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Geary WP2017/03
January 12, 2017

Heterogeneity in Early Life Investments: A Longitudinal Analysis of Children's Time Use *

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January 2017

Abstract

Early life investments in children promote skills and capabilities, and subsequently influence a variety of health, social, and economic outcomes in later life. In this paper, we examine heterogeneity in children's time use using diary data from two waves of a nationally representative longitudinal cohort study. Children from disadvantaged households spend significantly less time reading and engaging in sport than their counterparts, and more time in unstructured activities and using media. Though gaps are relatively small at age 9, they widen considerably over time. At age 13, girls in households with low maternal education spend on average 6 minutes per day reading (95% CI 3-10) and 12 minutes per day in sport (95% CI 8-16), while girls in households with high maternal education spend 14 minutes reading (95% CI 11-17) and 27 minutes in sport (95% CI 23-31). Similar differences were found for boys. Using a decomposition analysis, we find that resources, preferences, initial endowments, and differential costs all play a role in explaining time use concentration across households, indicating that disadvantaged families may be constrained in how they choose their preferred time use options. Given the important role of extra-curricular activities in promoting cognitive and non-cognitive skill development, the systematic differences in time use we document in this paper are likely to contribute to cumulative disadvantage and widening skill gaps over adolescence and into adulthood.

Keywords: Time Use, Socioeconomic Differences, Early Life Conditions; Skill Development

JEL Classification: I30, J10, J22

* Preliminary. We are grateful to seminar participants at the UCD Geary Institute, the 2016 Growing Up in Ireland conference, and the 2016 Irish Economics and Psychology conference for comments.
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1 Introduction

How children spend their time has important implications for their cognitive and non-cognitive development. Activities pursued in one context, such as participating in team-based or other extra-curricular engagements, can contribute to the development of competencies in another, such as in school or the labour market. Sports and other prosocial activities promote positive development by creating opportunities for belonging, helping others, and skill building (Fredricks and Eccles 2006). Activities that children participate in, such as visiting museums or engaging in cultural events provide both direct and indirect learning opportunities (Bradley and Corwyn 2002). Other features of beneficial pastimes include fostering non-cognitive skills such as the ability to focus on tasks, the ability to work with others, self-regulation, and self-esteem (Posner and Vandell 1999).

Moreover, there is a literature which demonstrates that participation in extra-curricular activities in childhood is associated with adult outcomes. These findings are, in turn, consistent with research linking a wide range of health, social, and labour outcomes to cognitive and non-cognitive skills including educational attainment, alcohol and drug use, teenage pregnancy, incarceration, and wages (Heckman 2008). If there are differences in time use in childhood which affect skill development, we would expect to observe this association between activity participation in early life and later life outcomes. There are also other potential direct effects of children's time use on their current and subsequent wellbeing, particularly in relation to physical activity. Rates of childhood and adolescent obesity in high income countries have increased substantially over recent decades (Ng et al. 2014), as have rates of sedentary activity (Brownson et al. 2005). Participation in health-promoting activities and physical exercise in childhood may impact on adult health directly through reducing the risk of overweight and obesity (DeMattia et al. 2007), and indirectly by promoting transmission of these healthy behaviours and routines into later life (Perkins et al. 2004; Telama et al. 2005). Poor health in childhood, including overweight and obesity, has been found to predict poor health in adulthood as well as affect education and labour outcomes (Gortmaker et al. 1993; Black et al. 2007; Smith 2009; Delaney et al. 2011).

From an economics perspective, children's time use allocation can be viewed as the realisation of parents' decisions about when and where to invest in the human capital of their families (Leibowitz 1974). Under a production function framework for human capital where parents aim to maximise life cycle returns to them and their children (Becker and Tomes 1986), investment decisions regarding the allocation of resources to inputs and time use will be based on, amongst other factors, initial endowments. This framework can provide an insight into potential explanations for heterogeneous patterns of time use across families. For example, underlying ability and permanent family resources (in the presence of credit constraints) are both expected be to positively associated with parental investments. If the nature of the human capital production process is unknown, input decisions may also depend on beliefs about which types of investment are most likely to maximise returns. The cost of inputs (both in monetary and non-monetary terms) may also differ across families.

Evidence across a wide range of contexts shows inequalities in non-cognitive skills by socioeconomic status (SES) (Heckman 2008). Evidence from the US points to diverging trends in time spent in skill-promoting activities by parental education (Ramey and Ramey 2010; Altintas 2016; Putnam 2016). If time use differences are systematically associated with family background, differences in children's time use, particularly during non-school hours, is a potential contributor to the emergence and persistence of this inequality.

The empirical evidence does appear to support gradients in early life investments, which is policy relevant given that half of the inequality in lifetime earnings has been argued to be due to factors determined by age 18 (Heckman 2008). Depending on the mechanisms underlying systematic differences, social policies that enhance the resources available to disadvantaged families may reduce inequality in time use that are driven by income or cost constraints. Though there exists a wide range of literature describing heterogeneity in parental time use across family background (see for example Gustafsson and Kjulin 1994; Hallberg and Klevmarken 2003; Sayer et al. 2004; Guryan et al. 2008; Kalil et al. 2012; Fiorini and Keane 2014), there exists very little literature describing heterogeneity in children's time use. Parental time spent with children is an important input in its own right, yet an analysis that only considers

parental time use misses an important piece of the picture, that is, what children do outside of time spent with parents.

Therefore, an understanding of differences in how children's time use is allocated is important for informing our understanding of current and, potentially, future differences in wellbeing across groups. In this paper, we examine socioeconomic differences in time use among children in a longitudinal cohort in Ireland. We describe the extent to which children's time use varies across family background, as they grow from late childhood (age 9) to early adolescence (age 13).

We make a number of contributions to the literature. First, we use detailed time diary data from a nationally representative longitudinal panel of school children. Time diary data is more accurate than data derived from stylized survey questions on overall time spent in a particular activity (Kan and Pudney 2008). These data also capture all of a child's activities during a day, instead of focusing on a few particular categories. Thus, we are able to examine not only differences in time spent in one specific category of activities, but which activities are substituted for in their place. In addition, we are able to use the longitudinal nature of our data to analyse trajectories in time use as children age, including patterns of substitution within the same children over time. To the best of our knowledge, this is the first paper to analyse longitudinal changes in time use among children. Second, we investigate the association between SES and time use on both the extensive margin (participation in activities), and the intensive margin (length of participation). Third, we apply concentration curves to quantify the extent of the income-related inequality in time use and use decomposition analysis to investigate the factors that contribute to this inequality.

The rest of the paper is as follows: Section 2 reviews the economics and public health literature on the association between children's time allocation and outcomes. Section 3 provides a theoretical framework for understanding differences in time use. Section 4 discusses the data and our estimation strategy. Section 5 presents our results and Section 6 discusses the findings.

2 Literature

A large literature has linked participation in sports and clubs to positive educational and labour outcomes. Eccles et al. (2003) found that participation in sports, school-based leadership and spirit activities, and academic clubs was associated with an increased likelihood of being enrolled full-time in college at age 21, while participation in prosocial activities was associated with lower rates of alcohol and drug use. Applying individual fixed effects models to the National Education Longitudinal Study across three waves, Lipscomb (2007) found that involvement in either athletic or academic clubs is associated with a 5 percent increase in Bachelor's degree attainment expectation. Using an IV strategy exploiting change in female athletic participation due to Title IX legislation in the United States, Stevenson (2010) found that a 10 percentage point rise in state-level female sports participation generates a 1 percentage point increase in female college attendance and a 1 to 2 percentage point rise in female labour force participation. Pfeifer and Cornelißen (2010) also found that even after controlling for important variables and selection into sport, the effect of sport on educational attainment is statistically significant and positive, with a bigger effect for women. Similarly, using longitudinal data from two different nationally representative sources, Barron et al. (2000) found that athletic participation contributes to productivity beyond that of other types of extracurricular activities: wages are higher by between 4.2% (National Longitudinal Study of the High School Class of 1972) and 14.8% (National Longitudinal Survey of Youth) if athletic participation in high school is chosen in place of other activities.

Participation in sport and other stimulating activities also has important long-term health effects. A study tracking a cohort of Finish children for 21 years found that high levels of physical activity at ages 9 to 12, especially when continuous, significantly predicted a high level of adult physical activity (Telama et al. 2005). A longitudinal study of respondents at ages 12, 17, and 25 found that childhood sports participation significantly predicted adulthood sports participation and physical fitness (Perkins et al. 2004). Evidence from a randomized trial shows that children exposed to stimulating early environments emphasizing development of language, emotional regulation, and cognitive skills have significantly lower prevalence of risk factors for cardiovascular and metabolic diseases in their mid-30s (Campbell et al. 2014).

Time use in other areas is also important for cognitive development. Fiorini (2010) found that computer time at age 5 positively impacts test scores at age 7; the effect is larger than that of time spent in child care. Conversely, time spent watching television or playing video games has a negative effect on test scores. Using the same data, Fiorini and Keane (2014) found that time spent in educational activities including reading a story, being talked to, or helping with chores, particularly when done with parents, is the most productive input for cognitive skill development. They find that a reallocation away from sleep, general care, or after school care to that of educational activities would have a positive effect on skills comparable to that of increasing parental education (Fiorini and Keane 2014).

Finally, unstructured time may have benefits for physical activity as well as development of self-esteem and resilience. Independent mobility is associated with increases in physical activity for 10-12 year olds (Wen et al. 2009; Page et al. 2010). A lack of experience of autonomy and independence in childhood may contribute to a lack of self-confidence and self-esteem, anxiety during transitions, and reduced social competence in young adulthood (Lang and Deitz 1990; Malone 2007). Exposure to risks and challenges without adult supervision may build problem solving skills and resilience (Malone 2007). Unstructured social activities may promote self-discovery and personal expressiveness with peers (Coatsworth et al. 2005). However, little empirical work has investigated the extent to which unstructured time benefits child development.

3 Theoretical Framework

Following Becker and Tomes (1986), we consider a two period setup where adult earnings at time t, (Y_t), are a function of adult human capital (H_t):

$$Y_t = f(H_t) \tag{1}$$

Adult human capital depends on a vector of determinants formed in childhood (period $t-1$), as well as initial endowments (γ):

$$H_t = \emptyset\,(X_{t-1}, \gamma_t) \tag{2}$$

With $\frac{\partial H_t}{\partial X_{t-1}}$ and $\frac{\partial H_t}{\partial \gamma_t}$ both > 0. Here we focus on parental investments (X), however in reality these determinants may include factors such as public expenditure, and, for example, macroeconomic environment. We expect there to be cross-complementarities (Cunha and Heckman 2007), in that higher initial ability is likely to raise the effectiveness of parental investments:

$$\frac{\partial^2 H_t}{\partial X_{t-1} \partial \gamma_t} > 0 \tag{3}$$

In the absence of credit constraints, we would expect parents to be able to borrow against future earnings of their children, and any intergenerational correlation between the human capital of parents and children would operate solely through transmission of initial endowments. Consider instead the following simple example where households (k) operate according to a budget constraint dependant on current income (i.e. they are unable to borrow), and where parental utility depends solely and linearly on the adult earnings of their children in period t, with earnings also being a linear function of human capital. Then parents will choose investments in their children to maximise:

$$Max\ U_t = \emptyset_k(X_{t-1}, \gamma_t) \tag{4}$$

Subject to:

$$M_{t-1} = \sum_{i=i}^{I} p_{i,k}\,(X_i) * X_{i,t-1} \tag{5}$$

Where M_{t-1} is household income during the childhood period, and $p_{i,k}\,(X)$ is the price associated with a given parental investment X_i for family k. In this framework, prices are heterogeneous across families, reflecting differential access to services or facilities, or barriers due to factors such as location or social norms. In addition, the nature of the human capital production function is uncertain, and parents are required to make their best guess (E_k) as to how investments interact with endowments to make up future

human capital and thus earnings, $\emptyset_k(X_{t-1}, \gamma_t) = E_k\big(\emptyset(X_{t-1}, \gamma_t)\big)$. Under homogenous prices and a known production function, we would expect human capital investments to depend positively on household income (M_{t-1}), and initial endowments (γ_t). However, as we describe below, we expect heterogeneity in prices and human capital expectations to be systematically associated with family background, and therefore the choice of X_{t-1} to also depend on their determinants. While the goal of this paper is not to parameterise the relevant utility function, we do have evidence from the empirical literature as to the predictors of $E_k()$ and $p_{i,k}()$, including, for example, marital instability, reduced social capital, and differing beliefs about later life returns to parental investments (Kalil et al. 2012). Combined with the simple framework outlined above, we can therefore make a number of observations regarding the potential determinants of children's time use heterogeneity.

First, SES differences in time use may arise as a result of a lack of resources (M_{t-1}). Children from financially disadvantaged families are less likely to have access to material and cultural resources from infancy to adolescence (Bradley and Corwyn 2002). For example, the direct costs of extra-curricular activity participation are estimated at $1,600 per annum for a family of two children in the US (Putnam 2016). Moreover, low-income parents may need to work longer hours to earn enough to sustain their households. Kalenkoski et al. (2009) find that time spent in child care is responsive to income: increases in partners' wages increase women's primary child care time and decrease work time on all days, while increases in women's wages increase their partners' passive child care time and decrease work time on weekends. An analysis of allocation of parental time in Switzerland found that an increase in hourly wage decreases the amount of time allocated to housework and increases the amount of time allocated to childcare (Sousa-Poza et al. 2001). This suggests that at least some of the differences in parental time with children is due to resource constraints. Resources at the neighbourhood level may also influence children's health, behaviour, and educational achievement (Kling et al. 2007; Doyle et al. 2012).

Second, in terms of initial endowments, γ_t, factors such as birth weight are strongly patterned by SES (McGovern 2013). Although it can be difficult to separate out initial ability from parental responses as children age, it has been well established that gaps in

cognitive ability appear very early in life (Heckman and Masterov 2007). Therefore, we would expect part of the SES differences in time use to be explained by differences in initial endowments.

Third, the cost of engaging in a given activity, $p_{i,k}()$, may depend on geographic location, such as proximity to amenities, as well as the opportunity cost. For example, higher SES mothers are more likely to have flexible work schedules or spouses who are more involved in child rearing (Heckman 2008; Kalil et al. 2012). Low-income parents are more likely to have inflexible and atypical (late, rotating, or weekend) work schedules; in the US this disparity has been increasing since the 1970s (Hamermesh 2002). Previous research has found that while number of hours worked generally exerts a negative effect on parental time with children, the negative impact of hours worked in the evening (between 6pm and 10pm) is twice as large as daytime work hours (Rapoport and Le Bourdais 2008).

Finally, beliefs, $E_k()$, for example in the form of theories of parenting, may differ across SES. For example, highly educated parents may "concertedly cultivate" their children's development in order to maximize their children's future opportunities, for example, through monitoring their after-school and weekend activities, using more frequent and higher quality cognitively stimulating parenting practices, and leveraging their social capital to advocate for their children in school (Lareau 2003; Kalil et al. 2012; Harding et al. 2015). Conversely, lower educated parents may follow the parenting model of "accomplishment of natural growth", which allows children to be more independent and learn to make their own decisions about their use of time. Kalil et al. (2012) show that compared to less educated mothers, more educated mothers invest more time in basic care and play with children under 6 years of age, and more time in management of activities (such as scheduling and monitoring enriching extracurricular activities) for children aged 6 to 13. Evidence from the United States shows that highly educated parents tend to engage in more activities with their children and monitor their activities closely (Bianchi et al. 2006). Guryan et al. (2008) find that both within and across countries, higher parental education is associated with more parental time spent with children. Sayer et al. (2004) demonstrate similar results across 4 countries despite substantial cross-national variation in levels of economic support and services for

families, suggesting that better educated mothers may have different parental values and behaviours than less educated mothers. Gimenez-Nadal and Molina (2013) find similar results in the UK and Spain, concluding that maternal education is the most important factor determining parental time devoted to educational childcare. Finally, in the UK, Delaney and Doyle (2012) present evidence that time preferences differ across SES, as measured by traits such as hyperactivity, impulsivity and persistence, and that they are transmitted through parents' non-cognitive skills such as self-esteem and attachment, as well as through parental time investments such as time spent reading to the child and teaching the child.

In the remainder of the paper, we first focus on describing these SES differences in time use, and then return to evaluating the potential contribution of each of the four factors described in this framework in **Section 5.4**.

4 Data and Methods

4.1 Data

We use data from the Growing Up in Ireland (GUI) survey, a nationally representative longitudinal study of two cohorts (one of infants and one of children). We use the children's cohort, which first recruited and interviewed 8,568 nine-year-olds and their families in 2007/2008. A two-stage design was adopted that initially sampled primary schools, and subsequently, children within those schools. The second round of interviews occurred 4 years later, when 7,535 participants were successfully contacted at age 13.

Both waves of the GUI child cohort included a Time Use Diary (TUD), which recorded details on the activities of participants over a 24-hour period, dividing the day and night into 15-minute intervals. In the first wave, parents were asked to complete the diary with their children (if possible); at the second wave, the 13-year-old children were asked to complete the diary with the help of their parents (if necessary).

There were 22 pre-coded activities in wave 1 and up to five activities could be recorded concurrently. In wave 2, there were 21 pre-coded activities (and 4 spaces for specifying 'other' activities), and up to 3 activities could be recorded concurrently. Respondents were not asked to prioritise concurrent activities. However, only 1% of time slots had concurrent activities (3% of the after-school hours of 2pm to 9pm); therefore, we only

use data on the first activity recorded. The lists of possible activities were not the same across the two waves, therefore in order to compare time use at ages 9 and 13 we consolidate the activities into 12 categories: sleeping, care (which includes eating, traveling, and personal care), school, homework, sport/exercise, playing/unstructured time, leisure (hobbies and music lessons), media (which includes watching TV and videos, using the computer/internet, using phones and social media, and listening to music), reading for pleasure, housework, family time (which includes shopping trips and outings), and other. A summary of these categories is shown in **Table 1**.

Not all respondents completed the TUD: in wave 1 6,228 (72.6%) returned usable diaries and in wave 2 the corresponding number was 5,023 (67% of whom had also completed the TUD in wave 1). Response rates for TUD depended on a number of characteristics. Households were more likely to reply if the primary caregiver (usually the mother) was older, not employed, more educated, and owned their home. To adjust for this, survey weights were provided to ensure that the sub-sample of TUD respondents remained nationally representative (Quail and Williams 2013; Quail and Williams 2015). **Table 2** demonstrates that the weighted characteristics of the TUD respondents matches those of the main sample. We use these weights as part of all our analyses. Throughout the paper, we define a child's mother as a female parent or step parent living in the household, regardless of marital or biological status. We also drop the children whose mothers are not found in the household (1.2% of all observations).

As with the main family-based survey interviews, TUD data was collected throughout the year from August 2007 to July 2008 for wave 1, and from August 2011 to April 2012 for wave 2. Respondents were instructed as to what day of the week they were supposed to complete the diary so as to distribute respondent days across the week. Respondents indicated if they completed the diary during the diary data, at the end of the diary day, the day after the diary day, or another day. They also indicated whether the diary day was during the school term or out of term. Finally, they indicated what type of day it was. In wave 1, respondents indicated whether it was an "ordinary day", a school holiday, a day when the child was ill, and 7 other categories. In wave 2, these categories were consolidated into school day, holiday, or a day when a crisis occurred. The majority of respondents indicated it was an "ordinary day" in wave 1, and a school day in wave 2. Information on when and how the TUD was completed is provided in

Table A1 in the appendix. We adjust for these details in our analyses. In order to compare participants' activities on similar days, we subset our data to only those participants who completed a questionnaire on a weekday, during the term time, and on an "ordinary day" in wave 1 and a school day in wave 2, although we also consider the full sample as an robustness check. **Appendix Figure A1** shows the construction of the analysis dataset.

Table 1 Categorization of wave 1 and wave 2 activities

Category	Wave 1	Wave 2
Sleeping	*Sleeping *Resting/relaxing	*Sleeping/Resting
Care	*Personal care *Eating/drinking/having a meal *Traveling to and from school *Other traveling	*Personal care or getting ready *Eating *Traveling
School	*At school	*At school
Homework	*Homework	*Doing homework or study
Sport	*Physical play/exercise/sports	*Playing sport or doing physical exercise
Playing/ Unstructured time	*Playing board games, cards, etc *General play	*Just hanging around with friends *Playing with or exercising a pet
Leisure	*Hobbies and other leisure activities	*Music Lessons (or practicing music), drama, classes *Hobbies and other leisure activities
Media	*Computer/internet/playstation/xbox *Email/bebo/msn/texting/on the phone *Watching tv and videos/dvds etc	*Using the internet/emailing *Playing computer games *Talking on the phone or texting *Watching tv, films, videos, or dvds *Listening to music
Reading	*Reading books, comics, magazines	*Reading for pleasure or interest
Housework	*Household chores/housework	*Housework
Family	*Visits to relative's house for purposes other than play *On a family outing *On a shopping trip	*Spending time with family *On an outing *Out shopping to buy things
Other	*Religious activity *Not sure/missing	*Other (religious activity, medical appointment, babysitting, GUI activity) *Don't know/missing

Table 2 Distribution of wave 1 characteristics by sample

	Category	Full survey sample[a] N=8,568 (%)	TUD analysis sample[b] N=5,394 (%)
Household Income Quintile	Lowest	18.6	17
	2nd	18.8	19.3
	3rd	18.8	19.1
	4th	18.6	19.4
	Highest	18.7	19.1
	Missing	6.5	6.1
Mother's Education	Less than Secondary	29.7	29.6
	Secondary	36.4	37.6
	More than secondary	32.4	32.7
	Not in household	1.5	0
Mother's Age	39 or less	49.7	48.7
	40-49	45.9	48.6
	50 and over	2.9	2.7
	Not in household	1.5	0
Mother's Marital Status	Not married	16.7	16
	Married	81.9	84
	Not in household	1.5	0
Number of People in Household	2	3.3	3.6
	3	10.3	9.6
	4	29.9	29.5
	5	31.6	33.8
	6	16.2	15.8
	7 or more	8.7	7.7
Gender	Male	51.1	52.2
	Female	48.9	47.8
Region	Urban	44.7	41.7
	Rural	55.1	58.3
	Missing	0.2	0.1

Notes: TUD=Time Use Diary**.** "Married" indicates married or living together. Household income is equivalised by household size. [a]Weighted with original GUI sample weights. [b]Weighted with GUI time use sample weights from wave 1.

4.2 Descriptive Statistics

Before applying more formal analysis, we begin by describing the basic patterns underlying how children spend their time. Throughout the paper, we stratify by gender and age to allow for differential time use in boys and girls in each wave. **Figures 1 and 2** show the proportion of girls and boys that engage in activities from 2pm to 10pm, respectively. For 13 year olds, the school day ends at about 4pm for the majority of students. The immediate after-school period is often spent doing homework. The increase in the proportion of all children engaging in care at 6pm is most likely the consumption of an evening meal, although this is less pronounced for 13-year-old boys. From about 6pm onwards for both boys and girls, time is spent using media, doing sport, playing, with family, and doing care related activities (eating, traveling, or personal care). At both ages 9 and 13, a larger proportion of boys engage in sport than girls. Few 13-year-olds spend time during the week reading for pleasure. Compared to 9-year-olds, 13-year-olds end school later in the day (as expected). In addition, they go to sleep later in the evening, and are less likely to engage in sport and reading. In contrast, 13-year-olds are more likely to engage in homework, media, and family activities. **Table A2** in the appendix gives the mean time spent in all activities by gender and wave.

As we have described in the introduction, a novel feature of the data is that we are able to track children longitudinally as they age. For example, we can establish for every child, whether they are participating in the same activity at each point in the day at age 13 as they were at age 9. To describe these patterns, we construct a summary measure of substitutions, which we define as the average number of minutes that are transferred from an activity in wave 1 to another activity in the same time slot in wave 2. These substitutions refer exclusively to how the *same child* changed their time use as they aged, as opposed to differences in average cohort time use (therefore information on children who were only present in a single wave is not used). To summarize this information, we sum over each child (c), time slot (t), and activity (a), the number of minutes per day transferred from one activity to each of the other activities (Eq. 6).

$$Sub_{a_{ij}} = \frac{15}{N} * \left(\sum_{c=1}^{N} \sum_{t=1}^{T} \sum_{i=1}^{12} \sum_{j=1}^{11} I(a_{c,t,i,wave=1} = a_{c,t,j,wave=2}) \right) \forall i \neq j \qquad (6)$$

Here, $a_{c,t,i,wave=1}$ is activity i for child c in timeslot t in wave 1, $a_{c,t,j,wave=2}$ is activity j in the corresponding timeslot for the same child in wave 2, and $I()$ is the indicator function, evaluating whether these activities are the same. We multiply by 15 because the time slots are in 15 minute intervals. N =1,585, the total number of children present in both wave 1 and wave 2, and $T = 98$, the total number of 15-minute timeslots in a day. We report the net figures between activities, e.g. 10 minutes transferred from homework to reading and 5 minutes transferred from reading to homework results in an overall 5 minutes transferred from homework to reading. This measure is shown for all activities in matrix form as **Table A5** in the appendix, and summarised in **Figure 3** as a chord diagram. We present data for boys and girls combined as the gender-stratified patterns are similar. In this graph, the arrows indicate the direction of the substitution from one activity to another, with the size of the arrows giving the average number of minutes moved per day. The numbers around the outside give the total inflow and outflow of minutes for each activity. Note that most activities have both inflows and outflows. An exception is sleep, for which all of the total change in minutes of 100 per day is an outflow, the largest fraction of which (around 30 minutes) goes to additional care time. However, it appears that a very similar amount of time is moved from care to school, indicating that children are ultimately substituting sleep time with school. In addition, we find that reading minutes flow to many other activities, but the largest outflow is to media. For sport, the largest outflow is to homework, followed by school, family, media, playing, and care.

Next we establish whether there are any differences by family background in the raw data on activity participation. **Figure 4** shows the difference in the proportion of girls aged 13 engaging in after school activities by maternal education (the proportion of girls engaging in an activity whose mothers had completed more than secondary education minus the proportion of girls engaging in an activity whose mothers had completed less than secondary education). For example, the graph on the left shows that girls in households with high maternal education are more likely to participate in sport at all times after school compared to girls in households with low maternal education. Around 4pm, the difference in participation rates is over 5 percentage points. Conversely, girls in households with low maternal education are much more likely to be

participating in play - unstructured activities such as “hanging out with friends” - during the after-school hours of between 4pm and 10pm. The graph on the right shows that girls whose mothers have higher education are more likely to participate in homework activities around 6pm, although somewhat less likely to do so before and after. In contrast, they are less likely to engage with media. As shown in **Figure 5**, boys exhibit a broadly similar pattern.

Further details are given in the appendix. We examine differences in minutes spent by maternal education in **Tables A3** and **A4**. Though gaps are relatively small at age 9, they widen considerably over time. At age 13, girls in households with low maternal education spend on average 6 minutes per day reading (95% CI 3-10) and 12 minutes per day in sport (95% CI 8-16), while girls in households with high maternal education spend 14 minutes reading (95% CI 11-17) and 27 minutes in sport (95% CI 23-31). Similar differences are found for boys. **Figures A2 and A3** show the raw participation rates (as opposed to the differences shown below) by maternal education. We also examine differences in minutes spent by maternal education in **Figures A4 to A9.** Given that the heterogeneity in time use is clear from the descriptive statistics, we apply a more formal analysis in the following section.

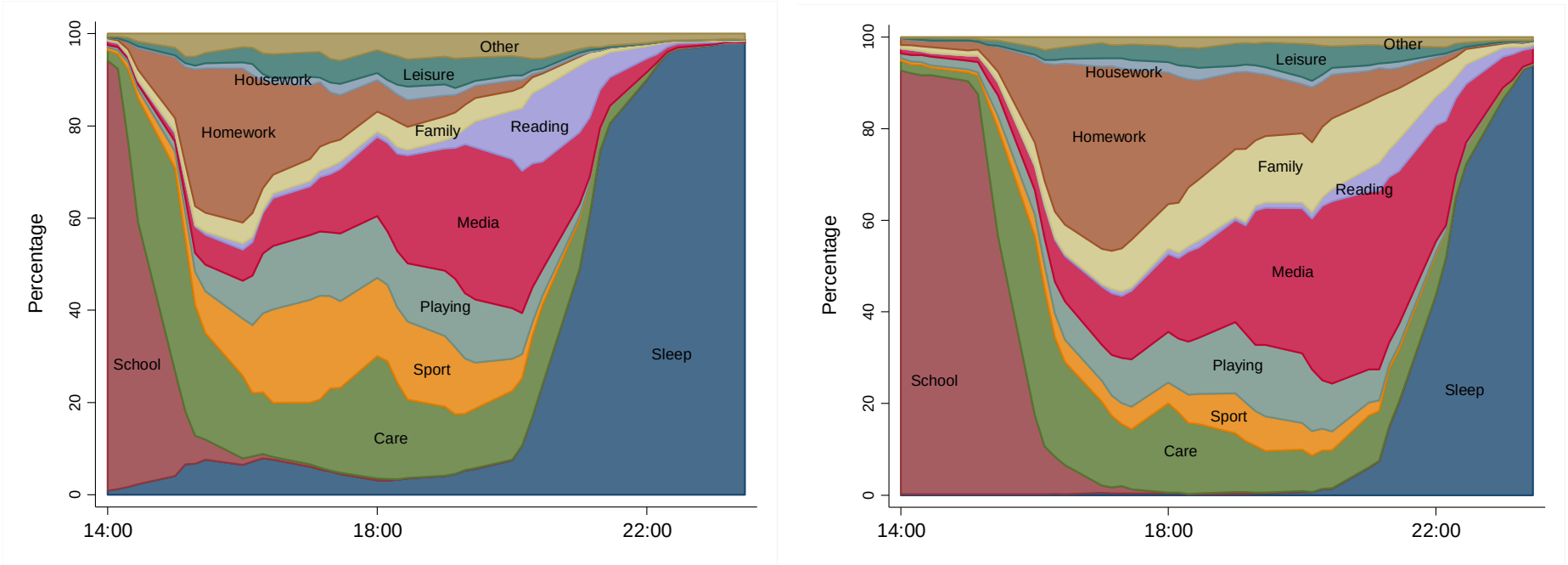

Fig. 1 Percentage of girls participating in after-school activities at age 9 (left) and age 13 (right)

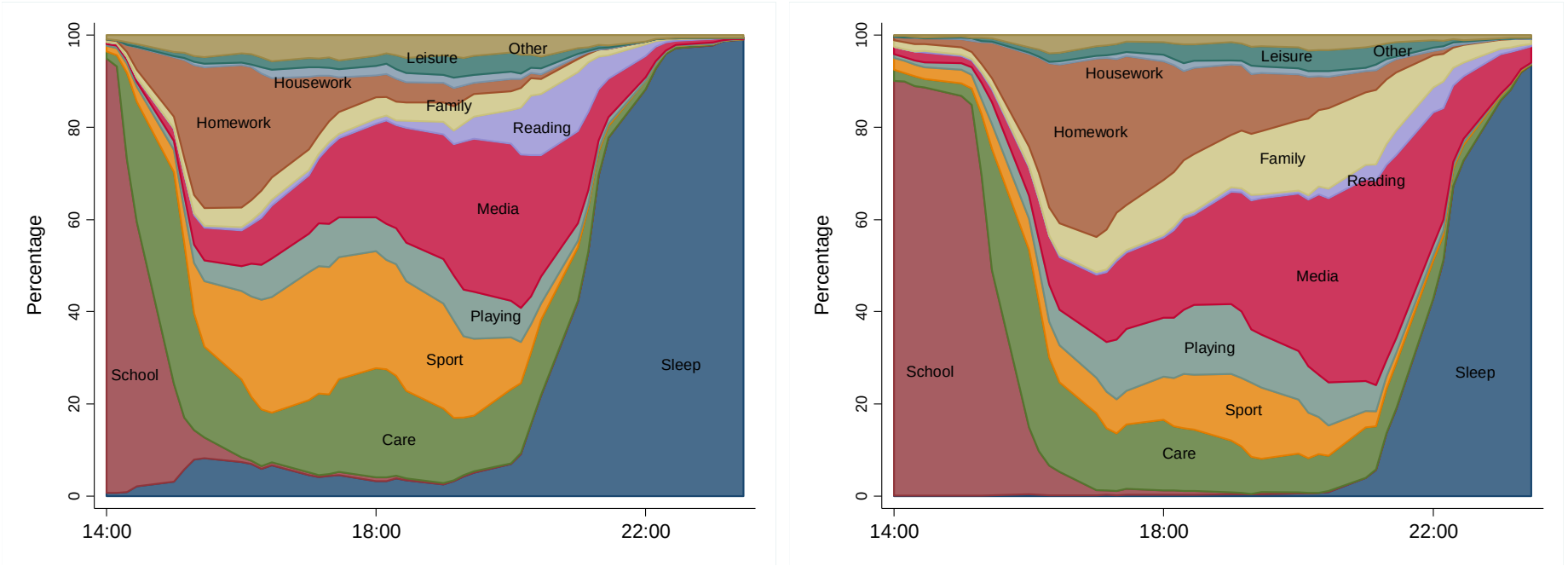

Fig. 2 Percentage of boys participating in after-school activities at age 9 (left) and age 13 (right)

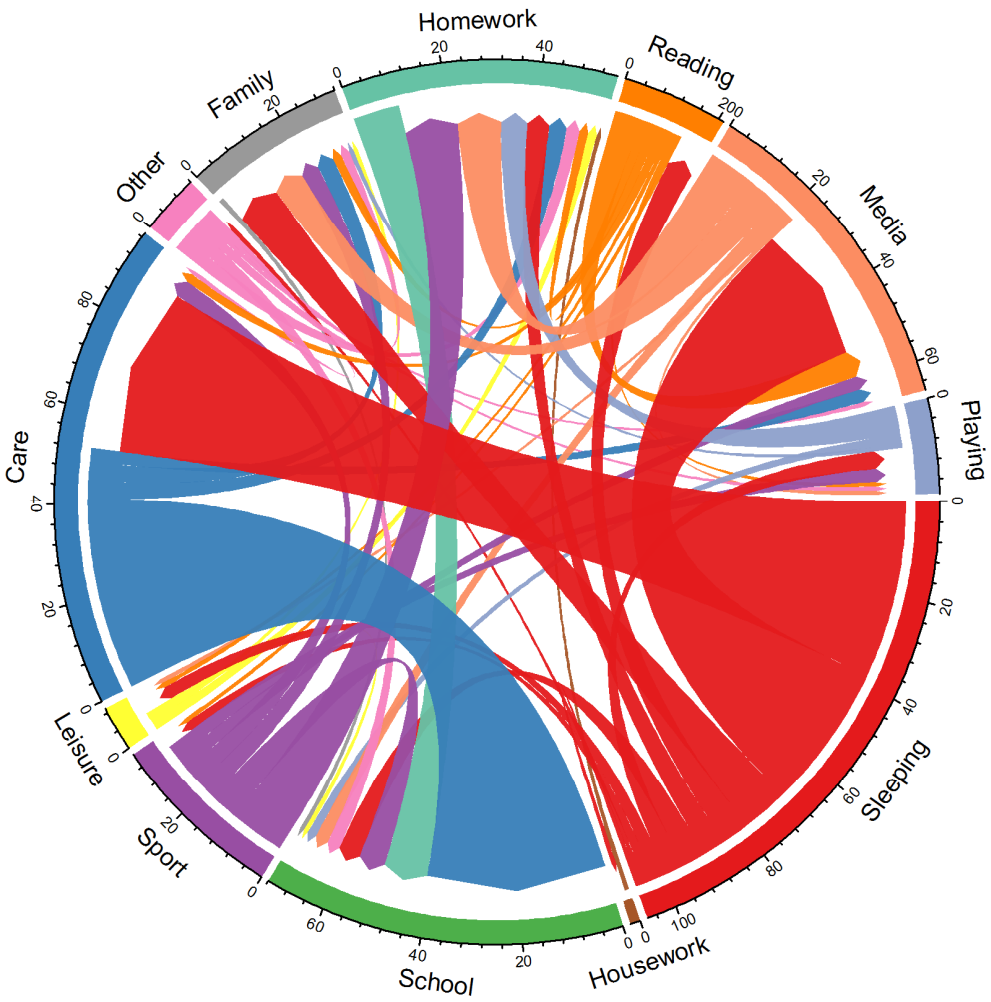

Fig. 3 Chord diagram of substitution patterns from age 9 to age 13

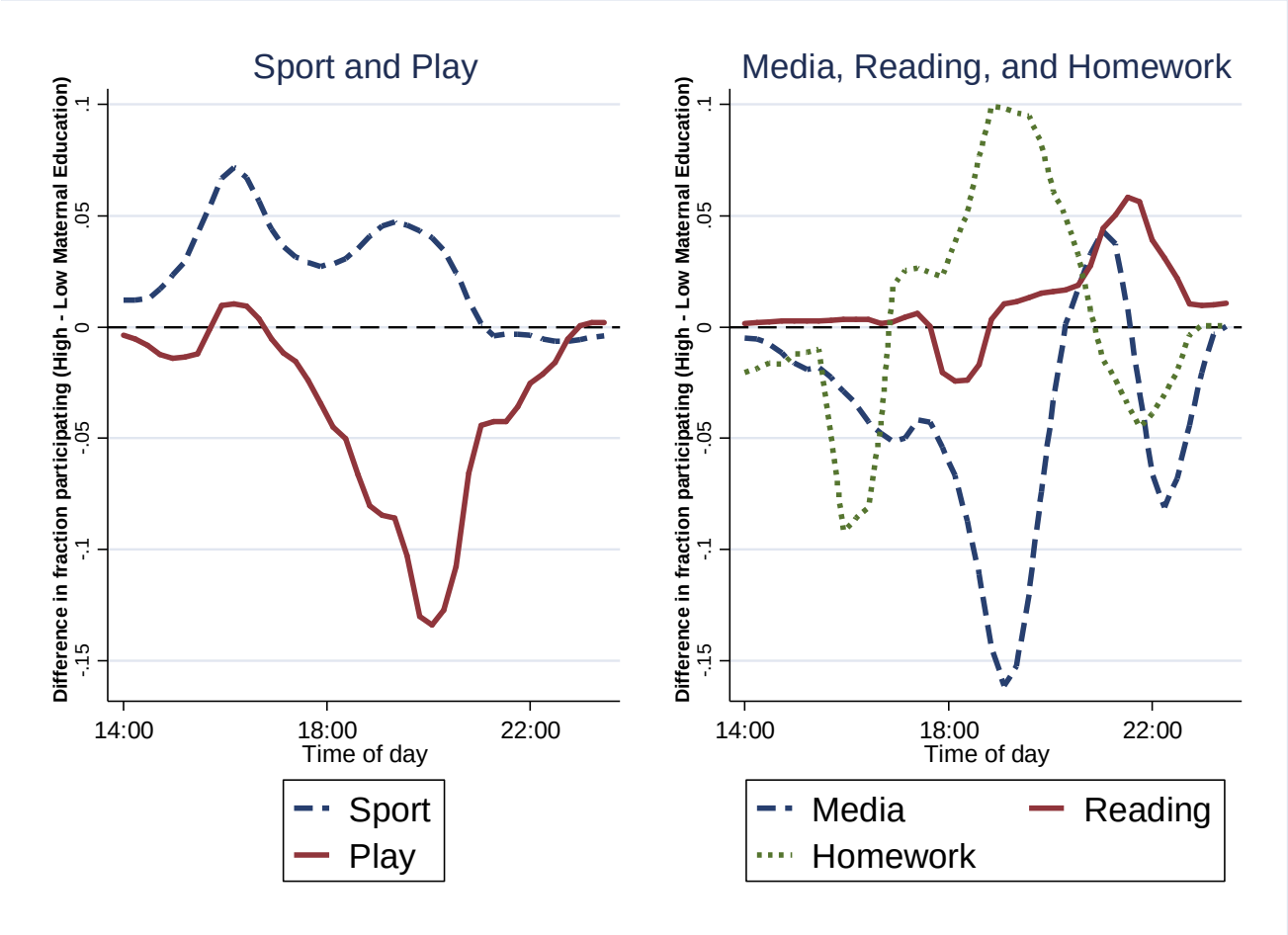

Fig. 4 Differences in girls' participation in after-school activities by maternal education at age 13

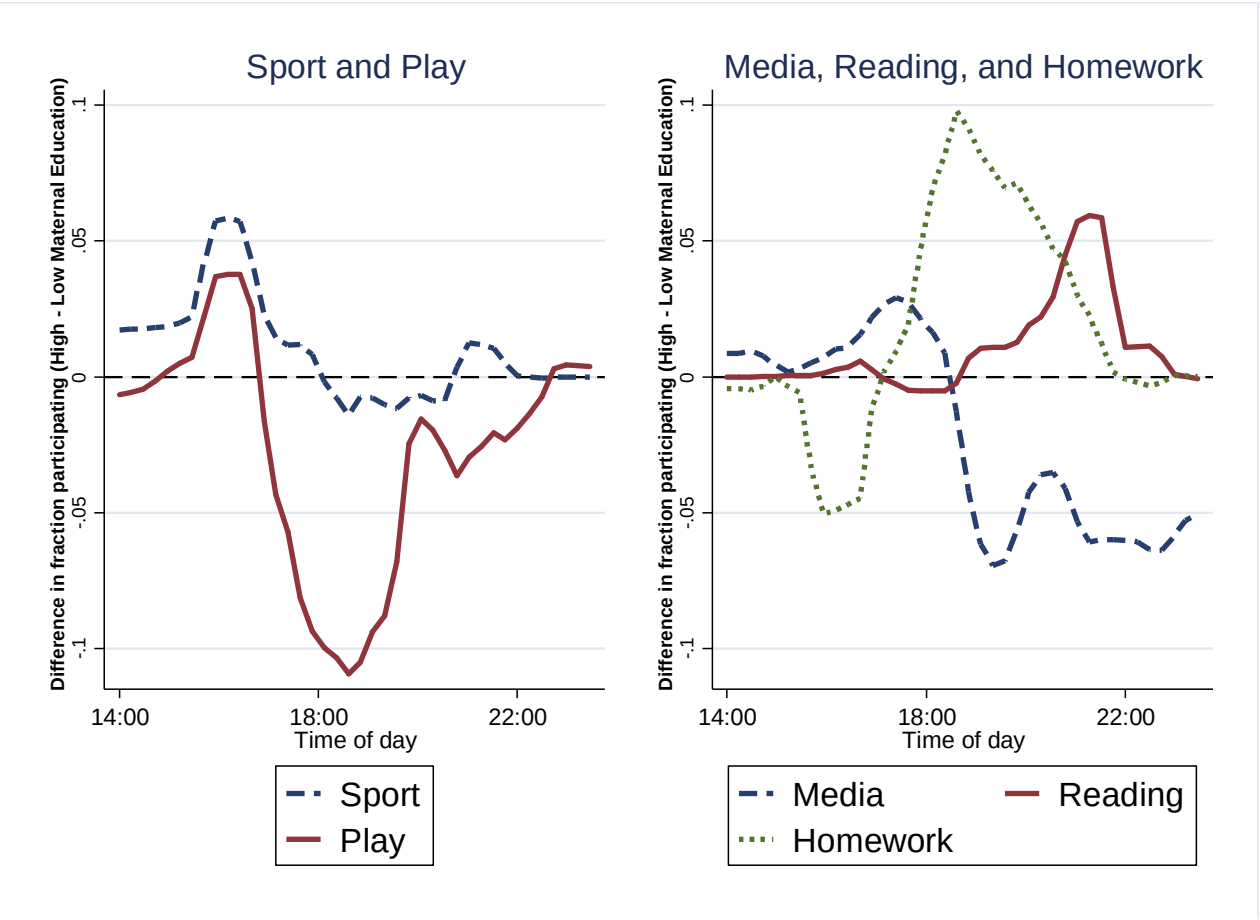

Fig. 5 Differences in boys' participation in after-school activities by maternal education at age 13

4.3 Modelling Heterogeneity in Children's Time Use: Empirical strategy

The data allow us to consider heterogeneity in time use on both the extensive and the intensive margin. We begin by examining SES differences in time use on the extensive margin, focusing on maternal education. We apply both logistic regression models and linear regression models, with standard errors clustered at the child level. We present results from weighted pooled models; however random effects estimates are very similar (available on request). Since we are interested in describing differences at each time point, and not only the change across waves, we do not consider fixed effect models, which would also have the disadvantage of relying on the subset of individuals present in both waves and who exhibited a change in maternal education. In this setup, the outcome is a binary indicator for any time spent in a particular activity (sport, reading, playing, media, and homework). We include an interaction between SES (as measured by mother's education) for child c in period t and an indicator for wave, and also control for TUD characteristics (day of week, month of year, who completed diary, and when it was completed) in ω_{ct}. The specification for the linear model is shown below. The remaining models also employ the same covariate specification, but vary according to the outcome and/or the link function (Eq. 7).

$$Participation_{ct} = Wave_{ct} + SES_{ct} + Wave * SES_{ct} + \omega_{ct}\beta + \varepsilon_{ct} \qquad (7)$$

We then examine socioeconomic heterogeneity in time use on the intensive margin, again focusing on heterogeneity by maternal education. We apply generalized linear negative binomial models with a log-link as well as linear regression models, each with clustered standard errors. The outcome is the number of minutes spent in a particular activity and the right hand side of the models is the same as above. We use generalized linear modelling (GLM) instead of a two-part model because the negative binomial accounts for over-dispersion whilst allowing for more straightforward interpretation of coefficients without the requirement of splitting the sample. Previous research has found very little difference in performance between GLM and two-part models (Buntin and Zaslavsky 2004). Moreover, we present separate results for participation.

Next, we use concentration curves to assess the degree of income-related inequality in the distribution of children's time use. The curves show the relationship between the cumulative share of equivalised household income and the cumulative share of time spent in a particular activity. The concentration index (C) is calculated as twice the area between the concentration curve and the 45 degree line of equality. This is the standard approach in the literature on assessing the extent of inequality in a continuous outcome, and has been used previously in a number of different contexts, including obesity (Walsh and Cullinan 2015), vaccination (Doherty et al. 2014), health in older populations (McGovern 2014), access to healthcare services (Layte and Nolan 2014), and child height-for-age (Wagstaff et al. 2003). In this paper, we derive concentration curves for reading and sports time.

Eq. 8 defines the concentration index as,

$$C = 1 - 2\int_0^1 L_h(p)dp \tag{8}$$

Where $L_h(p)$ is the concentration curve at percent of the population p. The concentration index is bounded between [-1, +1], with zero indicating perfect equality. A positive value indicates that lower income households receive less than their expected share of the minutes in each activity, while a negative value indicates they receive more than their expected share.

Finally, we conduct a decomposition analysis to examine the factors that underpin the observed inequalities in time use. Eq. 9 shows a linear regression model:

$$y = \alpha + \sum_{v=1}^{V} \beta_v x_v + \varepsilon \tag{9}$$

where y is the number of minutes spent in a particular activity and x_v are independent regressors. The concentration index for y can be decomposed into a weighted sum of the concentration index of the v regressors (O'Donnell et al. 2008), where the weight is the elasticity of y with respect to x_v and μ is the mean of y (Eq. 10):

$$C = \sum_{v=1}^{V} \frac{\beta_v \bar{x}_v}{\mu} C_v + \frac{GC_v}{\mu} \tag{10}$$

The last term is the residual, the unexplained inequality.

For this decomposition analysis, we focus on the concentration indices at age 13 and the factors identified in the theoretical model, namely resources, preferences and beliefs, initial endowments, and costs. We measure resource constraints using income ($M_{t-1} = f(equivalised\ household\ income)$); preferences and beliefs using education ($E_k = f(maternal\ education)$); initial endowments using test scores at age 9 ($\gamma_t = f(reading\ and\ maths)$); and costs using place of residence (urban or rural), household size, and mother's marital status ($p_{i,k} = f(demographics)$). There are potential limitations to each of these. For example, we use lagged test scores from age 9 as we do not have earlier evidence on initial endowments. However, ability at age 9 could reflect earlier parental investment decisions up to this point and could also be affected by other features of family background. Similarly, we do not have information on the cost of various activities, and we rely on proxying for these costs using demographic characteristics of families. The assumption is that family size, place of residence, and marital status reflect differences in monetary and non-monetary costs of time use decisions. For example, it seems reasonable that families with more children would find it more time consuming and difficult to arrange activities and transportation. Even if returns to scale eventually apply, we would expect the average cost of activities to be higher in larger families. Likewise, distance to school and local amenities, and therefore the transport and time cost of activities, is expected to be greater in rural locations. Finally, time use costs may also be higher in single-parent households for the same reasons. We are therefore careful in our interpretation, leaving a causal decomposition for future research. Nevertheless, the results we present here may still provide a preliminary indication as to the reasons for the inequality we observe.

5 Results

5.1 Extensive Margin

Table 3 (girls) and **Table 4** (boys) show the results for participation in after-school activities (sport, reading, play, media, and homework) as a function of maternal education. Logit and OLS models result in similar conclusions; the full table of coefficients are shown in **Appendix Tables A10** and **A11**. Focusing on column 1 of **Table 3**, we find no difference in sports participation by mother's education for girls at age 9 (rows 1 and 2). The coefficient on wave indicates that the overall percentage of girls engaging in sport falls by 37 percentage points in wave 2 relative to wave 1. However, this trend is differential across mother's education: girls whose mothers have more than secondary education are 15 percentage points more likely to engage in any sports activity in wave 2 than girls whose mothers have less than secondary education. The baseline participation rate (the fraction of girls in households with low mother's education in wave 1) is shown in the table in row 7; 61% participate in sports. Given this, and the overall decrease from wave 1 to wave 2, the magnitude of the coefficient on higher maternal education in wave 2 appears substantial. The odds ratios from the corresponding logit model in column 6 of **Table 3** convey the same information in relative terms; for example, girls whose mothers have more than secondary education are more than twice as likely to engage in any sports in wave 2 compared to girls whose mothers have less than secondary education.

Results for reading describe a different story. By age 9, a gap in reading time by mother's education has already emerged. From column 2 of **Table 3**, in wave 1 girls whose mothers have more than secondary education are 17 percentage points more likely to read for pleasure than girls whose mothers have less than secondary education. The corresponding odds ratio from the logit model in column 7 indicates that girls whose mothers have more than secondary education are twice as likely to read in wave 1 as girls whose mothers have less than secondary education.

This reading gap persists at wave 2, but does not widen (the coefficient on the interaction between maternal education and wave is not statistically significant). Overall, the percentage of girls who do any reading falls by 27 percentage points from wave 1 to wave 2.

For playing (unstructured time), the gap is reversed: at age 9, girls whose mothers have secondary education are more likely to engage in play time (a marginally significant coefficient indicating a difference of 7 percentage points), whereas by age 13, they are significantly less likely to have play/unstructured time (a difference of 17 percentage points) compared to girls whose mothers have less than secondary education. There is no evidence of statistically significant differences in media and homework participation across levels of maternal education in either wave, with both activities having baseline participation rates greater than 80%.

Overall, the participation results for boys are very similar for reading, playing, and media (**Table 4**). The gap in reading somewhat narrows in wave 2, but still persists (25-11=14 percentage points, $p<0.05$). For sports participation, there is no evidence of a gap by maternal education in either wave. Column 6 of **Table 4** suggests that participation in homework is somewhat lower for boys whose mothers have more than secondary education.

Table 3 Results for participation for girls

	Pooled OLS					Logit OR				
Variables	Any Sport	Any Reading	Any Playing	Any Media	Any Homework	Any Sport	Any Reading	Any Playing	Any Media	Any Homework
Mother's Education: Omitted=Less than Secondary										
Secondary	-0.01	0.11***	0.07*	0.04	-0.00	0.95	1.56**	1.33*	1.39	0.98
	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.16)	(0.27)	(0.22)	(0.31)	(0.23)
More than Secondary	-0.03	0.17***	0.04	0.01	-0.01	0.89	2.05***	1.18	1.08	0.94
	(0.04)	(0.04)	(0.04)	(0.03)	(0.02)	(0.15)	(0.33)	(0.19)	(0.22)	(0.21)
Wave = 2	-0.37***	-0.27***	0.01	0.01	0.07*	0.19***	0.21***	1.03	1.09	2.03
	(0.05)	(0.04)	(0.06)	(0.05)	(0.04)	(0.05)	(0.06)	(0.25)	(0.36)	(0.92)
Secondary * Wave 2	0.05	-0.02	-0.17**	-0.01	-0.04	1.30	1.20	0.51**	0.92	0.66
	(0.06)	(0.05)	(0.07)	(0.05)	(0.05)	(0.40)	(0.41)	(0.14)	(0.35)	(0.33)
More than Secondary * Wave 2	0.15**	0.01	-0.13**	-0.01	-0.04	2.07**	1.54	0.58**	0.93	0.71
	(0.06)	(0.05)	(0.07)	(0.05)	(0.04)	(0.61)	(0.50)	(0.16)	(0.33)	(0.34)
Diary Completion Controls	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
Baseline Mean Participation[1]	0.61	0.39	0.50	0.81	0.83					
Observations	3,606	3,606	3,606	3,606	3,606	3,606	3,606	3,606	3,606	3,606
R-Squared	0.12	0.10	0.03	0.01	0.20					

***Notes*:** [1] Participation for girls in wave 1, in households whose mothers have less than secondary education (which is the omitted category in the table); OR=odds ratio. Clustered errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4 Results for participation for boys

	Pooled OLS					Logit OR				
Variables	Any Sport	Any Reading	Any Playing	Any Media	Any Homework	Any Sport	Any Reading	Any Playing	Any Media	Any Homework
Mother's Education: Omitted=Less than Secondary										
Secondary	0.02	0.11***	0.04	0.02	-0.03	1.13	1.61***	1.19	1.17	0.79
	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.21)	(0.28)	(0.21)	(0.29)	(0.21)
More than Secondary	0.05	0.25***	0.09**	0.02	-0.07**	1.30	2.97***	1.45**	1.18	0.59**
	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.23)	(0.51)	(0.25)	(0.28)	(0.15)
Wave = 2	-0.32***	-0.20***	0.07	0.05	0.00	0.25***	0.28***	1.33	1.59	1.02
	(0.05)	(0.04)	(0.06)	(0.04)	(0.05)	(0.06)	(0.09)	(0.32)	(0.55)	(0.41)
Secondary * Wave 2	0.02	-0.08	-0.07	-0.07	0.04	1.05	0.85	0.76	0.54	1.40
	(0.06)	(0.05)	(0.07)	(0.05)	(0.05)	(0.31)	(0.30)	(0.21)	(0.22)	(0.66)
More than Secondary * Wave 2	0.01	-0.11**	-0.13**	-0.06	0.07	0.99	0.92	0.57**	0.57	1.72
	(0.06)	(0.05)	(0.07)	(0.04)	(0.05)	(0.28)	(0.32)	(0.16)	(0.22)	(0.74)
Diary Completion Controls	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
Baseline Mean Participation[1]	0.69	0.33	0.38	0.85	0.86					
Observations	3,574	3,574	3,574	3,574	3,574	3,573	3,573	3,573	3,573	3,573
R-Squared	0.14	0.11	0.02	0.01	0.20					

***Notes*:** [1] Participation for boys in wave 1, in households whose mothers have less than secondary education (which is the omitted category in the table); OR=odds ratio. Clustered errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

5.2 Intensive Margin

Table 5 (girls) and **Table 6** (boys) show the results of the OLS and negative binomial models for the time spent in each activity. Coefficients from negative binomial models are incidence rate ratios and can be interpreted as the relative increase in the number of minutes spent doing an activity for those in a given category compared to the omitted category (in percent terms). The full table of coefficients are shown in **Appendix Tables A12** and **A13**.

The gradients in time spent in activities by maternal education are similar to those of participation. Focusing on the OLS model in column 1, the coefficient on wave 2 indicates that girls spend, on average, 40 minutes less on sports activity per day at age 13 than they do at age 9 (interestingly the corresponding secular trend for media time is an increase of 36 minutes). In wave 1, girls whose mothers have more than secondary education spend 8 minutes less in sport. However, by wave 2 the gradient has reversed and girls whose mothers have more than secondary education spend 18 additional minutes (26-8) on sport per day ($p<0.01$). In column 6 of **Table 5**, the negative binomial results find no significant difference in sports time at wave 1, but by wave 2, girls whose mothers have more than secondary education spend almost 3 times more minutes in sport than girls whose mothers have less than secondary education. As with participation, the maternal education reading gap is present at age 9 (7 minutes and an IRR of 1.45) and negative for unstructured playing time at age 13.

For boys, results are similar, though there are a few noticeable differences. The gap in sports time at wave 2 is only marginally significant in the OLS model and not significant in the Negative Binomial model (**Table 6**). Boys whose mothers have more than secondary education spend more than 2 times the amount of time reading than boys who mothers have less than secondary education. Additionally, we see substantial gaps in homework time, with an additional 17-7=10 minutes in wave 2 for boys whose mothers have more than secondary education ($p<0.01$).

Table 5 Results for time spent in activities for girls

	Pooled OLS					Negative Binomial				
Variables	Sport (Min)	Reading (Min)	Playing (Min)	Media (Min)	Homework (Min)	Sport (IRR)	Reading (IRR)	Playing (IRR)	Media (IRR)	Homework (IRR)
Mother's Education: Omitted=Less than Secondary										
Secondary	-5.25	4.00*	0.92	2.81	-0.18	0.91	1.29**	1.07	1.05	1.00
	(4.37)	(2.16)	(4.32)	(4.19)	(2.52)	(0.08)	(0.16)	(0.11)	(0.06)	(0.06)
More than Secondary	-8.36**	6.81***	-0.26	-2.07	-3.44	0.87	1.45***	1.04	0.98	0.92*
	(4.24)	(1.94)	(4.09)	(3.98)	(2.34)	(0.08)	(0.16)	(0.11)	(0.06)	(0.05)
Wave = 2	-40.42***	-10.15***	15.01**	36.23***	34.23***	0.21***	0.36***	1.37**	1.56***	1.91***
	(4.18)	(2.31)	(7.55)	(10.17)	(7.34)	(0.04)	(0.10)	(0.19)	(0.16)	(0.21)
Secondary * Wave 2	14.70***	-0.83	-20.44**	-6.46	1.01	1.96***	1.20	0.60***	0.91	0.92
	(5.43)	(2.76)	(8.32)	(11.14)	(7.70)	(0.43)	(0.36)	(0.10)	(0.11)	(0.11)
More than Secondary * Wave 2	25.52***	1.24	-21.87***	-15.74	1.56	2.89***	1.62*	0.56***	0.84	0.97
	(5.20)	(2.81)	(8.24)	(10.72)	(7.61)	(0.59)	(0.47)	(0.10)	(0.09)	(0.11)
Diary Completion Controls	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
Baseline Mean Time Spent[1]	53	16	37	67	49					
Observations	3,606	3,606	3,606	3,606	3,606	3,606	3,606	3,606	3,606	3,606
R-Squared	0.13	0.05	0.04	0.07	0.18					

***Notes*:** [1] Average time spent in activity for girls in wave 1, in households whose mothers have less than secondary education (which is the omitted category in the table); IRR=incidence rate ratio. Clustered errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6 Results for time spent in activities for boys

	Pooled OLS					Negative Binomial				
Variables	Sport (Min)	Reading (Min)	Playing (Min)	Media (Min)	Homework (Min)	Sport (IRR)	Reading (IRR)	Playing (IRR)	Media (IRR)	Homework (IRR)
Mother's Education: Omitted=Less than Secondary										
Secondary	-1.81	4.11**	2.10	-2.10	-4.00	1.02	1.46***	1.05	0.97	0.88**
	(5.56)	(1.87)	(3.83)	(4.93)	(2.65)	(0.08)	(0.21)	(0.14)	(0.06)	(0.05)
More than Secondary	-3.53	11.39***	3.31	-4.02	-6.88***	0.98	2.10***	1.17	0.95	0.80***
	(5.10)	(2.04)	(3.50)	(4.82)	(2.45)	(0.07)	(0.28)	(0.15)	(0.06)	(0.05)
Wave = 2	-38.38***	-7.52***	17.47**	40.00***	14.12***	0.46***	0.41***	1.70***	1.48***	1.34***
	(6.34)	(2.09)	(7.36)	(8.75)	(5.03)	(0.08)	(0.12)	(0.32)	(0.12)	(0.13)
Secondary * Wave 2	22.23*	-2.38	-8.90	-12.86	14.02**	1.49*	0.97	0.79	0.90	1.26**
	(12.80)	(2.61)	(8.45)	(10.10)	(5.90)	(0.34)	(0.33)	(0.17)	(0.09)	(0.14)
More than Secondary * Wave 2	12.86*	-4.75*	-17.70**	-14.48	17.31***	1.26	1.18	0.57***	0.88	1.38***
	(6.97)	(2.72)	(7.79)	(9.61)	(5.52)	(0.23)	(0.37)	(0.12)	(0.08)	(0.15)
Diary Completion Controls	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
Baseline Mean Time Spent[1]	70	13	26	87	50					
Observations	3,574	3,574	3,574	3,574	3,574	3,574	3,574	3,574	3,574	3,574
R-Squared	0.11	0.06	0.03	0.06	0.16					

***Notes*:** [1] Average time spent in activity for boys in wave 1, in households whose mothers have less than secondary education (which is the omitted category in the table); IRR=incidence rate ratio. Clustered errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

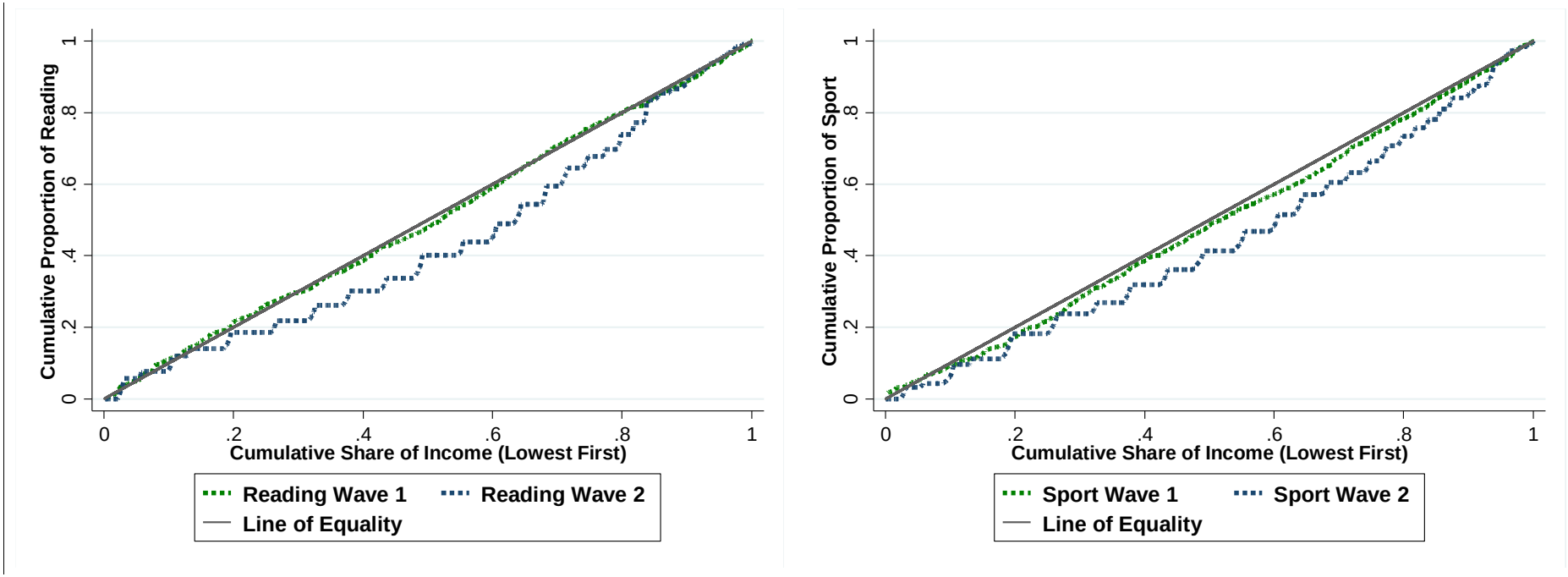

Fig. 6 Concentration curves for reading (left) and sport (right) for girls

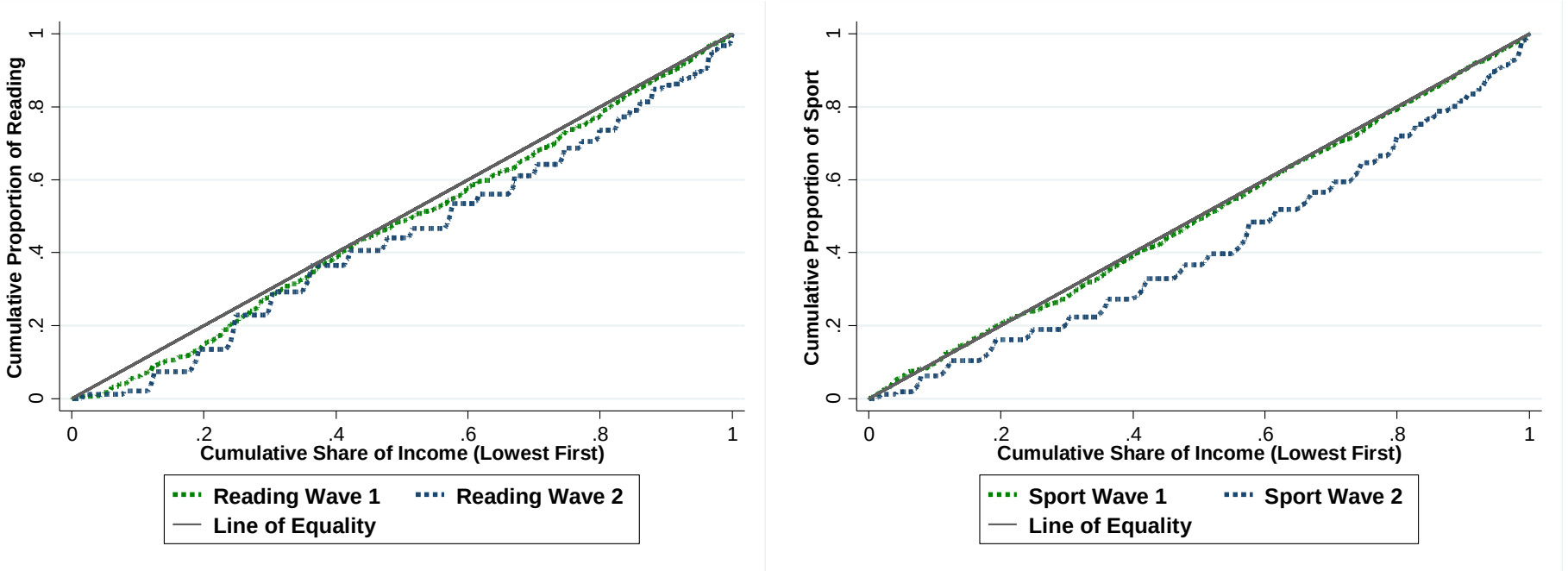

Fig. 7 Concentration curves for reading (left) and sport (right) for boys

5.3 Concentration Curves

Next we examine differences in time use by household income. **Figure 6** (girls) and **Figure 7** (boys) present concentration curve analysis for minutes spent reading and engaging in sport. It is apparent from all concentration curves that the income-related inequality in time use for these outcomes is minimal in wave 1, but that gaps emerge in wave 2. For example, for boys' sports, the bottom 60% of households (ranked according to their income) only receive around 40% of the share of total sports minutes, whereas in an equal distribution of time we would expect them to receive 60%. Examining the shape of the concentration curves, households mostly receive less than their expected share at each income percentile, however the difference is most pronounced around median household income.

5.4 Concentration Indices and Decomposition

Table 7 presents the wave 2 concentration indices for sport and reading (stratified by gender). We focus on wave 2 because the inequality in wave 1 appears negligible. The largest concentration index is that for boys' sports time at 0.14, with the others taking values between 0.07 and 0.09. As an intuitive interpretation, concentration indices indicate the proportion of the outcome that would need to be redistributed from the richest half of households to the poorest half of households in order to achieve an equal distribution (concentration index of 0) (Koolman and Doorslaer 2004). For example, if 14% of sports time was transferred from the richest half of households to the poorest half of households, the concentration index for boys would then be 0. A concentration index of this magnitude for boys' sport is comparable to that for children's obesity in Ireland (Walsh and Cullinan 2015), but is smaller than that for birth weight (Madden 2014).

Table 7 Concentration indices for sport and reading

	Girls		Boys	
	Sport	Reading	Sport	Reading
Concentration Index (SE)	0.09 (0.03)	0.08 (0.04)	0.14 (0.02)	0.07 (0.04)

Table 8 presents the results of the decomposition analysis. We identify the percentage contribution of each variable to the income-related inequality identified by the concentration indices, using proxies for the factors which we expect to be driving heterogeneity in parents' investment decisions and time use based on the theoretical discussion in **Section 3** ($M_{t-1}, \gamma_t, E_k, p_{i,k}$). All models adjust for diary completion variables. For maternal education, we show the combined contribution of indicator variables for secondary education and more than secondary education (relative to less than secondary education). There are two mechanisms through which a factor can explain income-related inequality in an outcome as measured by the concentration index. The first is elasticity, whereby the factor needs to be related to the outcome of interest (reading or sports time), and the second is concentration, whereby the factor must be unequally distributed across income groups. If either of these conditions is not met, then potential factors have no explanatory power for explaining the inequality. The results we present show the product of the elasticity and concentration for each factor, as a percentage contribution to the overall concentration index. Note that we include household income as an explanatory factor in the analysis, because even though the outcome may be concentrated among higher income households, without a corresponding time-use elasticity of income, income itself may not play a major role in explaining inequality in the outcome.

We find interesting differences in the factors that explain inequality in girls' time spent compared to boys'. For girls' sport, mother's education is the biggest factor, contributing 48% of the overall concentration index. Mother's marital status and a household size of at least 6 each contribute as well, indicating that for girls, preferences and costs are the biggest factors in income-related inequality in sports time. However, for boys' sport, income plays a substantial role, while all other factors, including mother's education, are trivial. For reading for both girls and boys, mother's education and lagged reading score are important contributing factors; however for boys, income again plays a role, while for girls, the coefficient on income is large and negative, indicating that girls from lower income households read more than their income would suggest. Rural region also contributes to girls' inequality in reading, but not to boys, while the opposite is true for mother's marital status. Girls' reading has the largest unexplained percentage, indicating that unobserved factors may be important in understanding inequality in

girls' reading time, while girls' sports, boys' sports, and boys' reading are all well-explained by the factors we've included in the model.

Table 8 Results of decomposition analysis (percent contribution to income-related inequality) for sport and reading

		Girls		Boys	
Factor	Variable	Sport	Reading	Sport	Reading
Resources (M_{t-1})	Log Equivalised Household Income	-11.5	-88.3	108.0	85.9
Preferences and beliefs (E_k)	Mother's Education (Secondary or More)	48.0	40.2	-6.7	50.5
Initial Endowments (γ_t)	Math score age 9	5.1	11.3	5.4	-24.2
	Reading score age 9	-2.5	65.9	-8.4	35.3
Costs ($p_{i,k}$)	Mother is Married	15.1	-8.7	-1.3	21.9
	HH size: 4	-2.9	5.5	-0.4	-6.8
	HH size: 5	-2.7	7.6	1.4	-3.4
	HH size: 6 or more	18.7	-23.9	-5.2	-15.5
	Rural region	-1.8	18.6	8.7	3.0
Unexplained		9.9	48.3	-8.1	-56.6

Notes: Adjusted for time use diary characteristics (day of week, month of year, who completed diary, and when diary was completed). The omitted category for household size is 2 or 3.

6 Discussion

The literature on the subsequent outcomes of children who engage in stimulating activities supports the hypothesis that how children spend their time during late childhood and early adolescence may have important consequences for their health, education, and labour outcomes in adulthood. Therefore, it is important to understand patterns in young people's time use, and in particular whether there are any systematic differences across family background. In this paper, we conduct a longitudinal analysis of heterogeneity in time use as children age.

We identify substantial differences in sports, reading, and unstructured time use by maternal education. For example, girls with mothers with more education are twice as

likely to participate in reading, and, on average spend around twice as many minutes reading per day at age 13 than girls with mothers with less education. Girls in this group are twice as likely to participate in any sport at age 13, and, on average spend around twice as many minutes engaging in sports per day at age 13. Finally, girls in this group are around 40% less likely to participate in unstructured play, and, on average spend around 40% fewer minutes in this activity per day at age 13. Although there are some differences in these results for boys, similar systematic gaps by family background remain. Both OLS and corresponding nonlinear models for participation and time spent in activities show consistent results.

It is important to note that the pattern of these differences over time is not uniform. Though no maternal education gap exists in sports and exercise participation at age 9, differences emerge by age 13, particularly for girls. Conversely, for girls' and boys' reading participation and time, the gap already exists by age 9. Given the literature on the implications of time use in childhood, these results have potential policy implications. For example, for policies that seek to reduce socioeconomic inequality in girls' sports time, it may be most effective to aim to intervene before the time of puberty (normally at ages 12-14), when the fall-off in sports participation is greatest, while for policies that aim to reduce inequality in reading skills, it may be most effective to intervene before age 9.

We find that boys and girls from low SES households (as measured by maternal education) spend much more time at age 13 in unstructured play time. Descriptive analysis suggests that they also spend more time using media such as TV, internet, and mobile phones, and that boys from low SES households fall behind on time spent doing homework by age 13. However, these differences did not remain statistically significant when we modelled time use more formally in regression analyses adjusting for TUD completion characteristics.

Because we have longitudinal data on the same children, we were able to assess which activities children substitute for as they age. The largest category absorbing sports time at age 13 was homework, while for reading the corresponding category was media. Future research should try to establish whether these substitution patterns are optimal.

In addition to differences by maternal education, our concentration curve analysis shows that time use also differs systematically by household income. In our decomposition analysis motivated by the literature on parental investment decisions, we aimed to shed preliminary light on the factors which explain this inequality in sports and reading time. Results suggest that for girls, beliefs and costs are the biggest contributing factors to income-related inequality in sports time, while for boys, income itself is the predominant factor. This is consistent with our finding that boys' sports participation and sports time does not vary by maternal education. For inequality in girls' reading, preferences, initial endowments, and costs all contribute; for boys' reading all factors play a substantial role. Further analysis is required to identify the causal contributions of each of these. However, although indicative, the decomposition analysis does suggest that there are important constraints on the extent to which families from different backgrounds are free to choose how best to make decisions regarding their children's time use. Given the important role of extra-curricular activities in promoting cognitive and non-cognitive skill development, if these constraints are preventing families from choosing their preferred time use options, the systematic differences in time use we document in this paper are likely to contribute to cumulative disadvantage and widening skill gaps over adolescence and into adulthood.

Notwithstanding the caveats we raise concerning the interpretation of the decomposition results, our estimates emphasize the importance of reducing direct monetary costs for participation in after-school activities. For boys, removing or subsidising equipment or membership costs would be expected to reduce income-related inequality in sports participation. In the US, these costs are estimated at 10% of annual income for two-child families in the bottom income quintile (Putnam 2016). Collecting further data on these costs could provide a basis for determining whether there is justification for policy intervention in this area.

Our analysis has a number of limitations. First, time diary data, though more accurate than stylized questions on time spent in activities, may suffer from measurement error, for example due to reporting bias. Second, the results may be affected by attrition. We attempt to deal with both of these potential issues by controlling for diary characteristics (such as day and method of completion) and using sample weights. Additional robustness checks including those participants who completed diaries on

weekend days give very similar results (see **Appendix Tables A6** to **A9**. However, future validation exercises, in particular by family strata, would be beneficial. Third, in our decomposition analysis, we proxy for the factors identified in our theoretical framework (resources, preferences and beliefs, initial endowments, and costs), with the socio-demographic variables available in our data, such as household income, maternal education, lagged test scores, marital status, family size, and place of residence. In the absence of better measures and an available identification strategy, we are careful in our interpretation, leaving a causal decomposition for future research.

More research on the consequences of these inequalities is needed to understand the impact of differences in time spent on inequalities in future educational attainment, social, and labour outcomes. For example, unstructured time may be beneficial in that it may increase independence, resilience, and social competence; however, little empirical work has examined this relationship. Future research should also further examine families' preferences and beliefs regarding which types of investments are optimal, the extent to which different types of investments are substitutes or complements (Leibowitz 2003) and reinforce or reduce the effects of initial endowments (Almond and Mazumder 2013), as well as the causal relationship between participation in certain activities and subsequent outcomes across the life course. Such research would inform the extent to which policy interventions should target the time use differences we document, and whether such policies could be used to improve children's life chances.

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Appendix

Table A1 Diary characteristics by wave, weighted

Variable	Category	Wave 1 (N=3923) No.	%	Wave2 (N=3257) No.	%
Day completed	Monday	886	23	668	22
	Tuesday	853	22	635	21
	Wednesday	745	19	606	20
	Thursday	731	19	560	18
	Friday	626	16	563	19
Month completed	January	335	9	283	9
	February	100	3	217	7
	March	23	1	392	13
	April	590	15	19	1
	May	154	4	26	1
	June	71	2	2	0
	July	1	0	0	0
	August	37	1	20	1
	September	632	16	497	16
	October	810	21	614	21
	November	744	19	567	19
	December	343	9	396	13
When was diary completed?	Now and then during diary day	1,153	30	569	19
	End of diary day	1,311	34	1,201	40
	Day after diary day	643	17	646	21
	Later	315	8	290	10
	Don't know	419	11	326	11
Who completed the diary?	Child (or child helped)	2,071	54	1,375	45
	Parent only	1,369	36	1,337	44
	Don't know	401	10	320	11

Table A2 Mean time spent (minutes) in activities by wave and gender

	Wave 1		Wave 2	
Gender	Mean	95%CI	Mean	95%CI
		Sleep		
Male	658	[654,661]	551	[548,554]
Female	663	[659,667]	546	[542,549]
		Homework		
Male	45	[43,47]	71	[68,75]
Female	48	[46,49]	81	[77,85]
		Reading		
Male	18	[16,19]	9	[8,11]
Female	20	[19,22]	11	[9,13]
		Sport		
Male	71	[67,75]	41	[32,49]
Female	50	[46,53]	21	[19,24]
		Housework		
Male	6	[5,7]	5	[4,6]
Female	6	[5,7]	6	[5,7]
		Media		
Male	81	[77,84]	108	[103,114]
Female	70	[67,73]	100	[94,106]

	Wave 1		Wave 2	
Gender	Mean	95%CI	Mean	95%CI
		School		
Male	345	[342,348]	411	[404,418]
Female	344	[340,348]	422	[418,426]
		Playing		
Male	29	[26,32]	38	[33,42]
Female	40	[37,43]	39	[35,43]
		Leisure		
Male	10	[9,12]	14	[12,16]
Female	17	[15,19]	17	[14,19]
		Care		
Male	139	[136,142]	134	[130,137]
Female	144	[140,148]	142	[138,146]
		Family		
Male	16	[12,19]	48	[44,52]
Female	16	[14,19]	45	[41,49]
		Other		
Male	23	[20,25]	11	[9,13]
Female	23	[20,26]	10	[8,11]

Table A3 Average time spent reading and in sports (minutes) by socio-demographic group for girls

	Reading				Sport			
	Wave 1		Wave 2		Wave 1		Wave 2	
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Income Quintile								
Lowest	21	[16,27]	12	[7,16]	40	[29,50]	20	[12,28]
2nd	18	[15,22]	6	[4,9]	54	[46,63]	16	[11,21]
3rd	21	[18,24]	8	[6,11]	45	[39,51]	18	[14,22]
4th	21	[19,24]	14	[10,18]	50	[44,57]	23	[18,29]
Highest	20	[17,23]	15	[9,20]	54	[47,61]	28	[22,34]
Mother's Education								
Less than Secondary	17	[13,20]	6	[3,10]	54	[46,62]	12	[8,16]
Secondary	21	[18,23]	9	[7,11]	49	[44,54]	20	[15,24]
More than secondary	23	[21,25]	14	[11,17]	46	[42,50]	27	[23,31]
Mother's Age								
39 or less	19	[17,22]	11	[6,16]	52	[46,57]	15	[11,19]
40-49	21	[19,23]	10	[9,12]	48	[44,52]	22	[19,25]
50 and over	23	[12,34]	13	[9,17]	42	[24,60]	30	[20,40]
Mother's Marital Status								
Not married	19	[13,24]	10	[5,15]	47	[36,58]	16	[10,23]
Married	20	[19,22]	11	[9,13]	50	[46,53]	22	[20,25]
Number of People in Household								
2 or 3	15	[11,18]	11	[5,16]	51	[40,61]	22	[14,30]
4	18	[16,21]	11	[9,14]	49	[44,55]	20	[16,24]
5	24	[21,27]	12	[9,14]	47	[42,52]	24	[20,29]
6+	20	[16,24]	11	[6,16]	52	[44,61]	19	[14,25]
Region								
Urban	19	[17,21]	13	[10,17]	51	[45,57]	23	[18,28]
Rural	21	[19,23]	11	[9,13]	49	[44,53]	21	[17,24]

Table A4 Average time spent reading and in sports (minutes) by socio-demographic group for boys

	Reading				Sport			
	Wave 1		Wave 2		Wave 1		Wave 2	
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Income Quintile								
Lowest	12	[7,16]	6	[4,9]	75	[59,90]	31	[23,39]
2nd	21	[17,25]	13	[7,18]	66	[57,75]	21	[15,27]
3rd	16	[13,19]	6	[4,9]	72	[64,80]	32	[25,39]
4th	17	[15,20]	8	[6,11]	73	[64,82]	38	[31,45]
Highest	19	[16,21]	12	[8,16]	73	[67,78]	54	[42,65]
Mother's Education								
Less than Secondary	12	[9,15]	5	[3,8]	75	[64,85]	31	[22,40]
Secondary	17	[15,19]	7	[5,10]	71	[65,77]	48	[27,68]
More than secondary	24	[21,27]	12	[10,15]	68	[64,73]	37	[33,42]
Mother's Age								
39 or less	17	[14,19]	8	[5,11]	72	[66,78]	27	[20,34]
40-49	19	[17,21]	9	[7,11]	72	[66,78]	43	[31,56]
50 and over	17	[10,25]	13	[8,18]	54	[37,71]	47	[32,63]
Mother's Marital Status								
Not married	16	[11,21]	5	[1,8]	76	[62,90]	29	[18,40]
Married	18	[17,20]	10	[8,12]	70	[66,74]	42	[32,53]
Number of People in Household								
2 or 3	20	[14,25]	7	[3,10]	67	[57,78]	32	[18,47]
4	18	[15,20]	8	[6,11]	68	[62,74]	48	[24,72]
5	19	[17,22]	9	[7,11]	75	[68,82]	39	[34,45]
6+	15	[12,17]	13	[8,18]	71	[61,82]	37	[28,45]
Region								
Urban	17	[15,20]	10	[7,12]	77	[70,84]	45	[37,53]
Rural	18	[16,20]	8	[6,10]	67	[62,72]	41	[25,58]

Table A5 Average substitution patterns (in minutes) from wave 1 activities to wave 2 activities

	Sleeping	School	Care	Sport	Playing	Media	Reading	Family	Homework	Housework	Leisure	Other
Sleeping		5	38	2	4	31	6	10	5	1	3	1
School												
Care		41				3		4	4			
Sport		6	4		3	3		4	12			
Playing		2						1	6			
Media		3			1			7	10		1	
Reading			2	1	1	6		2	2		1	
Family		1										
Homework		10										
Housework									1			
Leisure		1						1	2			
Other		3	1		1	1		2	3			

Notes: Rows correspond to wave 1 activities and columns correspond to wave 2 activities. Results are averaged across substitutions by the same child and in the same timeslot, and the net amount for any two activities is shown.

Table A6 Results for participation for girls using both weekday and weekend data

	Pooled OLS					Logit OR				
Variables	Any Sport	Any Reading	Any Playing	Any Media	Any Homework	Any Sport	Any Reading	Any Playing	Any Media	Any Homework
Mother's Education: Omitted=Less than Secondary										
Secondary	0.00	0.04	0.08**	0.03	-0.02	1.01	1.20	1.39**	1.34	0.87
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.14)	(0.16)	(0.19)	(0.25)	(0.14)
More than Secondary	0.02	0.15***	0.07**	0.02	-0.02	1.11	1.82***	1.33**	1.16	0.87
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.15)	(0.24)	(0.18)	(0.19)	(0.13)
Wave = 2	-0.35***	-0.24***	0.03	0.00	0.11***	0.21***	0.29***	1.16	1.05	2.14***
	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	(0.06)	(0.23)	(0.28)	(0.62)
Secondary * Wave 2	0.05	0.00	-0.16***	-0.01	0.00	1.29	1.11	0.51***	0.91	1.05
	(0.05)	(0.04)	(0.06)	(0.04)	(0.04)	(0.32)	(0.28)	(0.12)	(0.29)	(0.34)
More than Secondary * Wave 2	0.10**	-0.03	-0.17***	0.00	0.00	1.69**	1.09	0.49***	1.03	1.02
	(0.05)	(0.04)	(0.05)	(0.04)	(0.04)	(0.40)	(0.26)	(0.11)	(0.31)	(0.32)
Diary Completion Controls	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
Baseline Mean Participation[1]	0.59	0.39	0.54	0.83	0.57	0.59	0.39	0.54	0.83	0.57
Observations	5,593	5,593	5,593	5,593	5,593	5,593	5,593	5,593	5,593	5,593
R-Squared	0.13	0.08	0.04	0.01	0.41					

Notes: [1] Participation for girls in wave 1, in households whose mothers have less than secondary education (which is the omitted category in the table). OR=odds ratio. Clustered errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A7 Results for participation for boys using both weekday and weekend data

	Pooled OLS					Logit OR				
Variables	Any Sport	Any Reading	Any Playing	Any Media	Any Homework	Any Sport	Any Reading	Any Playing	Any Media	Any Homework
Mother's Education: Omitted=Less than Secondary										
Secondary	0.04	0.12***	0.05	0.03	-0.06**	1.21	1.75***	1.24	1.30	0.66**
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.18)	(0.25)	(0.17)	(0.28)	(0.12)
More than Secondary	0.08***	0.24***	0.13***	0.03	-0.08***	1.54***	2.85***	1.68***	1.34	0.60***
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.23)	(0.40)	(0.22)	(0.28)	(0.10)
Wave = 2	-0.31***	-0.15***	0.09*	-0.00	0.03	0.27***	0.38***	1.44*	1.00	1.27
	(0.04)	(0.03)	(0.05)	(0.04)	(0.04)	(0.05)	(0.09)	(0.28)	(0.29)	(0.33)
Secondary * Wave 2	0.03	-0.11***	-0.08	-0.01	0.09*	1.11	0.65	0.72	0.92	1.78*
	(0.05)	(0.04)	(0.05)	(0.04)	(0.04)	(0.26)	(0.18)	(0.16)	(0.33)	(0.54)
More than Secondary * Wave 2	0.03	-0.13***	-0.18***	-0.01	0.08**	1.03	0.75	0.48***	0.91	1.74**
	(0.05)	(0.04)	(0.05)	(0.04)	(0.04)	(0.23)	(0.20)	(0.10)	(0.30)	(0.48)
Diary Completion Controls	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
Baseline Mean Participation[1]	0.69	0.30	0.42	0.87	0.62	0.69	0.30	0.42	0.87	0.62
Observations	5,574	5,574	5,574	5,574	5,574	5,574	5,574	5,574	5,574	5,574
R-Squared	0.12	0.10	0.03	0.02	0.38					

Notes: [1] Participation for boys in wave 1, in households whose mothers have less than secondary education (which is the omitted category in the table). OR=odds ratio. Clustered errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A8 Results for time spent in activities for girls using both weekday and weekend data

	Pooled OLS					Negative Binomial				
Variables	Sport (Min)	Reading (Min)	Playing (Min)	Media (Min)	Homework (Min)	Sport (IRR)	Reading (IRR)	Playing (IRR)	Media (IRR)	Homework (IRR)
Mother's Education: Omitted=Less than Secondary										
Secondary	1.02	0.13	5.57	-3.11	-1.93	0.99	1.06	1.12	0.99	0.81**
	(4.65)	(2.35)	(4.40)	(5.29)	(1.88)	(0.07)	(0.11)	(0.09)	(0.05)	(0.08)
More than Secondary	-0.36	5.82***	7.74*	-7.19	-3.49*	0.99	1.34***	1.13	0.94	0.82*
	(4.33)	(2.22)	(4.26)	(4.76)	(1.84)	(0.07)	(0.13)	(0.09)	(0.05)	(0.08)
Wave = 2	-37.69***	-9.90***	22.64***	47.06***	29.39***	0.29***	0.47***	1.45***	1.54***	2.29***
	(4.94)	(2.87)	(7.87)	(11.01)	(5.75)	(0.05)	(0.09)	(0.17)	(0.12)	(0.31)
Secondary * Wave 2	5.73	1.41	-17.07*	-9.17	3.92	1.51**	1.15	0.68***	0.94	1.23
	(6.11)	(3.16)	(8.98)	(11.96)	(6.16)	(0.30)	(0.26)	(0.09)	(0.09)	(0.19)
More than Secondary * Wave 2	17.78***	0.76	-26.34***	-10.53	4.02	2.17***	1.35	0.61***	0.92	1.17
	(6.17)	(3.21)	(8.73)	(11.48)	(5.98)	(0.42)	(0.29)	(0.08)	(0.08)	(0.18)
Diary Completion Controls	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
Baseline Mean Time Spent[1]	59	18	48	92	34	59	18	48	92	34
Observations	5,593	5,593	5,593	5,593	5,593	5,593	5,593	5,593	5,593	5,593
R-Squared	0.15	0.04	0.07	0.15	0.27					

Notes: [1] Average time spent in activity for girls in wave 1, in households whose mothers have less than secondary education (which is the omitted category in the table); IRR=incidence rate ratio. Clustered errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A9 Results for time spent in activities for boys using both weekday and weekend data

	Pooled OLS					Negative Binomial				
Variables	Sport (Min)	Reading (Min)	Playing (Min)	Media (Min)	Homework (Min)	Sport (IRR)	Reading (IRR)	Playing (IRR)	Media (IRR)	Homework (IRR)
Mother's Education: Omitted=Less than Secondary										
Secondary	2.47	5.01***	5.42	-5.85	-4.56**	1.04	1.51***	1.15	0.95	0.92
	(5.80)	(1.57)	(4.09)	(5.28)	(2.00)	(0.07)	(0.18)	(0.12)	(0.05)	(0.08)
More than Secondary	5.52	12.09***	8.11**	-7.05	-5.39***	1.06	2.10***	1.24**	0.94	0.81**
	(5.39)	(1.70)	(3.69)	(5.24)	(1.87)	(0.07)	(0.24)	(0.12)	(0.04)	(0.07)
Wave = 2	-43.24***	-5.73***	36.75***	29.50***	13.71***	0.49***	0.52***	1.93***	1.30***	1.82***
	(6.99)	(1.78)	(9.17)	(9.12)	(3.94)	(0.08)	(0.12)	(0.27)	(0.09)	(0.24)
Secondary * Wave 2	17.70*	-3.82*	-23.93**	10.49	13.60***	1.34	0.80	0.68**	1.06	1.26
	(10.69)	(2.16)	(10.16)	(10.62)	(4.65)	(0.27)	(0.21)	(0.11)	(0.08)	(0.19)
More than Secondary * Wave 2	11.67	-6.03***	-32.95***	6.00	14.24***	1.24	1.01	0.54***	1.02	1.37**
	(8.02)	(2.28)	(9.60)	(10.00)	(4.33)	(0.22)	(0.25)	(0.08)	(0.07)	(0.20)
Diary Completion Controls	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
Baseline Mean Time Spent[1]	83	13	35	114	36	83	13	35	114	36
Observations	5,574	5,574	5,574	5,574	5,574	5,574	5,574	5,574	5,574	5,574
R-Squared	0.13	0.05	0.08	0.18	0.23					

Notes: [1] Average time spent in activity for boys in wave 1, in households whose mothers have less than secondary education (which is the omitted category in the table); IRR=incidence rate ratio. Clustered errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A10 Full Table for Girls' Participation

	Pooled OLS					Logit OR				
Variables	Any Sport	Any Reading	Any Playing	Any Media	Any Homework	Any Sport	Any Reading	Any Playing	Any Media	Any Homework
Mother's Education: Omitted=Less than Secondary										
Secondary	-0.01	0.11***	0.07*	0.04	-0.00	0.95	1.56**	1.33*	1.39	0.98
	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.16)	(0.27)	(0.22)	(0.31)	(0.23)
More than Secondary	-0.03	0.17***	0.04	0.01	-0.01	0.89	2.05***	1.18	1.08	0.94
	(0.04)	(0.04)	(0.04)	(0.03)	(0.02)	(0.15)	(0.33)	(0.19)	(0.22)	(0.21)
Wave = 2	-0.37***	-0.27***	0.01	0.01	0.07*	0.19***	0.21***	1.03	1.09	2.03
	(0.05)	(0.04)	(0.06)	(0.05)	(0.04)	(0.05)	(0.06)	(0.25)	(0.36)	(0.92)
Secondary * Wave 2	0.05	-0.02	-0.17**	-0.01	-0.04	1.30	1.20	0.51**	0.92	0.66
	(0.06)	(0.05)	(0.07)	(0.05)	(0.05)	(0.40)	(0.41)	(0.14)	(0.35)	(0.33)
More than Secondary * Wave 2	0.15**	0.01	-0.13**	-0.01	-0.04	2.07**	1.54	0.58**	0.93	0.71
	(0.06)	(0.05)	(0.07)	(0.05)	(0.04)	(0.61)	(0.50)	(0.16)	(0.33)	(0.34)
Day Diary Completed: Omitted=Monday										
Tuesday	0.08***	-0.02	-0.03	-0.00	-0.01	1.45***	0.93	0.90	0.97	0.87
	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.20)	(0.14)	(0.13)	(0.17)	(0.24)
Wednesday	0.03	0.01	-0.06*	0.02	-0.03*	1.14	1.06	0.78*	1.13	0.64*
	(0.03)	(0.03)	(0.04)	(0.03)	(0.02)	(0.18)	(0.17)	(0.11)	(0.21)	(0.17)
Thursday	0.03	-0.05	-0.01	0.01	-0.03*	1.17	0.80	0.97	1.11	0.67
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.17)	(0.12)	(0.14)	(0.20)	(0.16)
Friday	0.07**	-0.05	0.02	0.04	-0.43***	1.37**	0.77	1.07	1.32	0.07***
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.22)	(0.13)	(0.16)	(0.26)	(0.01)
Month Diary Completed: Omitted=January										

February	0.08	-0.09	-0.02	0.01	0.04	1.48	0.66	0.91	1.13	1.53
	(0.06)	(0.06)	(0.06)	(0.04)	(0.04)	(0.40)	(0.18)	(0.23)	(0.40)	(0.55)
March	0.18***	0.02	0.03	0.00	0.06*	2.33***	1.13	1.15	1.05	1.86*
	(0.06)	(0.07)	(0.06)	(0.04)	(0.04)	(0.64)	(0.37)	(0.30)	(0.39)	(0.66)
April	0.19***	-0.05	-0.04	-0.00	0.03	2.32***	0.80	0.85	0.97	1.35
	(0.06)	(0.06)	(0.06)	(0.04)	(0.03)	(0.61)	(0.21)	(0.21)	(0.33)	(0.40)
May	0.21**	-0.09	-0.20***	-0.08	-0.01	2.50**	0.67	0.43***	0.56	0.99
	(0.08)	(0.08)	(0.07)	(0.07)	(0.06)	(0.96)	(0.24)	(0.14)	(0.25)	(0.46)
June	0.35***	0.04	0.05	-0.04	0.01	5.75***	1.16	1.21	0.72	1.17
	(0.07)	(0.10)	(0.09)	(0.07)	(0.07)	(2.58)	(0.50)	(0.48)	(0.36)	(0.65)
July										
August	0.13	-0.07	0.03	-0.01	0.07	1.76	0.73	1.13	0.95	1.84
	(0.14)	(0.14)	(0.16)	(0.09)	(0.11)	(1.11)	(0.48)	(0.73)	(0.74)	(1.30)
September	0.09*	-0.06	0.01	-0.02	0.07**	1.51*	0.74	1.03	0.87	1.92**
	(0.05)	(0.05)	(0.05)	(0.04)	(0.03)	(0.33)	(0.17)	(0.21)	(0.25)	(0.55)
October	0.15***	-0.02	-0.03	-0.03	0.02	1.93***	0.90	0.89	0.77	1.23
	(0.05)	(0.05)	(0.05)	(0.04)	(0.03)	(0.42)	(0.21)	(0.18)	(0.22)	(0.34)
November	0.04	-0.03	-0.02	-0.02	0.04	1.20	0.88	0.91	0.83	1.44
	(0.05)	(0.05)	(0.05)	(0.03)	(0.03)	(0.26)	(0.20)	(0.18)	(0.23)	(0.39)
December	0.00	-0.08	0.04	-0.02	-0.02	1.00	0.69	1.19	0.84	0.80
	(0.05)	(0.06)	(0.05)	(0.04)	(0.04)	(0.24)	(0.18)	(0.26)	(0.26)	(0.25)
Time Diary Completed: Omitted=During Day										
End of diary day	-0.02	-0.02	0.02	-0.02	0.02	0.90	0.90	1.07	0.88	1.23
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.11)	(0.11)	(0.13)	(0.14)	(0.22)
Day after diary day	-0.00	0.02	0.04	-0.08***	0.03	0.98	1.11	1.17	0.57***	1.30
	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.15)	(0.17)	(0.17)	(0.11)	(0.27)
Later	-0.04	0.02	0.02	-0.02	-0.02	0.82	1.08	1.08	0.86	0.89
	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.15)	(0.21)	(0.18)	(0.20)	(0.22)
Don't know	-0.09	-0.03	0.01	0.05	0.14***	0.67	0.87	1.03	1.36	3.35***
	(0.08)	(0.09)	(0.08)	(0.05)	(0.04)	(0.24)	(0.33)	(0.33)	(0.49)	(1.18)

Was Diary Completed with Child?										
Omitted=Yes										
Parent only	0.06**	-0.01	0.00	-0.03*	0.01	1.31**	0.94	1.00	0.77**	1.08
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.14)	(0.10)	(0.10)	(0.10)	(0.16)
Don't know	0.08	0.07	0.10	-0.12**	-0.13***	1.45	1.35	1.53	0.43**	0.34***
	(0.08)	(0.09)	(0.08)	(0.05)	(0.04)	(0.52)	(0.56)	(0.51)	(0.15)	(0.12)
Constant	0.46***	0.46***	0.51***	0.87***	0.88***	0.80	0.86	1.06	6.82***	8.55***
	(0.06)	(0.06)	(0.06)	(0.04)	(0.04)	(0.22)	(0.24)	(0.27)	(2.27)	(3.15)
Observations	3,606	3,606	3,606	3,606	3,606	3,606	3,606	3,606	3,606	3,606
R-Squared	0.12	0.10	0.03	0.01	0.20					

Notes: OR=odds ratio. Clustered errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A11 Full Table for Boys' Participation

	Pooled OLS					Logit OR				
Variables	Any Sport	Any Reading	Any Playing	Any Media	Any Homework	Any Sport	Any Reading	Any Playing	Any Media	Any Homework
Mother's Education: Omitted=Less than Secondary										
Secondary	0.02	0.11***	0.04	0.02	-0.03	1.13	1.61***	1.19	1.17	0.79
	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.21)	(0.28)	(0.21)	(0.29)	(0.21)
More than Secondary	0.05	0.25***	0.09**	0.02	-0.07**	1.30	2.97***	1.45**	1.18	0.59**
	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.23)	(0.51)	(0.25)	(0.28)	(0.15)
Wave = 2	-0.32***	-0.20***	0.07	0.05	0.00	0.25***	0.28***	1.33	1.59	1.02
	(0.05)	(0.04)	(0.06)	(0.04)	(0.05)	(0.06)	(0.09)	(0.32)	(0.55)	(0.41)
Secondary * Wave 2	0.02	-0.08	-0.07	-0.07	0.04	1.05	0.85	0.76	0.54	1.40
	(0.06)	(0.05)	(0.07)	(0.05)	(0.05)	(0.31)	(0.30)	(0.21)	(0.22)	(0.66)
More than Secondary * Wave 2	0.01	-0.11**	-0.13**	-0.06	0.07	0.99	0.92	0.57**	0.57	1.72
	(0.06)	(0.05)	(0.07)	(0.04)	(0.05)	(0.28)	(0.32)	(0.16)	(0.22)	(0.74)
Day Diary Completed: Omitted=Monday										
Tuesday	0.00	-0.00	-0.10***	0.05**	0.02	1.01	0.98	0.65***	1.65**	1.26
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.14)	(0.15)	(0.09)	(0.32)	(0.32)
Wednesday	0.06*	0.01	-0.02	-0.01	-0.03	1.33*	1.03	0.90	0.92	0.75
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.20)	(0.16)	(0.13)	(0.21)	(0.21)
Thursday	0.03	-0.00	-0.04	0.02	0.02	1.18	0.98	0.85	1.13	1.23
	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.18)	(0.15)	(0.12)	(0.23)	(0.29)
Friday	-0.03	-0.08***	-0.03	0.02	-0.42***	0.88	0.63***	0.90	1.17	0.10***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.13)	(0.11)	(0.13)	(0.27)	(0.02)
Month Diary Completed: Omitted=January										

February	0.05	0.03	-0.09	0.04	-0.00	1.27	1.15	0.68	1.40	0.93
	(0.05)	(0.06)	(0.06)	(0.04)	(0.04)	(0.30)	(0.36)	(0.17)	(0.60)	(0.37)
March	0.14***	0.01	0.01	-0.01	-0.02	1.87***	1.05	1.05	0.92	0.79
	(0.05)	(0.05)	(0.06)	(0.04)	(0.04)	(0.44)	(0.32)	(0.24)	(0.30)	(0.30)
April	0.22***	-0.05	-0.17***	0.02	0.01	3.38***	0.80	0.47***	1.17	1.04
	(0.04)	(0.05)	(0.05)	(0.04)	(0.03)	(0.85)	(0.18)	(0.10)	(0.37)	(0.36)
May	0.16**	-0.08	0.03	-0.05	0.05	2.25**	0.69	1.13	0.68	1.47
	(0.07)	(0.06)	(0.08)	(0.06)	(0.06)	(0.87)	(0.23)	(0.37)	(0.30)	(0.84)
June	0.25***	-0.20**	-0.03	0.10*	-0.29	4.61**	0.33*	0.88	3.32	0.15**
	(0.08)	(0.08)	(0.18)	(0.05)	(0.18)	(3.25)	(0.21)	(0.65)	(2.68)	(0.13)
July	0.39***	0.60***	0.61***	-0.90***	0.05*					
	(0.05)	(0.04)	(0.05)	(0.04)	(0.03)					
August	0.18**	0.03	-0.07	0.08	-0.25**	2.34*	1.17	0.76	2.43	0.19**
	(0.09)	(0.10)	(0.11)	(0.06)	(0.12)	(1.08)	(0.52)	(0.35)	(2.11)	(0.13)
September	0.13***	0.05	-0.07	-0.02	-0.03	1.82***	1.27	0.75*	0.83	0.73
	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.34)	(0.25)	(0.13)	(0.23)	(0.21)
October	0.10**	0.00	-0.03	-0.01	-0.04	1.61**	1.01	0.87	0.89	0.66
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.30)	(0.20)	(0.15)	(0.25)	(0.21)
November	0.00	0.04	-0.02	-0.00	-0.03	1.02	1.22	0.92	0.99	0.72
	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.19)	(0.24)	(0.16)	(0.28)	(0.21)
December	-0.02	0.04	0.00	0.04	-0.08**	0.90	1.24	1.02	1.40	0.49**
	(0.05)	(0.04)	(0.05)	(0.03)	(0.04)	(0.19)	(0.26)	(0.20)	(0.43)	(0.16)
Time Diary Completed: Omitted=During Day										
End of diary day	-0.02	-0.03	-0.03	-0.03	0.03	0.89	0.86	0.87	0.74	1.34
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.11)	(0.11)	(0.11)	(0.14)	(0.25)
Day after diary day	-0.03	0.01	-0.01	-0.03	0.04	0.86	1.05	0.95	0.73	1.35
	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.13)	(0.16)	(0.13)	(0.17)	(0.26)
Later	-0.00	-0.06*	-0.06	-0.04	0.04	0.99	0.74*	0.78	0.67	1.37
	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)	(0.19)	(0.13)	(0.14)	(0.17)	(0.32)
Don't know	-0.10	0.05	0.01	0.03	0.06	0.62	1.28	1.06	1.24	1.61
	(0.08)	(0.07)	(0.09)	(0.05)	(0.07)	(0.24)	(0.44)	(0.39)	(0.59)	(0.85)

Was Diary Completed with Child?										
Omitted=Yes										
Parent only	0.03	0.02	0.00	-0.01	0.01	1.15	1.10	1.02	0.96	1.03
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.12)	(0.12)	(0.10)	(0.15)	(0.16)
Don't know	0.07	-0.09	-0.02	-0.07	-0.04	1.38	0.65	0.92	0.55	0.76
	(0.08)	(0.07)	(0.09)	(0.05)	(0.07)	(0.54)	(0.23)	(0.35)	(0.26)	(0.41)
Constant	0.61***	0.33***	0.49***	0.86***	0.92***	1.56*	0.48***	0.95	6.45***	11.53***
	(0.05)	(0.05)	(0.06)	(0.04)	(0.04)	(0.37)	(0.11)	(0.22)	(2.26)	(4.83)
Observations	3,574	3,574	3,574	3,574	3,574	3,573	3,573	3,573	3,573	3,573
R-Squared	0.14	0.11	0.02	0.01	0.20					

Notes: OR=odds ratio. Clustered errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A12 Full Table for Girls' Time

	Pooled OLS					Negative Binomial				
Variables	Sport (Min)	Reading (Min)	Playing (Min)	Media (Min)	Homework (Min)	Sport (IRR)	Reading (IRR)	Playing (IRR)	Media (IRR)	Homework (IRR)
Mother's Education: Omitted=Less than Secondary										
Secondary	-5.25	4.00*	0.92	2.81	-0.18	0.91	1.29**	1.07	1.05	1.00
	(4.37)	(2.16)	(4.32)	(4.19)	(2.52)	(0.08)	(0.16)	(0.11)	(0.06)	(0.06)
More than Secondary	-8.36**	6.81***	-0.26	-2.07	-3.44	0.87	1.45***	1.04	0.98	0.92*
	(4.24)	(1.94)	(4.09)	(3.98)	(2.34)	(0.08)	(0.16)	(0.11)	(0.06)	(0.05)
Wave = 2	-40.42***	-10.15***	15.01**	36.23***	34.23***	0.21***	0.36***	1.37**	1.56***	1.91***
	(4.18)	(2.31)	(7.55)	(10.17)	(7.34)	(0.04)	(0.10)	(0.19)	(0.16)	(0.21)
Secondary * Wave 2	14.70***	-0.83	-20.44**	-6.46	1.01	1.96***	1.20	0.60***	0.91	0.92
	(5.43)	(2.76)	(8.32)	(11.14)	(7.70)	(0.43)	(0.36)	(0.10)	(0.11)	(0.11)
More than Secondary * Wave 2	25.52***	1.24	-21.87***	-15.74	1.56	2.89***	1.62*	0.56***	0.84	0.97
	(5.20)	(2.81)	(8.24)	(10.72)	(7.61)	(0.59)	(0.47)	(0.10)	(0.09)	(0.11)
Day Diary Completed: Omitted=Monday										
Tuesday	7.37**	-0.52	-0.33	-4.85	0.32	1.23**	0.93	1.00	0.94	1.01
	(2.96)	(1.52)	(3.45)	(4.33)	(2.49)	(0.12)	(0.11)	(0.10)	(0.05)	(0.04)
Wednesday	6.37*	2.45	-0.04	2.13	0.83	1.18	1.11	0.99	1.02	1.00
	(3.43)	(1.95)	(3.69)	(5.00)	(2.62)	(0.13)	(0.14)	(0.10)	(0.06)	(0.04)
Thursday	4.77	-1.91	2.46	-2.90	2.30	1.08	0.77**	1.06	0.96	1.03
	(3.11)	(1.52)	(3.39)	(4.63)	(2.78)	(0.11)	(0.09)	(0.10)	(0.05)	(0.04)
Friday	10.08***	0.63	17.84***	14.48***	-26.63***	1.25**	1.02	1.51***	1.20***	0.53***
	(3.46)	(2.10)	(4.78)	(5.06)	(3.54)	(0.13)	(0.15)	(0.15)	(0.07)	(0.04)
Month Diary Completed: Omitted=January										
February	9.07*	-7.44*	-9.13	-4.14	1.14	1.43*	0.53**	0.81	0.96	1.11

	(4.77)	(3.85)	(7.17)	(8.23)	(5.22)	(0.26)	(0.13)	(0.15)	(0.08)	(0.10)
March	18.83***	-4.36	-5.72	2.69	-5.62	2.17***	0.68	0.83	0.99	0.98
	(5.26)	(3.96)	(7.54)	(11.05)	(5.51)	(0.43)	(0.17)	(0.15)	(0.11)	(0.08)
April	25.21***	-4.54	-9.27	-8.87	-0.57	1.96***	0.67*	0.78	0.90	1.04
	(6.09)	(3.78)	(7.15)	(7.16)	(3.68)	(0.30)	(0.14)	(0.13)	(0.08)	(0.08)
May	35.85***	-6.64	-20.76***	-14.51	5.30	2.28***	0.58*	0.56**	0.84	1.11
	(12.20)	(4.52)	(7.68)	(10.48)	(7.76)	(0.47)	(0.17)	(0.13)	(0.11)	(0.13)
June	53.81***	-0.28	-4.02	-9.86	-6.19	3.09***	0.87	0.89	0.94	0.96
	(12.38)	(5.46)	(10.31)	(13.09)	(5.96)	(0.59)	(0.23)	(0.20)	(0.16)	(0.14)
July										
August	29.60	-2.20	-18.34	8.86	12.31	1.95**	0.72	0.73	1.09	1.37
	(19.15)	(8.70)	(12.94)	(28.68)	(9.37)	(0.60)	(0.35)	(0.23)	(0.31)	(0.32)
September	16.39***	-5.96*	-3.16	-8.92	4.68	1.69***	0.60**	0.89	0.89	1.15*
	(4.55)	(3.55)	(6.73)	(7.12)	(4.37)	(0.27)	(0.12)	(0.13)	(0.07)	(0.08)
October	16.85***	-3.33	-8.72	-13.20*	-1.53	1.66***	0.75	0.78*	0.83**	1.03
	(4.13)	(3.70)	(6.07)	(6.80)	(3.56)	(0.24)	(0.15)	(0.11)	(0.06)	(0.06)
November	4.19	-4.31	-10.62*	-11.98*	2.01	1.21	0.71*	0.73**	0.88*	1.07
	(4.00)	(3.53)	(6.01)	(6.84)	(3.55)	(0.18)	(0.14)	(0.10)	(0.07)	(0.06)
December	-0.31	-7.16*	-3.75	-0.28	-7.38*	0.98	0.58**	0.92	1.01	0.93
	(4.13)	(3.73)	(6.27)	(8.13)	(4.25)	(0.16)	(0.13)	(0.13)	(0.09)	(0.07)
Time Diary Completed: Omitted=During Day										
End of diary day	-3.70	-0.91	-0.43	-5.51	3.31	0.86*	0.90	1.01	0.94	1.09*
	(2.92)	(1.49)	(3.06)	(3.79)	(2.46)	(0.07)	(0.10)	(0.08)	(0.04)	(0.05)
Day after diary day	0.16	0.57	5.61	-5.92	3.54	1.07	1.06	1.17	0.93	1.09
	(3.52)	(1.67)	(4.20)	(4.88)	(3.49)	(0.11)	(0.12)	(0.12)	(0.05)	(0.06)
Later	-4.10	3.07	6.16	3.33	-2.78	0.83	1.16	1.16	1.01	0.99
	(3.99)	(3.13)	(5.50)	(6.11)	(3.67)	(0.10)	(0.19)	(0.14)	(0.07)	(0.06)
Don't know	10.48	-1.87	0.77	-10.92	19.40***	1.05	0.87	1.03	0.91	1.57***
	(15.62)	(4.54)	(7.23)	(8.50)	(5.82)	(0.22)	(0.24)	(0.22)	(0.09)	(0.21)
Was Diary Completed with Child? Omitted=Yes										

Parent only	4.06*	-1.62	-1.82	-11.51***	0.65	1.15**	0.87	0.96	0.87***	0.99
	(2.31)	(1.25)	(2.70)	(3.13)	(2.29)	(0.08)	(0.08)	(0.06)	(0.03)	(0.04)
Don't know	-10.30	2.28	2.63	-3.11	-20.00***	0.92	1.25	1.08	0.94	0.66***
	(14.56)	(4.97)	(7.17)	(9.03)	(5.80)	(0.19)	(0.40)	(0.22)	(0.10)	(0.09)
Constant	34.66***	21.24***	42.51***	84.97***	50.50***	30.29***	25.72***	41.71***	82.57***	46.98***
	(5.61)	(3.72)	(7.40)	(7.88)	(4.00)	(5.17)	(5.42)	(6.61)	(7.50)	(3.53)
Observations	3,606	3,606	3,606	3,606	3,606	3,606	3,606	3,606	3,606	3,606
R-Squared	0.13	0.05	0.04	0.07	0.18					

Notes: IRR=incidence rate ratio. Clustered errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A13 Full Table for Boys' Time

	Pooled OLS					Negative Binomial				
Variables	Sport (Min)	Reading (Min)	Playing (Min)	Media (Min)	Homework (Min)	Sport (IRR)	Reading (IRR)	Playing (IRR)	Media (IRR)	Homework (IRR)
Mother's Education: Omitted=Less than Secondary										
Secondary	-1.81	4.11**	2.10	-2.10	-4.00	1.02	1.46***	1.05	0.97	0.88**
	(5.56)	(1.87)	(3.83)	(4.93)	(2.65)	(0.08)	(0.21)	(0.14)	(0.06)	(0.05)
More than Secondary	-3.53	11.39***	3.31	-4.02	-6.88***	0.98	2.10***	1.17	0.95	0.80***
	(5.10)	(2.04)	(3.50)	(4.82)	(2.45)	(0.07)	(0.28)	(0.15)	(0.06)	(0.05)
Wave = 2	-38.38***	-7.52***	17.47**	40.00***	14.12***	0.46***	0.41***	1.70***	1.48***	1.34***
	(6.34)	(2.09)	(7.36)	(8.75)	(5.03)	(0.08)	(0.12)	(0.32)	(0.12)	(0.13)
Secondary * Wave 2	22.23*	-2.38	-8.90	-12.86	14.02**	1.49*	0.97	0.79	0.90	1.26**
	(12.80)	(2.61)	(8.45)	(10.10)	(5.90)	(0.34)	(0.33)	(0.17)	(0.09)	(0.14)
More than Secondary * Wave 2	12.86*	-4.75*	-17.70**	-14.48	17.31***	1.26	1.18	0.57***	0.88	1.38***
	(6.97)	(2.72)	(7.79)	(9.61)	(5.52)	(0.23)	(0.37)	(0.12)	(0.08)	(0.15)
Day Diary Completed: Omitted=Monday										
Tuesday	1.02	-0.47	-5.72*	4.88	-0.57	1.02	0.94	0.84*	1.05	1.01
	(3.93)	(1.50)	(3.18)	(4.48)	(2.57)	(0.08)	(0.13)	(0.09)	(0.05)	(0.04)
Wednesday	10.86	0.92	2.61	4.86	-2.80	1.22	1.05	1.05	1.04	0.97
	(9.38)	(1.85)	(4.00)	(5.08)	(3.02)	(0.15)	(0.15)	(0.12)	(0.06)	(0.05)
Thursday	2.72	-0.80	-1.14	-0.61	0.94	1.07	0.89	0.91	0.98	1.02
	(4.14)	(1.54)	(3.55)	(4.49)	(2.62)	(0.09)	(0.13)	(0.10)	(0.05)	(0.04)
Friday	6.56	-2.33	9.35**	20.75***	-26.63***	1.06	0.80	1.27**	1.23***	0.52***
	(4.72)	(1.77)	(4.02)	(5.51)	(2.94)	(0.10)	(0.13)	(0.13)	(0.07)	(0.04)
Month Diary Completed: Omitted=January										
February	9.37	0.46	-9.22	4.52	-4.74	1.26	1.04	0.77	1.03	0.89

	(6.86)	(4.29)	(6.53)	(8.52)	(4.76)	(0.21)	(0.40)	(0.16)	(0.09)	(0.08)
March	24.05***	-1.23	3.34	-11.81	-5.28	1.83***	0.88	1.08	0.88	0.94
	(6.18)	(2.85)	(7.42)	(8.46)	(4.76)	(0.27)	(0.27)	(0.19)	(0.08)	(0.09)
April	47.24***	-4.38*	-14.77***	-1.50	-2.30	2.24***	0.71*	0.57***	0.97	0.95
	(6.83)	(2.60)	(4.88)	(6.76)	(3.93)	(0.24)	(0.15)	(0.11)	(0.07)	(0.08)
May	48.96***	-3.29	2.53	-15.39	1.83	2.24***	0.80	1.07	0.80	1.14
	(11.34)	(4.26)	(7.44)	(10.28)	(5.95)	(0.32)	(0.29)	(0.23)	(0.11)	(0.15)
June	72.79**	-9.28**	21.47	22.40	-23.45***	2.67***	0.39*	1.75	1.25	0.50**
	(34.72)	(4.16)	(34.46)	(22.40)	(8.81)	(0.77)	(0.22)	(1.24)	(0.27)	(0.15)
July	0.31	-2.73	-10.57*	-78.70***	-36.54***	1.09	0.71*	0.62***	0.00***	0.29***
	(6.41)	(2.52)	(5.81)	(6.73)	(4.11)	(0.13)	(0.15)	(0.11)	(0.00)	(0.02)
August	22.79**	-0.71	-7.63	19.04	-25.40***	1.56**	0.86	0.86	1.15	0.58**
	(11.10)	(4.96)	(8.95)	(16.20)	(8.47)	(0.31)	(0.31)	(0.28)	(0.16)	(0.13)
September	28.52***	0.05	-5.67	-3.61	-1.72	1.77***	1.01	0.87	0.93	0.92
	(4.52)	(2.41)	(4.74)	(6.48)	(3.81)	(0.17)	(0.19)	(0.12)	(0.06)	(0.06)
October	27.00***	-1.20	-3.69	-7.85	-3.99	1.74***	0.82	0.90	0.90	0.89
	(9.65)	(2.41)	(4.80)	(6.21)	(3.82)	(0.25)	(0.16)	(0.12)	(0.06)	(0.06)
November	6.70	-0.57	-0.31	2.79	-2.86	1.25**	0.86	1.03	1.01	0.92
	(4.56)	(2.35)	(5.29)	(6.38)	(3.62)	(0.14)	(0.16)	(0.14)	(0.07)	(0.06)
December	1.64	0.41	1.96	9.87	-5.52	1.07	0.97	1.16	1.08	0.89
	(4.92)	(2.57)	(5.72)	(6.87)	(4.12)	(0.14)	(0.21)	(0.18)	(0.07)	(0.07)
Time Diary Completed: Omitted=During Day										
End of diary day	0.68	-0.98	-0.46	-10.90***	3.47	0.99	0.95	0.97	0.90**	1.10**
	(5.38)	(1.35)	(3.02)	(4.00)	(2.31)	(0.09)	(0.11)	(0.09)	(0.04)	(0.05)
Day after diary day	-3.15	0.74	3.48	-5.84	2.99	0.95	1.13	1.05	0.96	1.10*
	(4.57)	(1.82)	(4.15)	(5.31)	(2.72)	(0.09)	(0.15)	(0.12)	(0.05)	(0.06)
Later	-1.96	-2.12	0.07	-3.27	0.38	1.07	0.80	0.97	0.95	1.05
	(6.26)	(1.97)	(4.87)	(6.70)	(3.27)	(0.13)	(0.15)	(0.14)	(0.07)	(0.07)
Don't know	-18.73*	3.94	13.84	-8.74	6.23	0.68	1.36	1.53	0.91	1.19
	(9.76)	(4.33)	(8.81)	(12.87)	(7.38)	(0.17)	(0.46)	(0.40)	(0.11)	(0.16)
Was Diary Completed with Child? Omitted=Yes										

Parent only	5.72	-0.83	-1.76	-6.01*	5.85***	1.13*	0.81**	0.96	0.95	1.12***
	(4.75)	(1.20)	(2.60)	(3.46)	(1.97)	(0.08)	(0.08)	(0.07)	(0.03)	(0.04)
Don't know	14.96	-5.22	-9.21	0.60	-1.35	1.30	0.56	0.76	1.00	1.00
	(10.10)	(4.27)	(9.00)	(13.29)	(7.46)	(0.33)	(0.20)	(0.21)	(0.12)	(0.14)
Constant	44.80***	15.07***	29.66***	86.82***	52.65***	40.11***	16.31***	28.77***	88.34***	52.46***
	(8.60)	(2.65)	(5.17)	(7.41)	(4.37)	(5.30)	(3.49)	(4.86)	(7.40)	(4.49)
Observations	3,574	3,574	3,574	3,574	3,574	3,574	3,574	3,574	3,574	3,574
R-Squared	0.11	0.06	0.03	0.06	0.16					

Notes: IRR=incidence rate ratio. Clustered errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

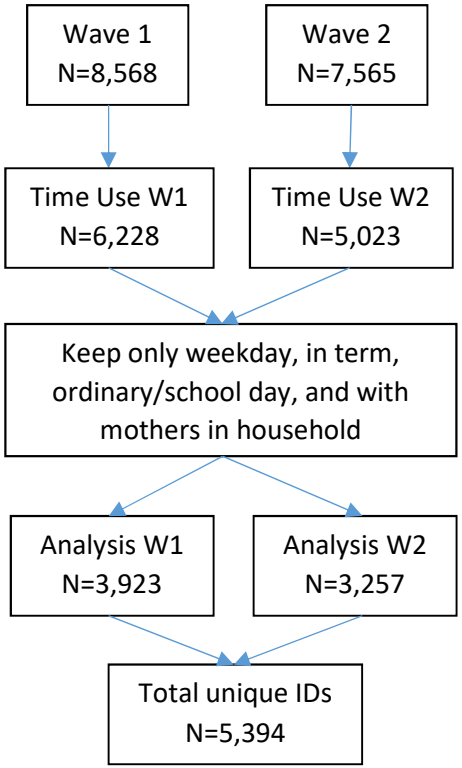

Fig. A1 Construction of Analysis Data

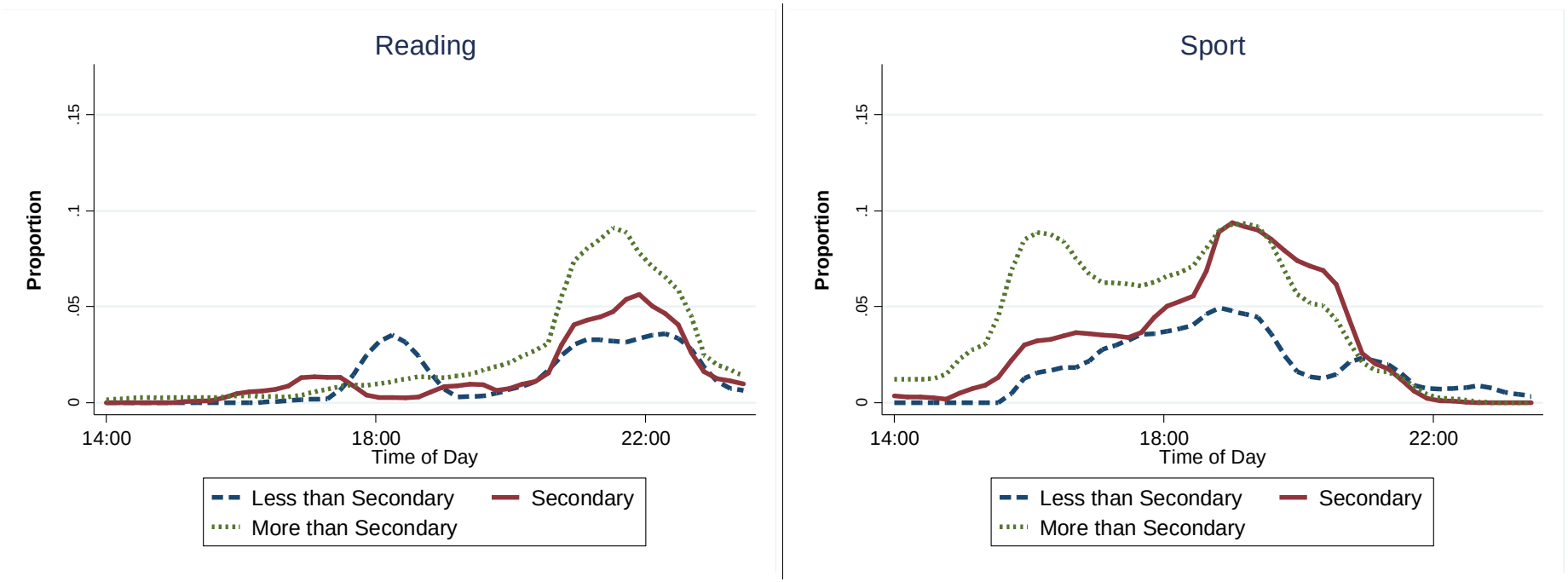

Fig. A2 Reading (left) and sports (right) participation by maternal education at age 13 for girls

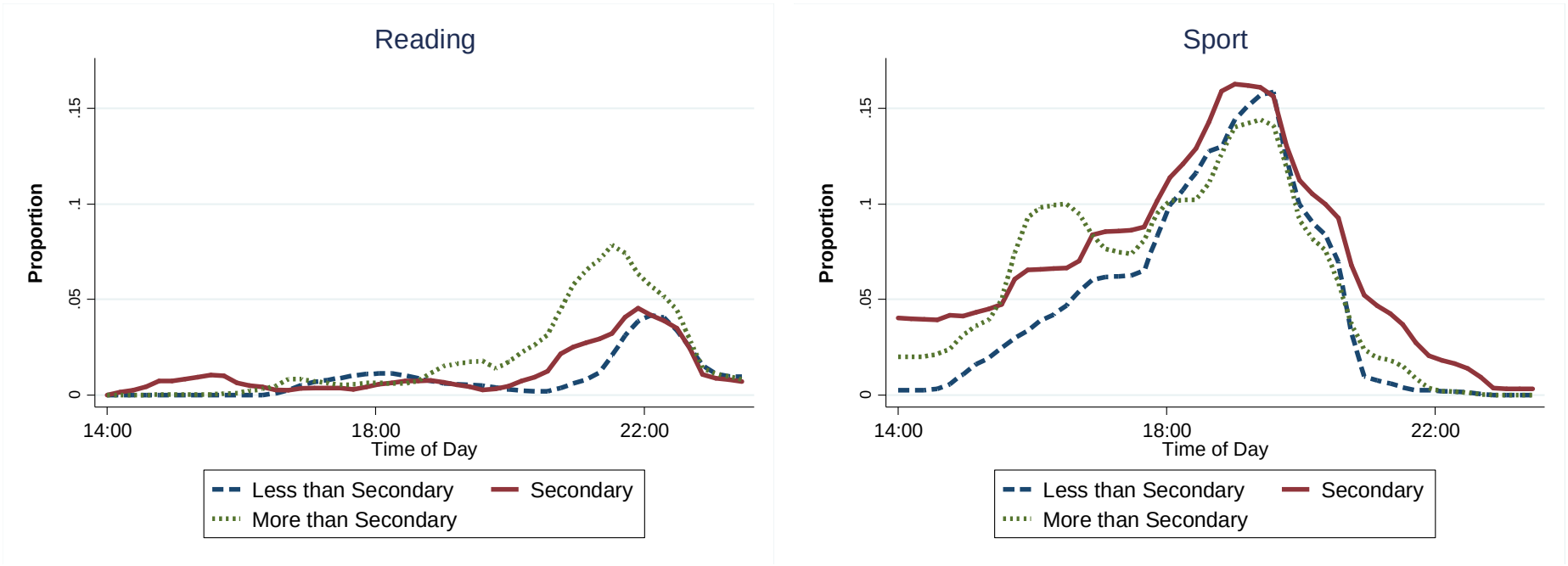

Fig. A3 Reading (left) and sports (right) participation by maternal education at age 13 for boys

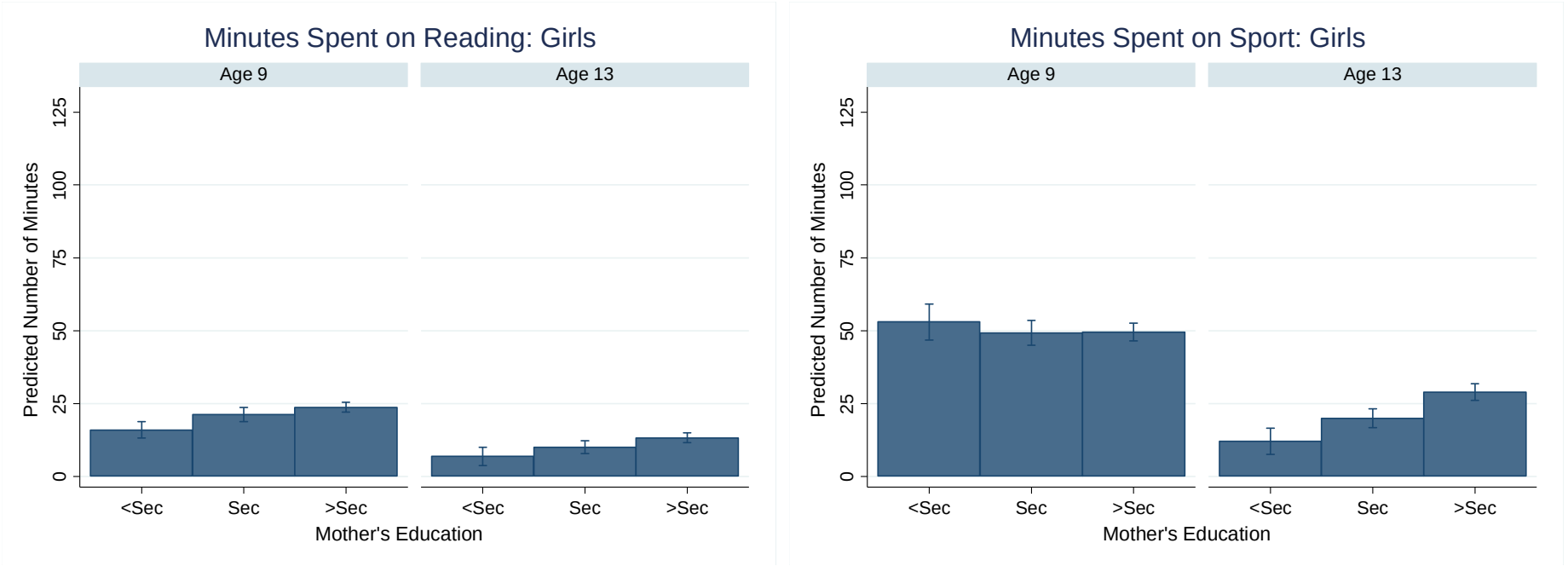

Fig. A4 Predicted average minutes spent in reading (left) and sports (right) by maternal education and age for girls

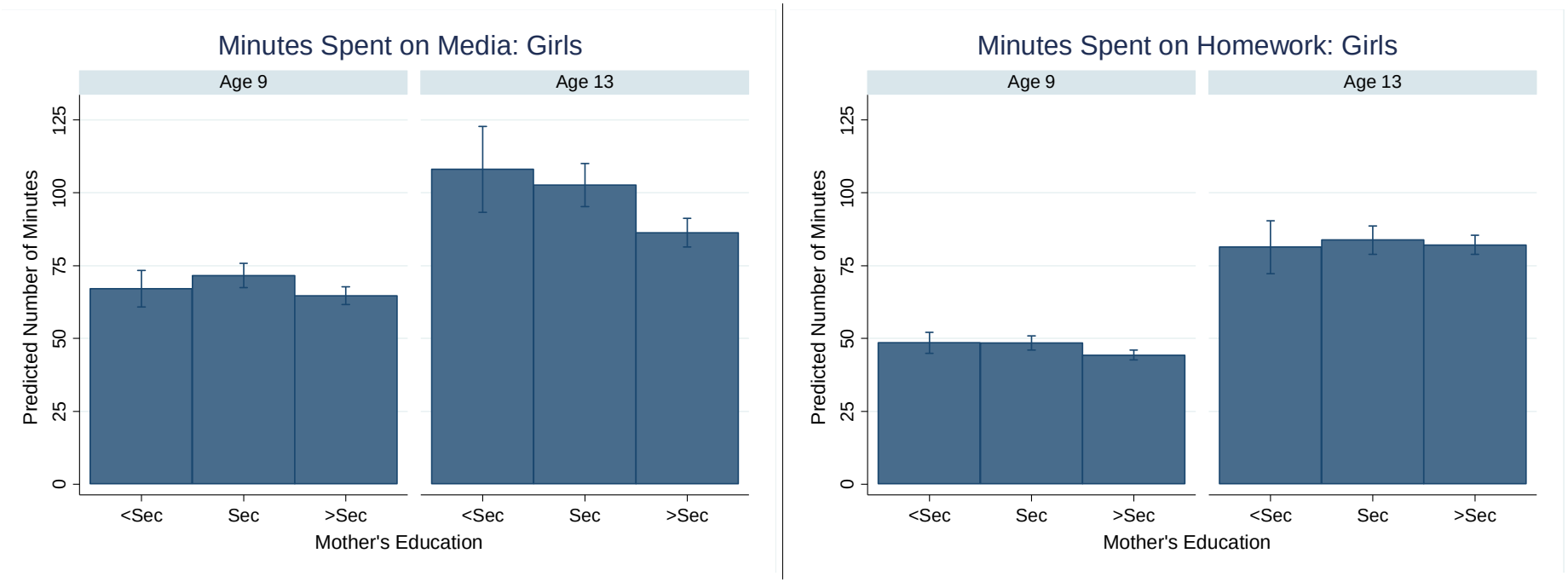

Fig. A5 Predicted average minutes spent in media (left) and homework (right) by maternal education and age for girls

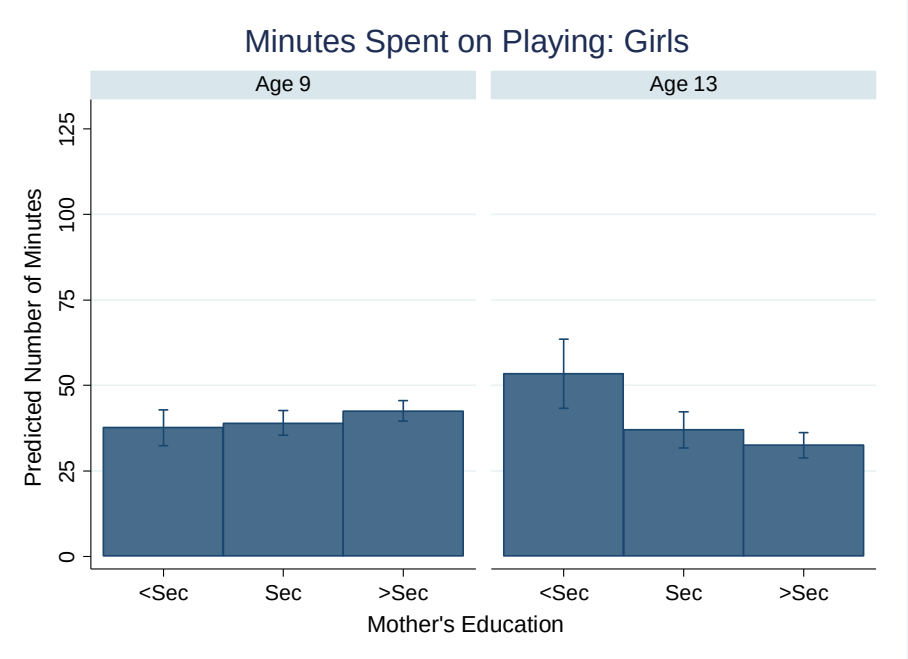

Fig. A6 Predicted average minutes spent playing (in unstructured activities) by maternal education and age for girls

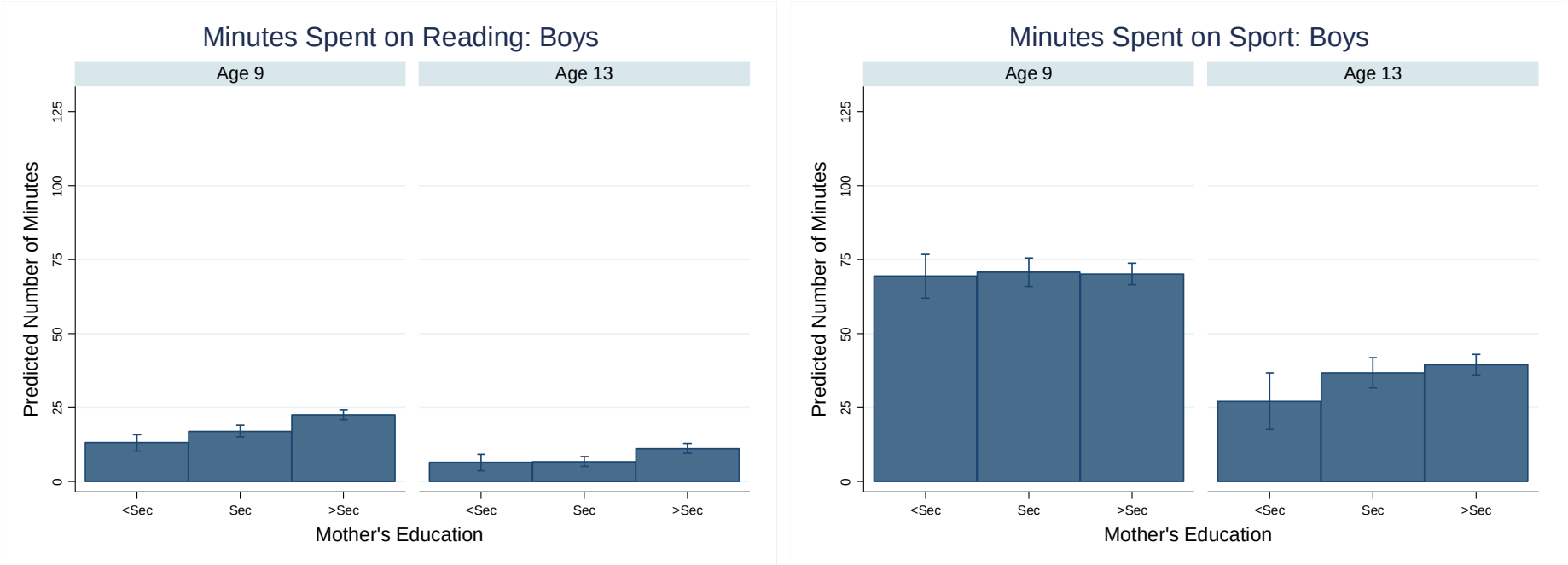

Fig. A7 Predicted average minutes spent in reading (left) and sports (right) by maternal education and age for boys

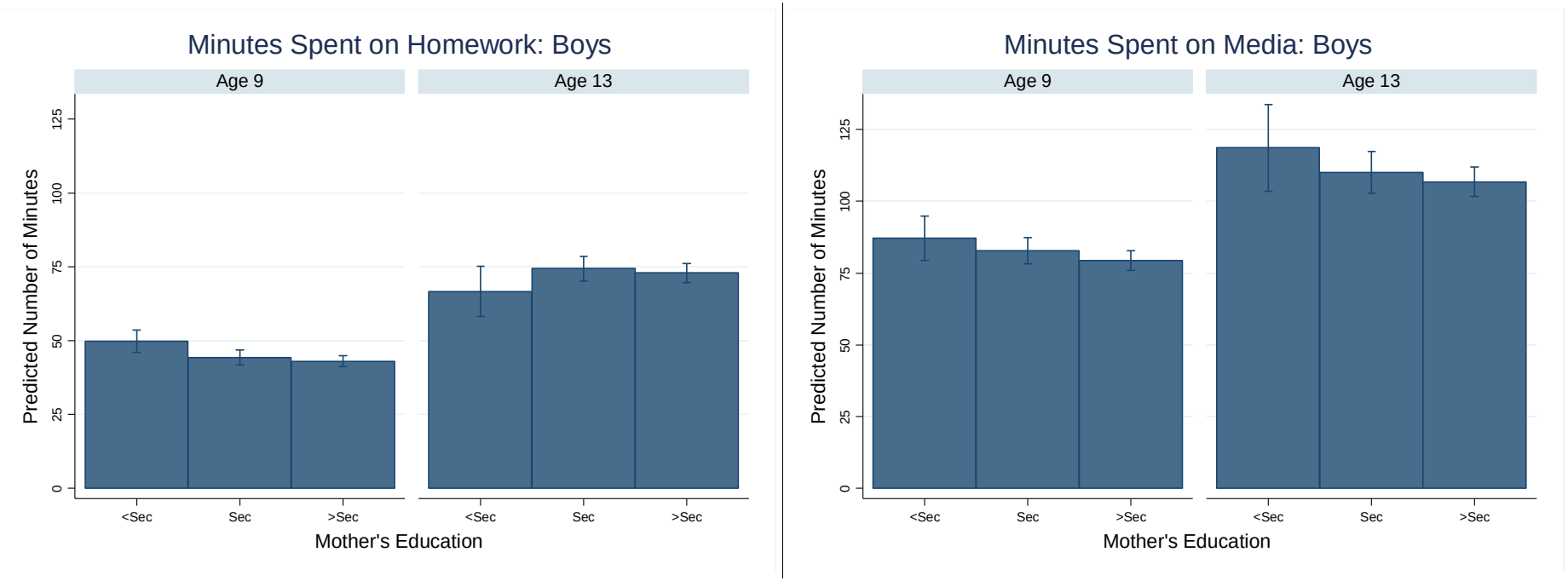

Fig. A8 Predicted average minutes spent in media (left) and homework (right) by maternal education and age for boys

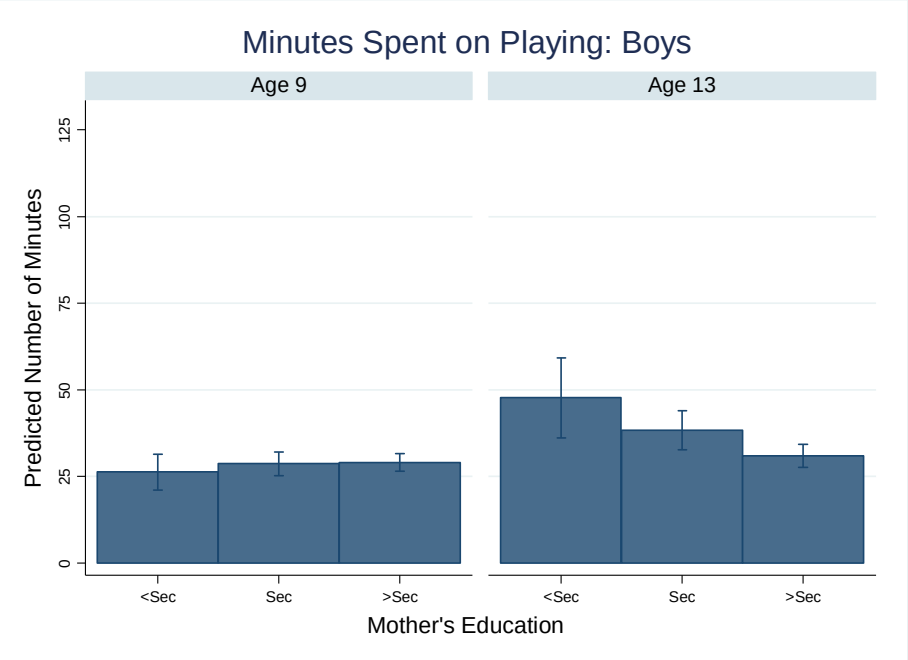

Fig. A9 Predicted average minutes spent playing (in unstructured activities) by maternal education and age for boys