-cognitive activities. In other words, ***relative time*** devoted to childcare activities does not change between different groups of parents although the ***absolute time*** devoted to childcare is quite volatile. This pattern holds for all countries in the study. In order to check that our results were not driven by the large absolute values for parental time investment on non-cognitive childcare, the basic childcare part of non-cognitive childcare, was dropped. The result with this modified non-cognitive childcare indicated the same pattern.

Investment patterns on cognitive and non-cognitive activities

Empirical results from the parents' time allocation towards cognitive and non-cognitive childcare activities are presented in table 5 and 6. These tables present the conditional

differences for time invested by the parents on cognitive and non-cognitive[14] childcare activities for three different samples (Full, Working and Non-working). Results from further analysis are reported for the age of the child, conditional on the level of education. The estimation results for the two highest levels of education variables completed and above upper secondary school, should be interpreted as additional minutes per day invested by the parents on their children's cognitive and non-cognitive skills relative to the lowest level of education.

Level of Education

We start by analyzing the impact of parents' time investment on their children's cognitive and non-cognitive activities for all the individuals in our sample given their level of education, and then proceed to examine the investment by working and non-working parents.

Tables 5 and 6 shows that parents' time investment has a positive educational gradient for both cognitive and non-cognitive childcare. For instance, US parents in the Full sample with an education above upper secondary school invest on average 2.15 minutes more per day on their children's cognitive childcare compared to US parents with an not completed upper secondary school as seen in Table 6. The effect from parents' investment on non-cognitive childcare activities is presented in table 5. For instance, in the US Full sample, parents with education above upper secondary school invest on average around 32 minutes more per day on non-cognitive activities compared to those US parents' with uncompleted upper secondary school. The same positive pattern can also be depicted for those with completed upper secondary school, where on average 18 minutes more per day is invested. Furthermore, the same pattern is evident for Dutch parents in the Full sample. For instance, the educational gradient increases with almost 4.5 minutes per day on average for parents with completed upper secondary school investing in the children's non-cognitive chidlcare, while the increase between completed and above upper secondary school is almost 11 minutes per day on average. Positive patterns of the education gradient in terms of parents' investment on non-cognitive childcare indicate that there are similarities between investing in children's non-cognitive skills and parents' level of education but also that parents on average invest more time per day on non-cognitive activities compared to cognitive.

[14] We have tried to exclude the basic childcare activities from our non-cognitive variable, but this does not change any of our results in any significant way.

Table 5: Conditional differences for non-cognitive childcare

Non-cognitive childcare

	France			Netherlands			Spain			UK			US		
	Parents	Mothers	Fathers	Parents	Mothers	Fathers	Parents	Mothers	Fathers	Parents	Mothers	Father	Parents	Mothers	Fathers
Panel A: Full sample															
Edu2	9.13***	10.28**	5.54**	4.49	8.52*	-0.47	7.97***	7.78***	5.94***	0.14	-0.85	0.17	17.71***	17.79***	14.96***
Edu3	15.15***	16.49***	11.86***	15.52***	21.63***	8.28**	21.23***	19.54***	18.50***	9.54***	11.48***	6.61**	32.45***	34.28***	26.70***
OBS	4906	2593	2313	4319	2373	1946	12824	6919	5905	5733	3308	2425	13079	7730	5349
Panel B: Working sample															
Edu2	5.63**	2.57	5.86***	0.76	3.81	-2.85	5.48***	5.61	4.75***	-1.41	-4.81	0.46	17.86***	18.10***	16.06***
Edu3	12.48***	8.80*	13.01***	12.53***	13.51**	9.22**	20.45***	20.50***	17.29***	8.14***	9.97**	6.27**	31.28***	32.40***	28.30***
OBS	3774	1697	2077	3549	1722	1827	8844	3549	5295	4398	2212	2186	10290	5396	4894
Panel C: Non-working sample															
Edu2	13.36**	15.40**	5.05	17.61**	12.91	0.43	11.06***	9.70***	13.82***	3.33	5.70	-3.70	14.27**	13.74*	8.60
Edu3	21.90***	24.17***	8.52	24.07***	31.49***	-32.30	21.65***	19.01***	30.15***	10.36	8.98	19.88	33.56***	35.45***	17.99
OBS	1132	896	236	770	651	119	3980	3370	610	1335	1096	239	2789	2334	455

Note: Table 5 shows the conditional differences by level of education for time spent on non-cognitive childcare activity for all parents, mothers and fathers in all the selected countries. All time use measures are presented in minutes per day. Conditional differences reports the coefficients from an OLS regression with robust standard errors with the following control variables: age, age-square, age of the youngest child, number of children, hours worked, couple status, gender dummy and proposed diary weights. The reference category for the level of education dummy variables is *Edu1*. *, ** and *** illustrates significant level at 10 %, 5% and 1%.

Table 6: Conditional differences for cognitive childcare

Cognitive childcare

	France			Netherlands			Spain			UK			US		
	Parents	Mothers	Fathers	Parents	Mothers	Fathers	Parents	Mothers	Fathers	Parents	Mothers	Father	Parents	Mothers	Fathers
Panel A: Full sample															
Edu2	1.11	1.40	1.11	1.27**	3.37***	-0.06	1.80***	2.45***	0.90***	0.93**	1.36**	0.22	1.03	0.67	1.59*
Edu3	1.98**	3.04**	1.08	1.15**	3.05***	-0.07	3.40***	4.12***	2.54***	2.09***	2.95***	0.87	2.15***	2.68**	1.58**
OBS	4906	2593	2313	4319	2373	1946	12824	6919	5905	5733	3308	2425	13079	7730	5349
Panel B: Working sample															
Edu2	0.02	-1.03	0.82	0.86*	2.38***	0.10	0.78**	0.24	1.00***	0.63	1.01*	0.23	0.97	0.42	1.72*
Edu3	0.18	-0.90	0.96	0.94*	2.57***	0.05	2.28***	1.52**	2.68***	1.77***	2.56***	0.84	2.16***	2.57**	1.79**
OBS	3774	1697	2077	3549	1722	1827	8844	3549	5295	4398	2212	2186	10290	5396	4894
Panel C: Non-working sample															
Edu2	2.49*	2.61	2.62	2.99**	4.41***	-1.91	3.16***	3.73***	0.66	1.61*	1.97**	-0.33	1.31	1.02	0.82
Edu3	6.86***	8.39***	0.79	2.32*	3.28*	-0.60	5.69***	6.70***	1.38	2.81**	3.13**	0.94	2.30	2.49	-0.53
OBS	1132	896	236	770	651	119	3980	3370	610	1335	1096	239	2789	2334	455

Note: Table 6 shows the conditional differences by level of education for time spent on cognitive childcare activity for all parents, mothers and fathers in all the selected countries. All time use measures are presented in minutes per day. Conditional differences reports the coefficients from an OLS regression with robust standard errors with the following control variables: age, age-square, age of the youngest child, number of children, hours worked, couple status, gender dummy and proposed diary weights. The reference category for the level of education dummy variables is *Edu1*. *, ** and *** illustrates significant level at 10 %, 5% and 1%.

The same positive pattern between the level of education and time investment on non-cognitive childcare activities for working parent can also be seen. For instance, Spanish working parents with above upper secondary school education invest on average around 20 minutes more per day on non-cognitive activities compared to Spanish parents with uncompleted upper secondary school. This pattern can also be depicted when comparing the levels of education corresponding to complete and uncompleted upper secondary school for the Spanish working parents. Here, Spanish parents that are in the labour market and have an completed level of education invest on average almost 5 minutes more per day on non-cognitive childcare, compare to parents with the lowest level of education. Furthermore, looking at the difference between Spanish working parents with above upper secondary school and those with completed upper secondary school, we can depict a positive significant pattern in terms of time investment on non-cognitive childcare were working parents with above upper secondary school invest on average almost 15 minutes more per day on non-cognitive activities.

The positive patterns concerning the education gradient in terms of parents' investment on non-cognitive childcare that is shown for Full sample and Working sample, are also depicted for Non-working sample. For instance, French non-working parents with above upper secondary education invest on average almost 22 minutes more per day on non-cognitive childcare compared to those parents that have the uncompleted upper secondary school. This pattern can also be depicted when comparing uncompleted and completed upper secondary school for French non-working parents, as those with completed upper secondary school invest on average 13 minutes more on their child's non-cognitive skills. A final comparison of the tables shows that as the level of education increases, the time invested by parents on their children's cognitive and non-cognitive skills increases on average per day however with the clear differences that more time is devoted to non-cognitive childcare activities. Moreover, the same patterns can be depicted when excluding the basic childcare element from the non-cognitive childcare variable.

Age of the child

We next turn our attention to parents' time investment on cognitive and non-cognitive childcare activities for different child age cohorts. In order to draw conclusions about parents' time investment on cognitive and non-cognitive childcare, only parents with one child are

Table 7: Conditional differences for non-cognitive childcare by child age groups

Non-cognitive childcare

	France			Netherlands			Spain			UK			US		
	Age 1	**Age 2**	**Age 3**	**Age 1**	**Age 2**	**Age 3**	**Age 1**	**Age 2**	**Age 3**	**Age 1**	**Age 2**	**Age 3**	**Age 1**	**Age 2**	**Age 3**
Panel A: Parents full sample															
Edu2	13.40	3.930	-1.40	23.36	-20.90	4.17*	-0.15	6.51**	1.53**	6.34	-5.30	-5.52	39.47***	-1.33	6.63**
Edu3	15.08	10.89**	-3.80	27.64*	-5.18	-0.62	17.84**	10.31***	2.48**	10.34	-6.16	-4.98	51.45***	6.54	5.52**
OBS	620	627	923	581	399	574	1791	1909	2981	803	649	837	1658	1822	1646
Panel B: Mothers full sample															
Edu2	14.23	1.42	-6.23	48.46*	-33.07	5.94	-5.37	7.16	1.33	10.88	-11.07	-8.35	49.45***	-7.61	8.49*
Edu3	14.57	14.76**	-9.06	56.41**	-9.07	0.27	12.44	12.77**	2.73	14.73	-12.77	-6.57	57.63***	-2.19	7.16*
OBS	325	346	493	329	266	329	947	1057	1631	450	401	481	946	1162	992
Panel C: Fathers full sample															
Edu2	10.44	5.73	3.39**	-8.33	-15.58	3.75	4.69	5.15	1.90***	-1.50	1.96	-2.29	34.14***	4.53	4.46*
Edu3	15.96*	4.66	1.91*	6.21	-10.77	-0.55	23.03***	7.55*	2.48***	5.34	3.32	-2.52	46.67***	16.66***	3.97**
OBS	295	281	430	252	133	245	844	852	1350	353	248	356	712	660	654

Note: Table 7 shows the conditional differences by level of education for time spent on non-cognitive childcare activity for parents, mothers and fathers in all the selected countries. All time use measures are presented in minutes per day. Conditional differences reports the coefficients from an OLS regression with robust standard errors with the following control variables: age, age-square, hours worked, couple status, gender dummy and proposed diary weights by MTUS. The child age groups are: Age1=0-4 years, Age2=5-11 years and Age3=12-17 years. The reference category for the level of education dummy variables is *Edu1*. *, ** and *** illustrates significant level at 10 %, 5% and 1%.

Table 8: Conditional differences for cognitive childcare by child age groups

Cognitive childcare

	France			Netherlands			Spain			UK			US		
	Age 1	**Age 2**	**Age 3**	**Age 1**	**Age 2**	**Age 3**	**Age 1**	**Age 2**	**Age 3**	**Age 1**	**Age 2**	**Age 3**	**Age 1**	**Age 2**	**Age 3**
Panel A: Parents full sample															
Edu2	0.10	2.98*	0.41	-1.01	1.83	-1.95	0.14	1.22	0.55***	0.01	1.34	2.00*	-2.31	1.68	0.44
Edu3	0.44	3.40*	3.18**	-1.55	0.43	-1.45	-0.08	3.87***	1.83***	0.11	3.25*	1.56	-2.07	2.05	0.72
OBS	620	627	923	581	399	574	1791	1909	2981	803	649	837	1658	1822	1646
Panel B: Mothers full sample															
Edu2	0.11	2.65	-0.12	-1.51	3.68*	-1.15	0.17	1.94	0.64***	-0.04	1.36	0.21	-0.90	2.70	-0.55
Edu3	0.81	3.81	3.56	-1.83	1.58	-1.45	-0.27	4.82**	1.29**	0.02	4.87*	2.38	-0.90	3.05	0.70
OBS	325	346	493	329	266	329	947	1057	1631	450	401	481	946	1162	992
Panel C: Fathers full sample															
Edu2	0.13	3.48***	1.13*	-0.53	8.254**	-1.40	0.07	0.08	0.34**	0.08	1.71	4.08	-3.62	-0.13	1.40
Edu3	0.02	2.71**	2.92**	-1.19	6.528**	-0.43	0.10	2.57	2.19***	0.29	0.10	0.41	-3.09	0.25	0.74
OBS	295	281	430	252	133	245	844	852	1350	353	248	356	712	660	654

Note: Table 8 shows the conditional differences by level of education for time spent on cognitive childcare activity for parents, mothers and fathers in all the selected countries. All time use measures are presented in minutes per day. Conditional differences reports the coefficients from an OLS regression with robust standard errors with the following control variables: age, age-square, hours worked, couple status, gender dummy and proposed diary weights by MTUS. The child age groups are: Age1=0-4 years, Age2=5-11 years and Age3=12-17 years. The reference category for the level of education dummy variables is *Edu1*. *, ** and *** illustrates significant level at 10 %, 5% and 1%.

included. Thus all the time investment on childcare is devoted to households with only one child. This is due to data restriction, time use diaries do not incorporate the time investment per child in a household with more than one child. If we include households with several children, there is no way to isolate the parental time investment to each child.[15] Table 7 and 8 present's results for all our individuals in each selected sampled country on the time investments by parents, mothers and fathers on cognitive and non-cognitive childcare for different child age cohorts. The tables illustrate the pattern that highly educated parents allocate more time towards the two different childcare activities compared to low educated parents, independent of the age of the child.

Table 8 shows that parents invest more time on cognitive childcare for children in the second age cohort (i.e. between 5-11 years old). For instance, when the child is between 5-11 years old, Spanish parents with a level of education above upper secondary school invest on average 3.87 minutes more per day on cognitive childcare compared to Spanish parents with uncompleted upper secondary school. However, Spanish high educated parents do not invest as much time on cognitive childcare for children between 0-4 years and 12-17 years old. Same pattern is seen for mothers' time investment , that time investment on cognitive childcare is higher in the second age cohort (5-11 years) compared to the first (0-4 years) and third (12-17 years) age cohorts.

Furthermore, the results from the age cohort tables show that more time is allocated to younger children's non-cognitive childcare activities. For instance, table 7 shows that US fathers with the highest level of education invest on average 46.67 (*Age 1*), 16.66 (*Age 2*) and 3.97 (*Age 3*) minutes more per day on non-cognitive childcare compared to American fathers with less than upper secondary school. This result is also consistent for parents (panel A) and mothers (panel B).

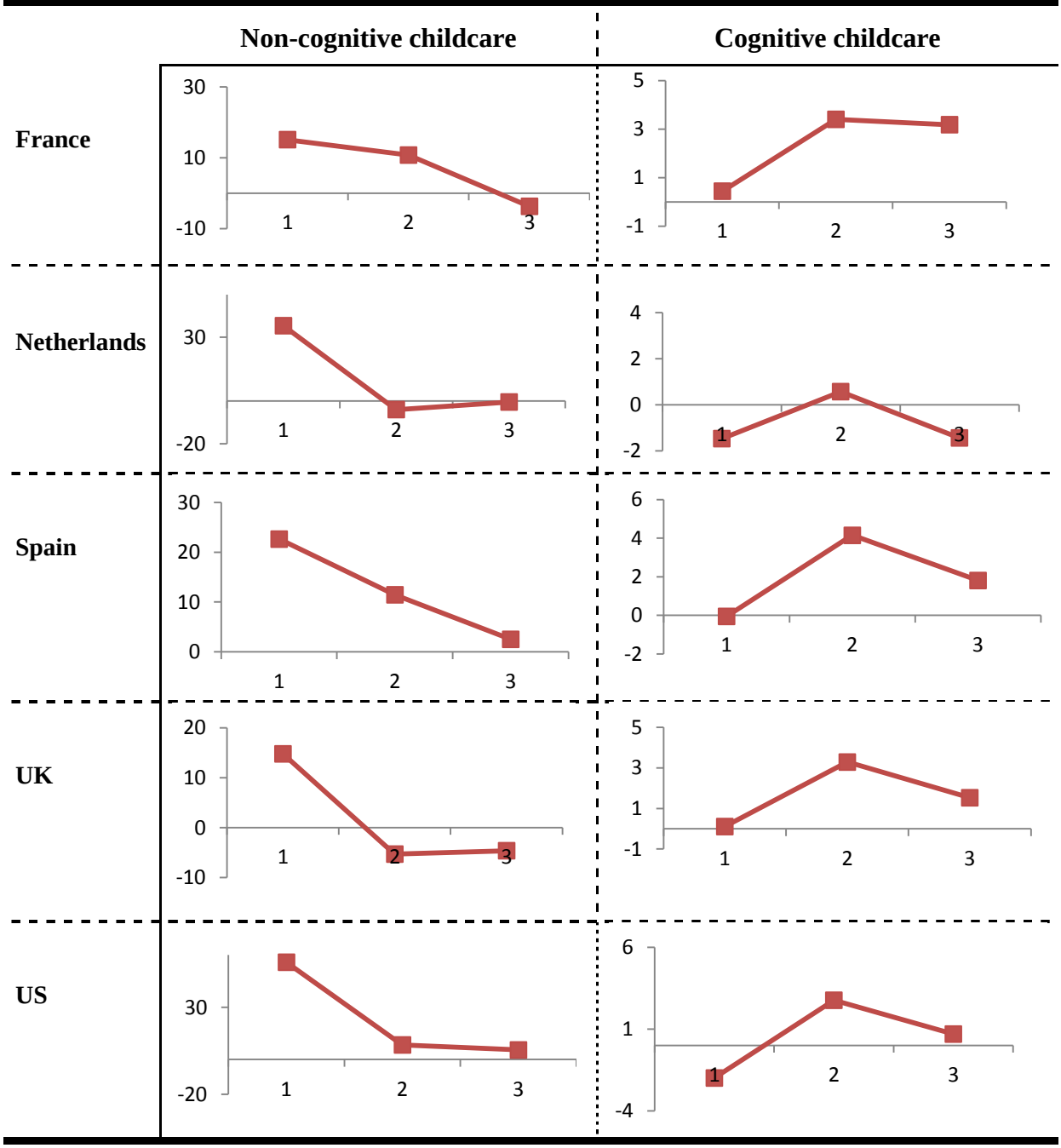
General patterns

The evidence presented so far indicates that there is a positive increasing educational gradient for time investment on childcare by parents, independent on the division of sample into mothers, fathers or parents (and controlled for labour market statues). The positive and increasing magnitude of the educational gradient for parents (independent of country) gives

15 There might be differences in household types between the three different age cohorts. For instance, even though currently there exist only one child in the household, the household might plan to have more children in the future, or the household might have had children that have left the nest.

empirical prominence to why the intergenerational transmissions of education are high, because high compared to low educated fathers and mothers increase their investment on both cognitive and non-cognitive childcare. In order to detect any systematic patterns we have plotted the point estimates for the highest educated in Parents full sample (panel A) from table 7 and 8.

Figure 1: Parental time investment as a function of the age of the child for US



Note: Figure 1 illustrates parents' time investment on cognitive and non-cognitive childcare as a function of the age of the child for parents with above upper secondary. The y-axel is time investment on childcare activities and the x-axel is the age of the child (*1=0-4 years, 2=5-11 years, 3=12-17 years*).

The results depicted in figure 1 seems to suggest the presence of a concave rather than linear time investment function when analyzing parents time investment on cognitive childcare by different age cohorts. During the early years of childhood very little time is invested on the different types of cognitive childcare activities. Moreover, it seems that more highly educated parents allocated less time on cognitive childcare when the child is between the age 0-4, compared to less educated parents. As the age of the child increases, more time is allocated towards cognitive childcare (i.e. a movement occurs along the function). However, during the child's adolescence period the time investment on cognitive childcare decreases. This may be due to two interacting reasons: 1.) upper secondary school is not mandatory and therefore not attended by every child. 2.) During adolescence, children begin to take decisions about their own usage and allocation of time and therefore parents are not necessarily the primary input when cognitive help is needed (Del Boca et al. 2012).

The findings also indicate that when dividing the sample into different age cohorts, there is also a non-linear pattern for non-cognitive childcare. It seems that as the age of the child increases, less time is allocated towards non-cognitive childcare (i.e. a movement along the function in figure 1). Two likely reasons behind this movement can be: 1.) during the early stages of childhood the child is totally dependent on the care that she receives from parents and 2.) as she grows up the child becomes more in control of her time usage. Once again the pattern of the intergenerational transmission of education and it being high is highlighted, independent of the division of sample or country.

Concluding remarks

Economic studies have focused on how cognitive skills affect labour market outcomes. However, recent literature has just begun investigating the effects of non-cognitive skills on labour market outcomes later on in life. These findings indicate that both cognitive and non-cognitive skills are important in explaining higher earnings and the success of the individual in the labour market.

Previous findings show that environment and nurture have a large effect on the skill formation of the child, in terms of cognitive or non-cognitive skills. We examine the time investment of the parents in the household, in order to detect patterns and associations in their investment on these two childcare activities. Our analysis is conditional on the educational

attainment of parents and for different child age cohorts using time use data from France, Netherlands, Spain, UK and US.

The results indicate that for the full sample (i.e. both working and non-working parents), there is a positive educational gradient with respect to time invested on cognitive and non-cognitive childcare. In other words, as the level of education increases, the time on both childcare activities increases. Furthermore, the educational gradient for non-cognitive childcare increases for each level of education, i.e. more time is invested on non-cognitive childcare. This result can be an indication of why the mobility of intergenerational transmission is low. Parents with higher education invest more on their child's human capital, which in turn leads to higher intergenerational transmissions.

Dividing the full sample into working and non-working parents, our results show that the slope of the educational gradient for non-cognitive childcare increases for working parents. This result indicates the low mobility of intergenerational transmissions: parents who are in the labour market invest more on non-cognitive childcare as their level of education increases. To conclude, for all countries and samples we can detect a strong pattern when it comes to how higher educated parents invest more on their children's non-cognitive childcare activities. This is also the case for the youngest child age cohort and the highest level of education, which is an indication that childcare activities should be considered in a multidimensional fashion.

Within the Beckerian perspective, our results imply that parents with higher educational levels invest more time in their child. This is especially interesting since this positive educational gradient for both cognitive and non-cognitive childcare is evidently independent of the parent's working status. In other words even parents with a higher opportunity cost of time (i.e. higher wage rates) allocate more time towards both cognitive and non-cognitive childcare activities, as compared to parents with a low opportunity cost of time.

The theoretical framework proposed by Becker and Tomes (1986), indicates that imperfect capital markets could be the reason for the high intergenerational transmissions in developed countries. Because, not every family have the same possibility to borrow financial capital for their child's human capital investment, due to credit constraints. The findings of this study indicate that, despite perfect capital markets, the intergenerational transmissions of education and income would still be high. The reason: parents with higher education are more inclined to invest time in their child's cognitive and non-cognitive skills.

The part of our results which indicates that parents' time investment in cognitive childcare seems to be a concave function of the age of the child, strengthens one of the

assumptions of the technology of skill formation, namely the one about critical time periods. It matters at which stage some investments are made in the child's human capital formation. The results of this paper seem to indicate that high educated parents increase their rate of investment in cognitive childcare when the child is between five and eleven years old.

The fact that parents' time investment on non-cognitive childcare is a decreasing function of the age of the child, supports Cunha and Heckman's argument that skill formation is highly sensitive to the timing of investment on children (i.e. during the early preschool period). The results of this paper show that high compared to low educated parents invest proportionally more on non-cognitive childcare when children are small. This indicates the strong pervious pattern that parents with a higher level of education allocate more of their time resource to the non-cognitive variable, which is in line with Cunha and Heckman's technology of skill formation.

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Appendix

Table A1: Education variable in detail

	Less than upper secondary (*Edu1*)	**Upper secondary (*Edu2*)**	**Over upper secondary (*Edu3*)**
France	0. Without a diploma	1. CEP, DFEO 2. BEPC 3. CAP, BEP	4. Bac technique 5. Bac general 6. Bac + 2 7. Superieur a Bac + 2
Netherlands	1. Only primary education 2. Lower levels of secondary education (1, 2 years)	3. Higher levels of secondary education (3,4 years) 4. Higher levels of secondary education (at least 5 years) 5. High school degree	6. Polytechnic level 7. University level
Spain	1. Illiterate 2. Less than 5 years in school 3. Attended school 5 or more years, no completed secondary education	4. Completed secondary education 5. High-school degree 6. Professional training, first Degree	7. Professional training, second degree 8. General degree 9. Bachelor's degree 10. Doctoral degree
UK	6. Qualification below GCSE/ O level, trade apprenticeships 12. No qualifications	3. A levels, vocational level 3 and equivalent (AS level, NVQ 3) 4. O levels, GCSE grade A-C, vocational level 2 and equivalent 5. GCSE below grade C, CSE, vocational level 1 and equivalent 7. Other qualification 8. Qualifications - but DK which 9. Qualifications - GCSE - but DK grade 10. Qualifications – City and Guilds - DK level 11. Qualifications - Other - but DK grade/level	1. Degree level qualification or above 2. Higher education below degree level (HNC, nursing qualification)
US	1. Grades 0-8 only 2. Grades 9-11 - not hs graduate	3. High school graduate	4. Some college 5. College graduate 6. Postgraduate

Note: Table A1 shows the underling groups for each level of education (*Edu1*, *Edu2* and *Edu3*) by country.

Table A2: Codes for Country Specific Original Time Diary Files

Codes for Country Specific Original Time Diary Files

Country	Cognitive childcare codes	Non-cognitive childcare codes
France	**420** - teach child with associative aim; **421** - supervise homework	**410** - Look after children with an associative aim; **411** - Look after children; **412** - Medical care to children away from home; **413** - Medical care to children at home; **422** - Conversations with the children; **423** - Indoor games, artistic and sport training; **424** - Outdoor games, promenade, sport training; **414** - Other activity on behalf of children
Netherlands	**220** - Help children with homework, assignments	**200** - Looking after, taking care of babies; **260** - Taking children to doctors, dentists etc.; **240** - Playing inside the home with children; **250** - Take walks, cycle, play outside with children
Spain	**421** - Help with homework	**411** - Care of infants; **412** - Care of older children; **413** - Medical care of children outside home; **414** - Medical care of children in the home; **577** - Help with childcare; **422** - talking with children; **423** - Playing with children; **424** - Outside plays and walks with children; **415** - Accompanying children; **416** - Visiting the school; **425** - Waiting associated to childcare
UK	**3820** - Teaching the child; **4272** - Teaching a child as help	**3800** - Unspecified childcare; **3810** - Unspecified physical care and supervision; **3811** - Feeding the child; **3819** - Other specified physical care; **4270** - Unspecified childcare as help; **4271** - Physical child care as help; **3830** - Playing and talking with child; **4273** - Talk to child as help; **3840** - Accompanying child; **3890** - Other specified childcare; **4274** - Accompany child as help; **4279** - Other specified childcare as help
US	**420** - play with/teach child with associative aim; **421** - supervise homework	**410** - Look after children with an associative aim; **411** - Look after children; **412** - Medical care to children away from home; **413** - Medical care to children at home; **422** - Conversations with the children; **423** - Indoor games, artistic and sport training; **424** - Outdoor games, promenade, sport training; **414** - Other activity on behalf of children

Note: http://www.timeuse.org/mtus/surveys

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