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**Keywords:** Birth order, Children's time use, Human capital development

**JEL Classification:** J12, J13, J22, J24

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# The Effect of Birth Order on Children's Time Use\*

Nicole Black,<sup>†</sup> Danusha Jayawardana,<sup>‡</sup> and Gawain Heckley<sup>§</sup>

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## Abstract

Recent research shows that birth order affects human capital outcomes, yet there is limited empirical evidence on the underlying mechanisms. This study examines the effect of birth order on children's time use across activities that are important for human capital development. Using detailed time-use diaries of Australian children aged 2-15, we find that within families with two or three children, later-born children spend less time on enrichment activities and more on digital media, compared to first-born children. We obtain the same findings when we repeat the analysis using detailed time-use diaries of US children. Further investigation reveals that part of the birth order effect is driven by parents spending less time with later-born children compared to first-borns. However, later-borns also independently devote less of their *own* time to enrichment activities, suggesting that personal time use may be an important mechanism behind the well-documented impact of birth order on human capital development. We find evidence that later-born children experience more lenient parenting, which may help explain this pattern of own time use.

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# 1 Introduction

It is now well established that first-born children tend to have better life outcomes than second-born children, who in turn tend to have better life outcomes than third-born children and so on. This birth order effect has been found for a wide set of outcomes including educational attainment (Black, Devereux and Salvanes, 2005; Booth and Kee, 2009; De Haan, 2010; Lehmann, Nuevo-Chiquero and Vidal-Fernandez, 2018; Pavan, 2016), skills (Black, Grönqvist and Öckert, 2018; Monfardini and See, 2016; Zhang, Guo and Zhang, 2023), earnings (Kantarevic and Mechoulan, 2006), and health and risky behaviours (Argys et al., 2006; Averett, Argys and Rees, 2011; Black, Devereux and Salvanes, 2016; Breining et al., 2020). Birth order has also been shown to have intergenerational effects on human capital (Havari and Savegnago, 2022). However, there is limited evidence on the underlying mechanisms explaining why birth order matters for human capital development and long-term outcomes. In this paper, we study the impact of birth order on how children spend their time across activities that are important for human capital development.

Birth order effects are interesting because they capture the impacts of changes in the family environment that are arguably unrelated to the individual child's initial human capital endowments (Black, Grönqvist and Öckert, 2018). Recent evidence has found no important genetic differences by birth order and in fact earlier-born children have lower birth weight on average than later-born, indicating if anything, worse initial health endowments for earlier-born children (Isungset et al., 2022; Brenøe and Molitor, 2018). Children and parents do not choose the birth order, rather they respond to birth order. Understanding the mechanisms behind these birth order effects is important for designing interventions that help to mitigate inequalities in human capital that arise due to one's order of birth.

Theoretical models that explain how birth order can influence child outcomes, including the 'quantity vs quality model,' (Becker and Lewis, 1973) and the 'resource dilution model' (Blake, 1981), indicate that as the number of children increases, the parental resources available for each child is reduced. They imply that first-born children are likely to benefit from more (undivided) attention and human capital investments relative to later-born children of the same age. There is some empirical support for parental time investments to decline with birth order. For instance,

using American Time Use Survey data, [Price \(2008\)](#) finds that first-born children receive significantly more quality time with their parents compared to second-born children of the same age from similar families, and this results from parents dividing their time approximately equally across their children at any point in time. Additionally, [Hotz and Pantano \(2015\)](#) show that parents are more likely to monitor the homework of their earlier-born children compared to later-born offspring. However, parental time investments in children's human capital make up only a small part of a day.<sup>1</sup> The potential impact of parental time investments may therefore be limited relative to children's own time investments.

Throughout a day children can allocate their time across different activities, and these allocations have different potential implications for future outcomes (see e.g. [Conti, Mason and Poupakis \(2019\)](#)). For instance, time spent on digital media is less productive for cognitive skills than time spent on homework and reading ([Black, Jayawardana and Heckley, 2024](#)). How children allocate their time will likely depend on parental preferences, rules and monitoring capacity, and there is some evidence that such parenting behaviours change with a child's birth order ([Hotz and Pantano, 2015](#)). In this paper we examine the extent to which birth order shapes how children allocate their time across a wide range of activities – some more productive than others – and explore the potential role of parental rules and monitoring behaviours.

This paper uses a detailed cohort panel survey following children in Australia from age 2 to 15 years. A unique feature of this survey is that it includes detailed time use diaries, which document how children spend their time over a 24-hour period in repeated survey years. We classify all activities into seven mutually exclusive categories and compare the time allocations of first-born children to later-born children of the same age, born in the same year, living in the same neighbourhood, within families of the same size (with two or three children), with similar background characteristics at time of birth. The results show stability to alternative covariate sets and even to other contexts. Applying our specification to the U.S. context using data from the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID) yields consistent results, supporting the generalisability of our findings.

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<sup>1</sup>In Australia, parents spend an average of 2 to 4 hours per day on all child care activities for children under the age of 15, including teaching, helping with tasks, playing, reading, or talking with them ([Australian Bureau of Statistics, 2022](#)), yet children are awake on average 14 hours per day.

We find that later-born children on average spend about 9-14 minutes (or 6-10%) more per day on digital media activities (such as watching TV and playing video games), depending on family size. This appears to be at the cost of about 11-18 minutes (or 11-20%) less spent on enrichment activities (such as reading, playing board games, doing homework or playing a musical instrument). These magnitudes are moderate, however, given the cumulative nature of skills development, incremental differences in investments in childhood can have large payoffs (Heckman, 2007). We also find that second-born children in two-child families spend slightly less time sleeping, and somewhat more time on socialising and general care compared to first-borns. However, these differences are small in magnitude and are not observed in three-child families. We find no discernible differences in time spent on school or physical activity by birth order. When we explore heterogeneity by age group, we find that the increase in time spent on digital media and the reduction in time spent on enrichment activities are generally greater for 10-14 year old children, suggesting that early adolescence is a period where particular attention to birth order effects is needed.

Decomposing our time use results, we find that the reduction in time spent on enrichment activities by later-born children is partly driven by parents spending less time engaging in enrichment activities together with their child, but also (and to a greater extent) driven by a reduction in children doing enrichment activities alone. This suggests that a reduction in parental quality time with the child for later-born children is only part of the story. The increase in digital media time for later-born children is largely driven by those activities that children do alone. We show that one possible explanation for this is that parents are more lenient with later-born children. Parents are less likely to have rules around TV watching and video games for later-born children, and later-born children themselves are less likely to perceive that their parents expect them to follow rules.

This paper makes several contributions to the literature. To our knowledge, no study has examined the impact of birth order on children's own time use. This is most likely due to a lack of representative surveys that include detailed time use diaries of children. While some studies, relying on survey reports of certain activities, indicate that birth order impacts time spent on homework and watching TV (Black, Grönqvist and Öckert, 2018) and participation in extracur-

ricular activities (Rees et al., 2008), none have used detailed time use diary data to consider a comprehensive range of activities. An advantage of time use diaries (TUDs) is that each activity is recorded at the time of the activity, which helps reduce measurement errors, particularly those that may also vary with birth order and unobservables, such as recall bias, aggregation bias and desirability bias.

The study closest to ours is Price (2008), which examines how birth order affects the time parents spend with their children. It finds that parents spend an additional 20-30 minutes of quality time with their first-born children compared to second-born children, where quality time refers to activities primarily directed toward or centered around the child. We extend this study in several ways. First, we use detailed time use data of children rather than of parents. This allows us to investigate the impact of birth order on how children allocate their time across a full range of activities, even when they are not with their parents - a particularly important aspect as children gain independence during adolescence. Second, we explore the impacts of birth order on *with whom* children spend their time. This is important for understanding whether the scarcity of parental time for higher parity children plays a key role. We also explore parental rules as a possible explanation for differences in time use by birth order. Furthermore, we follow children over a long time frame, from ages 2-4 every two years through to ages 14-16 providing a comprehensive picture of the birth order effect throughout a child's development.

## 2 Data

### 2.1 The Longitudinal Study of Australian Children (LSAC)

The data comes from the Longitudinal Study of Australian Children (LSAC), a nationally representative panel survey conducted every two years since 2004.<sup>2</sup> This study follows approximately 10,000 children from two cohorts: the Baby or 'B' cohort, comprising those aged 0/1 years in 2004; and, the Kinder or 'K' cohort, consisting of children aged 4/5 years in 2004.

Data is primarily collected through face-to-face interviews with the main parent, who is typic-

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<sup>2</sup>See Soloff, Lawrence and Johnstone (2005), for comprehensive details on the study design.

ally the mother (in over 90% of cases). Additionally, data is collected from the school, teacher and the child themselves, especially at older ages. Detailed data regarding children's attributes, abilities, family environment and parental socio-demographic characteristics are collected. LSAC collects data from only one child per family. We identify the birth order of each child using reported information on the total number of siblings, number of older siblings, and number of younger siblings.

Information on children's activities over a 24-hour period is collected through time use diaries (TUDs) from ages 0/1 to 14/15. Compared to other methods of measuring how individuals spend their time, TUDs reduce measurement error in several important ways. Because TUDs are completed in real time, they minimise recall bias, which is common in retrospective surveys (Chau et al., 2019). They also reduce social desirability bias by recording actual behaviour rather than relying on self-reported assessments, which are often influenced by the desire to over-report 'good' behaviours and under-report less favourable ones. Finally, TUDs prompt respondents to record all activities, including routine or easily forgotten tasks, which helps to improve granularity and overall precision compared with typical survey data (Gershuny et al., 2020).

There are only three large-scale time use diary datasets that collect child-level data: LSAC, the Child Development Supplement (CDS) of the Panel Study of Income Dynamics in the United States, and the Millennium Cohort Study (MCS) in the United Kingdom. Among these, LSAC stands out because of its uniquely detailed and consistently collected time use data spanning the full course of childhood. In contrast, CDS and MCS collect TUDs over fewer waves (the CDS includes TUDs three times over a 10-year period, and the MCS includes them only at age 14). This makes LSAC uniquely suited to provide new insights into how birth order shapes children's time allocation across different stages of childhood.

## **2.2 Measuring time use**

The LSAC TUDs are designed to capture the different activities of children at various stages of development. For children below the age of 10, the main parent is responsible for recording two diary entries - one on a weekday and another on a weekend day. The activities are documented

in 15-minute intervals from 4:00 am on the designated day until 4:00 am the following day, using a predefined list of activities. From age 10 onward, each child is tasked with completing one TUD themselves, on the day before their scheduled LSAC interview. Unlike the structure of parent-completed diaries, those completed by children follow an ‘activity episode’ structure, wherein the child records the activity and its start time. The TUD is checked and coded by the LSAC interviewer at the interview, which helps to gain richer information and minimise incomplete TUDs.

TUDs are collected in every wave until age 14/15, excluding waves 4 (ages 6/7) and 5 (8/9) for Cohort B. We exclude Wave 1 of Cohort B (age 0/1) because the recorded activities for infants differ greatly from those observed for older children. TUD entries that lack information about the day of diary completion (around 5% of the sample), and those not totaling 24 hours (0.1%), are excluded from our analysis. This leaves us with a sample of 8,650 children with 37,383 observations of TUD information across eight waves (2004 to 2018).

Naturally, the activities that children engage in change as they age. To maintain consistency across different age groups, we follow [Black, Jayawardana and Heckley \(2024\)](#) and classify all activities into seven broad, mutually exclusive time use categories: sleep; school; enrichment activities; physical activities; social activities; digital media; and, general care.<sup>3</sup> These categories capture activities that are important for human capital development. A list of activities included in each category is shown in [Table 1](#).

## 2.3 Analysis sample

To consistently examine the effects of birth order on time use, we impose several sample restrictions. First, we limit the sample to children in families ranging from two to three children, which represents 77% of the total sample. One-child families and larger families with four or more children generally differ in terms of family environment and resource constraints ([Lehmann, Nuevo-Chiquero and Vidal-Fernandez, 2018](#)). Second, we exclude children with twins due to the inherent difficulty in accurately identifying their birth order ([Black, Devereux and Salvanes,](#)

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<sup>3</sup>[Black, Jayawardana and Heckley \(2024\)](#) consider eight time use categories, however, here we combine general care and other activities into a single category. The results remain stable even when considering these categories separately.

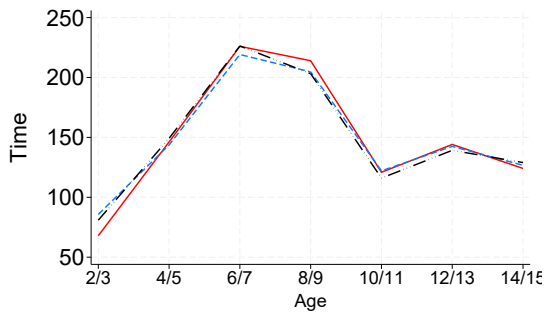
Table 1: Time use categories and activities

| Category              | Activities  |
|-----------------------|---|
| Sleep                 | Sleeping, napping.  |
| School                | Attending playgroup, day care or school.  |
| Enrichment activities | Being read to (for children <10 years), doing homework, tutoring classes, music lessons, non-active club activities (e.g. chess), reading, playing a musical instrument, playing chess or board games /crosswords, doing art/crafts or drawing. |
| Physical activities   | Team sports, individual sports, outdoor activities such as walking and cycling (including active commuting).  |
| Social activities     | Outings, visiting people, attending movies, sporting events, chatting to people (face-to-face, on the phone and via video, e.g. Skype).   |
| Digital media         | Watching television, playing games on an electronic device (e.g. computer, Xbox, Nintendo), and using computers (e.g. application use, internet browsing, downloading content), and social media use (for children >10).                        |
| General care          | Having meals, bathing, dressing, health care use, inactive commuting and time spent on household chores, both paid and unpaid.  |

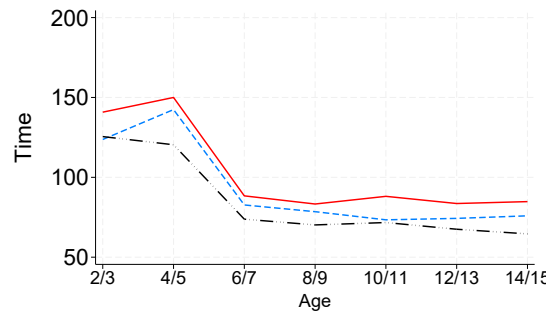
2005). Lastly, our sample is further refined to include only children from families with both biological parents and biological siblings. This allows us to ascertain the true birth order in the family by excluding adopted or half siblings. These combined restrictions result in an estimation sample of 5,654 children, with 22,152 observations.

Table A1 in the Appendix provides the summary statistics of our analysis sample. Within our sample, 63% of the families have two children, the rest having three children. Across the whole sample, 44%, 43% and 13% of children are first-, second- and third-born respectively. However, when examining the distribution of birth order conditional on family size, we observe a fairly uniform distribution, suggesting the sampling frame is representative of children from different birth orders. Specifically, among two-child families, about half are first-born, and among three-child families about a third are first-born and a third second-born.

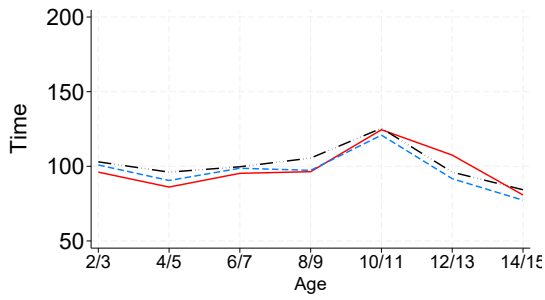
Figure 1 presents the average time spent on each activity across all ages, by birth order. There are no noticeable birth order differences in the average time allocated to schooling. As expected, school time increases around age 6, corresponding with the typical school starting age. A dip



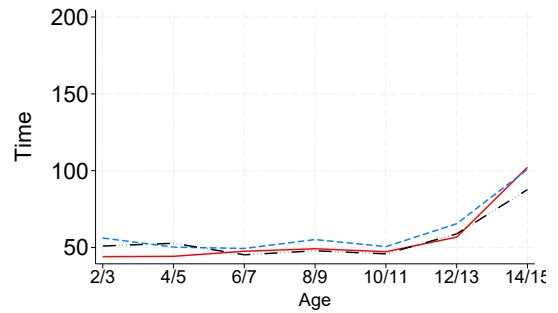
(a) School



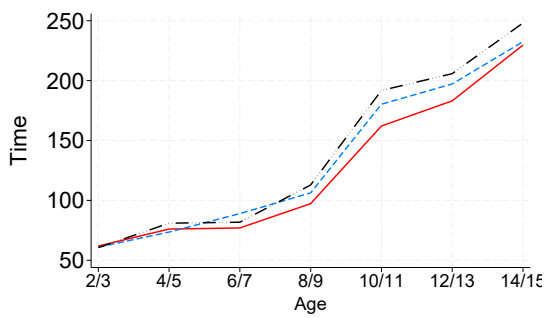
(b) Enrichment activities



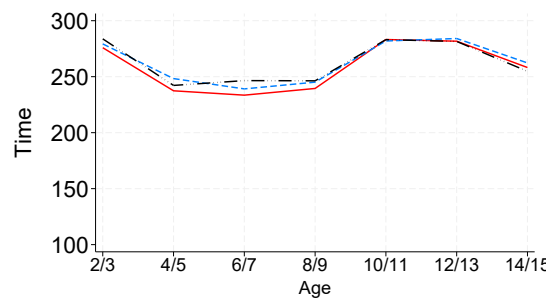
(c) Physical activities



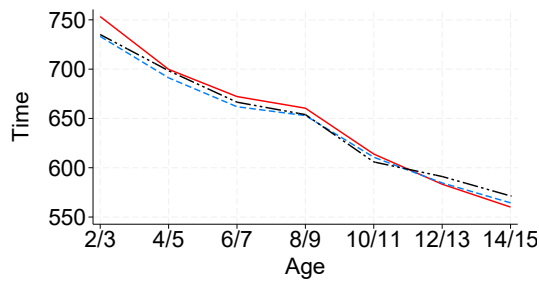
(d) Social activities



(e) Digital media



(f) General care



(g) Sleep

— First-born    - - - Second-born    - - - Third-born

Figure 1: Average time use by age and birth order

Notes: The figure presents mean time use for each category by age and birth order. Time is in minutes and weighted to account for whether the diary entry is from a weekday or a weekend.

at age 10 likely reflects a change in the survey question, where school time before age 10 includes before- and after-school care, while from age 10 onward it captures only organised school lessons. Time spent on physical and social activities remains relatively stable across ages, with a slight increase in both activities after age 10, with no clear differences by birth order. Similarly, sleep time shows a gradual reduction as children grow older, but with no clear differences by birth order.

However, as children age, there is a substantial decrease in the average time dedicated to enrichment activities, coupled with an increase in time spent on digital media. Across all ages, later-born children consistently spend less time on enrichment activities compared to first-borns. In contrast, later-born children spend more time on digital media than first-born kids from about ages 6/7 but not before school age. These birth order differences in time use for both enrichment activities and digital media are statistically significant.

### **3 Empirical Model**

We now formally examine the effect of birth order on children's time use. Our identification relies on cross-family comparisons, where we compare a first-born child with a later-born child (either second- or third-born) of the same age, from the same birth year cohort, living in the same neighbourhood, within the same sized family, controlling for initial family characteristics at birth. The key identifying assumption is that family size is predetermined and not influenced by the outcomes of the children. With a sufficiently large and representative sample, controlling for family size allows for the estimation of a reduced-form effect of birth order. Another assumption is that there are no cohort-specific time trends in time use (i.e., children born in later years do not spend their time differently to children born in earlier years). This can be addressed by the inclusion of birth year fixed-effects. However, this raises a further issue that within each cohort, children of higher parity are more likely to have a mother and father who were younger at birth and this may result in differences in parental investments or preferences. Further controlling for parents' age at the child's birth and other initial family characteristics is important for addressing this issue.

To estimate the effect of birth order on children’s time use, we run the following regression model using ordinary least squares:

$$TU_{it,a} = \beta_{0,a} + \beta_{1,a}Second_i + \beta_{2,a}Third_i + \mathbf{X}'_{it}\boldsymbol{\beta}_{3,a} + \mathbf{B}'_{it}\boldsymbol{\beta}_{4,a} + \varepsilon_{it,a} \quad (1)$$

where  $TU_{it,a}$  is the number of minutes in a day spent on activity  $a$  by child  $i$  in year  $t$ . We estimate separate regressions for each of the seven time use activities  $a \in A$  where  $A$  is the set of activities we consider  $A = \{\text{sleep, school, enrichment activities, physical activities, social activities, digital media and general care}\}$ .  $Second_i$  and  $Third_i$  are indicator variables denoting second- and third-born in the family, with first-born as the reference category. These are our main variables of interest and capture the non-linear effects of birth order on time use. We estimate Equation 1 separately for families with two and three children to more fully disentangle the effects of birth order from family size and address any potential bias arising from optimal stopping (Black, Devereux and Salvanes, 2005).

A vector of exogenous controls,  $\mathbf{X}'_{it}$ , includes the child’s gender, age (in months) fixed-effects, birth cohort (birth year) fixed-effects, and residential area fixed-effects, denoted as Statistical Area Level 2 (SA2).<sup>4</sup> Covariates are also included to account for variation in the administration of the TUDs: dummy variables for diary type (completed by child or by their parent), whether or not it was completed on a school day, and when it was completed (day, month and year fixed-effects).

We include a rich set of parental characteristics measured at baseline (i.e at birth or at age 4) to further control for the initial family environment, denoted by the vector  $\mathbf{B}'_{it}$ . These include the mother’s and father’s age at birth (first- and second-order polynomials), indicators for marital status (married, divorced, separated or never married), education level (no formal education, high school only, diploma/certificate or university degree), and employment status (out of labour force, unemployed, employed part-time, or employed full-time) for both parents. The inclusion of these characteristics follows Price (2008). We check the sensitivity of our estimates to different sets of controls used in previous economic studies on birth order effects, and

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<sup>4</sup>SA2 areas are designed to represent a community that interacts together socially and economically. Australia is divided into 2,473 SA2s, with an average of about 10,000 people per SA2.

find that our specification is robust across the different covariate sets.

In our main analysis we are unable to include family fixed-effects since we observe only one child per family within the LSAC sample. Instead we rely on a rich set of observable family characteristics observed at child birth (baseline). Previous studies examining the effects of birth order on outcomes such as education, health, delinquency and crime have consistently shown that with adequate sample size and appropriate controls, ordinary least squares (OLS) estimates are similar to within-family (or siblings) fixed-effects estimates (Black, Devereux and Salvanes, 2016; Breining et al., 2020; Lehmann, Nuevo-Chiquero and Vidal-Fernandez, 2018). We summarise the estimates from these three studies in Appendix Table A2.

For a siblings fixed-effects model of time use to be meaningful, data on how siblings spend their time at the same age (not at the same point in time) is required. This is because children's activities naturally vary with age, so it is important to hold age constant. This is less of an issue for examining cognitive outcomes because test scores are typically age- or grade-adjusted. To our knowledge, no dataset which includes TUDs of siblings of the same age exists for a sufficiently large sample.<sup>5</sup>

We run a series of robustness checks to assess the internal and external validity of our model, including accounting for the censored nature of time use and for extreme patterns of time use, and replicating our model in a different country context (the U.S). These are detailed in Section 4.2, and provide strong support for our model specification.

## 4 Results

### 4.1 The effect of birth order on time use

Table 2 presents the main results based on the baseline model given in Equation 1, split by family size. To account for multiple hypothesis testing, we report both standard and Romano-Wolf adjusted p-values. Coefficients marked with a superscript 'v' indicate that the corresponding

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<sup>5</sup>The Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID) from the U.S. has TUDs for siblings, however, there are only 42 individuals with siblings that have TUD data at the same age.

effects are still significant at least at the 5% level after adjustment.<sup>6</sup>

Across all specifications, as birth order increases, children’s time spent on enrichment activities decreases, while time spent on digital media activities increases. In two-child families, second-born children spend 11 minutes less per day on enrichment activities compared to first-born children, which corresponds to approximately 11% relative to the mean. This decrease appears to be offset by greater digital media use, with second-borns spending an additional 9 minutes per day on digital media (around 6% relative to the mean). A similar pattern is seen for second-born children in families with three children, while for third-born children, the effects are more pronounced. Relative to first-born children, third-born children spend 18 minutes (20%) less on enrichment activities and 14 minutes (10%) more on digital media per day.<sup>7</sup>

Table 2: Effect of birth order on time use

|                             | Sleep                             | School            | Enrichment activities              | Physical activities | Social activities                | Digital media                     | General care                    |
|-----------------------------|-----------------------------------|-------------------|------------------------------------|---------------------|----------------------------------|-----------------------------------|---------------------------------|
| <b>Two-child families</b>   |                                   |                   |                                    |                     |                                  |                                   |                                 |
| <i>Ref: First-born</i>      |                                   |                   |                                    |                     |                                  |                                   |                                 |
| Second-born                 | -4.620*** <sup>v</sup><br>(1.681) | -0.895<br>(1.231) | -11.459*** <sup>v</sup><br>(2.024) | -3.447*<br>(1.942)  | 6.700*** <sup>v</sup><br>(1.771) | 8.980*** <sup>v</sup><br>(2.388)  | 4.742** <sup>v</sup><br>(2.361) |
| Outcome mean                | 641.9                             | 141.1             | 98.4                               | 98.9                | 61.0                             | 134.6                             | 264.2                           |
| <b>Three-child families</b> |                                   |                   |                                    |                     |                                  |                                   |                                 |
| <i>Ref: First-born</i>      |                                   |                   |                                    |                     |                                  |                                   |                                 |
| Second-born                 | -0.387<br>(2.413)                 | 0.879<br>(1.717)  | -9.424*** <sup>v</sup><br>(3.095)  | 1.168<br>(3.151)    | 5.294*<br>(2.871)                | 5.762<br>(3.751)                  | -3.293<br>(3.717)               |
| Third-born                  | -1.729<br>(2.692)                 | 1.347<br>(1.904)  | -18.229*** <sup>v</sup><br>(3.321) | -1.616<br>(3.668)   | 3.828<br>(3.066)                 | 14.420*** <sup>v</sup><br>(4.198) | 1.979<br>(4.288)                |
| Outcome mean                | 634.3                             | 141.9             | 89.1                               | 109.8               | 60.0                             | 141.7                             | 263.2                           |

Notes: Sample sizes: Two-child families = 13,907; and Three-child families = 8,245. Robust standard errors in parenthesis, clustered at individual level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. A coefficient marked with a ‘v’ indicates that its corresponding effect is still considered significant at least at 5% level, even after accounting for multiple tests performed by using the Romano-Wolf stepdown method. Table A3 in the Online Appendix presents both the model p-values and adjusted p-values. All estimations control for child’s gender, and fixed-effects for child’s age (in months), birth cohort, residence area and time (year, month and day), and parental characteristics such as age at birth, marital status, employment and education status.

We also observe birth order effects on sleep, social activity and general care, particularly, in two-child families. Compared to first-born children, second-born children spend about 0.7% less time on sleeping, 10% more time on social activity, and 2% more time on care and chores.

<sup>6</sup>Full sets of adjusted p-values are reported in Table A3 in the Online Appendix.

<sup>7</sup>Sensitivity tests shown in Online Appendix Figure A1 indicate that the estimates are robust to the choice of control variables.

However, due to the lack of consistency in these results across specifications and the relatively small magnitude of these effects, we place less emphasis on these.

Given the significant effects we observe on enrichment and media activities, we further explore which specific types of activities contribute to these results. To this end, we dis-aggregate enrichment activities into two sub categories: learning (e.g. doing homework, tutoring classes, music lessons); and, leisure (reading for leisure, playing a musical instrument for leisure, playing chess or board games/crosswords, and doing art/crafts or drawing). As shown in Table 3, later-born children spend less time on both learning and leisure activities compared to first-born children, with similar magnitudes of effects for both of these enrichment categories.

Table 3: Effect of birth order on different enrichment and digital media activities

|                             | Enrichment activities             |                                   | Digital media                    |                                  |                                  |
|-----------------------------|-----------------------------------|-----------------------------------|----------------------------------|----------------------------------|----------------------------------|
|                             | Leaning                           | Leisure                           | Games                            | Passive media                    | Other media                      |
| <b>Two-child families</b>   |                                   |                                   |                                  |                                  |                                  |
| <i>Ref: First-born</i>      |                                   |                                   |                                  |                                  |                                  |
| Second-born                 | -5.009*** <sup>v</sup><br>(1.400) | -6.451*** <sup>v</sup><br>(1.455) | 3.347*** <sup>v</sup><br>(1.395) | 4.169*** <sup>v</sup><br>(1.820) | 1.463*** <sup>v</sup><br>(0.660) |
| Outcome mean                | 48.7                              | 49.7                              | 30.7                             | 94.2                             | 9.6                              |
| <b>Three-child families</b> |                                   |                                   |                                  |                                  |                                  |
| <i>Ref: First-born</i>      |                                   |                                   |                                  |                                  |                                  |
| Second-born                 | -2.423<br>(2.034)                 | -7.001*** <sup>v</sup><br>(2.196) | -0.320<br>(2.247)                | 5.361*<br>(2.962)                | 0.721<br>(1.203)                 |
| Third-born                  | -9.297*** <sup>v</sup><br>(2.133) | -8.932*** <sup>v</sup><br>(2.466) | 4.402*<br>(2.520)                | 9.865*** <sup>v</sup><br>(3.323) | 0.153<br>(1.258)                 |
| Outcome mean                | 41.3                              | 47.8                              | 33.1                             | 98.0                             | 10.5                             |

Notes: Sample sizes: Two-child families = 13,907; and Three-child families = 8,245. Robust standard errors in parenthesis, clustered at individual level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. A coefficient marked with a 'v' indicates that its corresponding effect is still considered significant at least at 5% level, even after accounting for multiple tests performed by using the Romano-Wolf stepdown method. Table A4 in the Online Appendix presents both the model p-values and adjusted p-values. All estimations control for child's gender, and fixed-effects for child's age (in months), birth cohort, residence area and time (year, month and day), and parental characteristics such as age at birth, marital status, employment and education status.

We explore three sub-categories of digital media activities: playing games on an electronic device (e.g. computer, Xbox, Nintendo); passive media (predominantly watching television); and, other media activities (which include use of social media such as social networking sites, texting, online chatting/messaging as well as other activities such as application use, internet browsing and downloading content). Less than 8% of total digital media time is spent on this third category. We find that later-born children spend more time on all categories of digital

media, electronic games, passive media and other, although the effects for games and other media are not statistically significant in three-child families.<sup>8</sup>

We also examine whether the effect of birth order on time use varies by age group. Table 4 shows the estimates for time spent on enrichment and digital media activities separately by three age groups: pre-school (2–4 years), early school age (6–8 years), and early adolescence (10–14 years).<sup>9</sup> We find that among two-child families, second-born children spend less time on enrichment activities than first-born children in all age groups. The magnitude of effect, especially relative to the mean, increases with age such that among preschoolers, second born children spend 7% (10 minutes) less on enrichment activities, and by early adolescence, this effect is 18% (14 minutes). However, the difference across age groups is not statistically significant ( $p$ -value = 0.44). We see a similar pattern for three-child families.

For digital media, we find that the birth order effect is primarily driven by the older group of early adolescents. Second born children in this age group spend 8% (15 minutes) more time on digital media compared to first-born children, while for children in younger age groups, the birth order effects are small and not statistically significant. This difference across age groups is statistically significant ( $p$ -value = 0.02). We again see a similar pattern for three-child families. Overall, these findings suggest that early adolescence is a period of particular concern for higher parity children, as they spend more time on less productive (digital media) activities and less time on productive (enrichment) activities.

So far we have considered incremental impacts of birth order on *average* children's time use. However, averages can be influenced at any point in the distribution. It is also instructive to understand if there are birth order effects on the extent to which children engage in certain activities at unhealthy or potentially harmful levels. To investigate this, we estimate the effect of birth order on the probability of adhering to recommended levels of physical activity, digital media and sleep by age from 24-hour movement guidelines in Australia ([Department of Health and Aged Care, 2019](#)).

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<sup>8</sup>In two-child families, we examine whether the increase in time spent on other media is driven by social media use and find that it is not (results not shown), likely reflecting the low average social media use in this cohort, which is approximately 4 - 5 minutes per day.

<sup>9</sup>Appendix Tables A5 and A6 provide the estimates for other time use activities.

Table 4: Effect of birth order on enrichment and media time use by age

|                             | Enrichment activities    |                                    |                                       | Digital media            |                                    |                                       |
|-----------------------------|--------------------------|------------------------------------|---------------------------------------|--------------------------|------------------------------------|---------------------------------------|
|                             | Preschool<br>(2-4 years) | Early<br>school age<br>(6-8 years) | Early<br>adolescence<br>(10-14 years) | Preschool<br>(2-4 years) | Early<br>school age<br>(6-8 years) | Early<br>adolescence<br>(10-14 years) |
| <b>Two-child families</b>   |                          |                                    |                                       |                          |                                    |                                       |
| <i>Ref: First-born</i>      |                          |                                    |                                       |                          |                                    |                                       |
| Second-born                 | -10.469***<br>(3.956)    | -10.267***<br>(3.477)              | -14.436***<br>(2.850)                 | 1.667<br>(2.566)         | 6.921*<br>(3.665)                  | 14.563***<br>(4.206)                  |
| Outcome mean                | 139.9                    | 86.6                               | 80.2                                  | 69.1                     | 99.8                               | 192.7                                 |
| <b>Three-child families</b> |                          |                                    |                                       |                          |                                    |                                       |
| <i>Ref: First-born</i>      |                          |                                    |                                       |                          |                                    |                                       |
| Second-born                 | -12.741<br>(11.370)      | -8.305<br>(6.231)                  | -12.568***<br>(3.720)                 | 3.152<br>(6.171)         | 0.381<br>(5.883)                   | 10.918**<br>(5.527)                   |
| Third-born                  | -17.150<br>(11.547)      | -22.276***<br>(6.190)              | -16.991***<br>(4.175)                 | 5.316<br>(6.692)         | 2.158<br>(5.955)                   | 22.290***<br>(6.449)                  |
| Outcome mean                | 134.0                    | 84.9                               | 74.8                                  | 70.9                     | 99.2                               | 190.1                                 |

*Notes:* Sample size: Two-child families: 2-4 years = 3,851, 6-8 years = 3,582 and 10-14 years = 6,474, Three-child families: 2-4 years = 1,599, 6-8 years = 2,297 and 10-14 years = 4,349, Robust standard errors in parenthesis, clustered at individual level. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . All estimations control for child's gender, and fixed-effects for child's age (in months), birth cohort, residence area and time (year, month and day), and parental characteristics such as age at birth, marital status, employment and education status.

For sleep, preschoolers aged 4 should have at least 10 hours, children aged 6-12 at least 9 hours, and young people aged 14 should aim for 8 hours. In terms of physical activity, 4-year-olds are recommended to be active for at least 3 hours per day, while those aged 6 to 14 should engage in at least 1 hour of physical activity daily. Regarding digital media (or screen time), the recommended limits are no more than 1 hour per day for 4-year-olds and no more than 2 hours per day for those aged between 6 and 14. There are no specific guidelines for enrichment activities. However, recognising the importance of enrichment activities in child development, we also consider any non-zero time spent on these activities as a relevant cut-off. We construct indicator variables for each of these activities, where one denotes adherence to the recommended durations, and 0 indicates otherwise.

Table 5 presents the results. In line with our main results, we find that among two-child families, second-born children are significantly less likely to adhere to the recommended time spent on sleep, enrichment activities and on digital media, but are no more likely to meet recommended levels of physical activity. For three-child families, we also find that later-born

Table 5: Estimated effects of birth order on meeting the recommended time guidelines

|                             | Meet Recommended Guidelines for |                      |                     |                      |
|-----------------------------|---------------------------------|----------------------|---------------------|----------------------|
|                             | Sleep                           | Enrichment           | Physical activities | Media                |
| <b>Two-child families</b>   |                                 |                      |                     |                      |
| <i>Ref: First-born</i>      |                                 |                      |                     |                      |
| Second-born                 | -0.020***<br>(0.006)            | -0.052***<br>(0.008) | -0.010<br>(0.009)   | -0.035***<br>(0.010) |
| Outcome mean                | 0.88                            | 0.80                 | 0.48                | 0.53                 |
| <b>Three-child families</b> |                                 |                      |                     |                      |
| <i>Ref: First-born</i>      |                                 |                      |                     |                      |
| Second-born                 | 0.001<br>(0.010)                | -0.061***<br>(0.013) | 0.011<br>(0.015)    | -0.010<br>(0.015)    |
| Third-born                  | 0.001<br>(0.010)                | -0.079***<br>(0.015) | 0.006<br>(0.017)    | -0.026<br>(0.016)    |
| Outcome mean                | 0.89                            | 0.77                 | 0.56                | 0.51                 |

Notes: Sample size: Two-child families = 13,907; and Three-child families = 8,245. Robust standard errors in parenthesis, clustered at individual level. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . All estimations control for child's gender, and fixed-effects for child's age (in months), birth cohort, residence area and time (year, month and day), and parental characteristics such as age at birth, marital status, employment and education status.

children are less likely to adhere to the recommended time spent on enrichment activities and digital media, although the estimates for digital media are imprecisely estimated and not statistically significant. Our main results are therefore capturing important differences in children's time-use related to enrichment activities and digital media use.

## 4.2 Robustness Checks

In this section we assess the internal and external validity of our results. First, we examine the sensitivity of our estimates to the linearity assumption of the OLS model by estimating a poisson model. The poisson distribution can be better suited to non-negative count-based data, such as the number of minutes spent on an activity. The marginal effects from re-estimating our main model using a poisson distribution are reported in Panel A of Online Appendix Table A7 and show that the effects are very similar to those reported in Table 2.

Second, we observe that some children have extreme patterns of time use in certain activities. Some of these patterns may be plausible, for instance, an illness may result in extended periods of sleep or TV-watching. However, to ensure that the effects are not driven by such outliers, we

re-estimate our model excluding extreme values. For learning, digital media, physical activity and social activity, we exclude observations that fall four standard deviations above the mean time use for a given age and type of day (i.e. school or non-school day). For sleep, we exclude observations that fall four standard deviations below the mean time use for age and type of day. The results presented in Panel B of Online Appendix Table A7 show that, while the effect sizes are slightly smaller than the baseline estimates, they remain qualitatively the same.

Finally, we examine the external validity of the results by replicating our analysis using data from the United States using the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID). The CDS TUDs are available for only three waves from 1997 to 2017, with data collected every five years. After applying sample restrictions outlined in Section 2.3 and ensuring observations have complete TUD data, we obtain a much smaller analytical sample of 1,056 children with 3,112 observations.

Table 6 presents the estimates from the baseline model specified in Equation 1 using CDS data. Despite differences in country context and time period, the findings remain consistent - later-born children allocate less time to enrichment activities and more time to digital media. In two-child families, second-born children spend approximately 13 minutes less per day on enrichment activities (a 12% reduction relative to the mean) and 15 minutes (9%) more on digital media. In three-child families, the effects are larger. Compared to first-born children, second- and third-born children spend 20 minutes (19%) and 41 minutes (40%) less on enrichment activities, respectively, and 28 minutes (17%) and 33 minutes (20%) more on digital media. Consistent with the LSAC findings, birth order does not significantly impact other time use activities. These results suggest that the birth order effects on children's time use are generalisable beyond the Australian cohorts that we examine using the LSAC data.

### **4.3 Mechanisms**

Our findings consistently suggest that birth order has a significant effect on children's time use, with children of higher birth order spending less time engaged in enrichment activities and more time with digital media time. In this section, we explore some potential explanations for these findings. Recognising that parental investment behaviour plays a critical role in shaping chil-

Table 6: Effect of birth order on time use - CDS sample

|                             | Sleep   | School  | Enrichment activities | Physical activities | Social activities | Digital media | General care |
|-----------------------------|---------|---------|-----------------------|---------------------|-------------------|---------------|--------------|
| <b>Two-child families</b>   |         |         |                       |                     |                   |               |              |
| <i>Ref: First-born</i>      |         |         |                       |                     |                   |               |              |
| Second-born                 | -6.962* | 0.434   | -12.737**             | -2.347              | 1.751             | 14.603**      | 5.258        |
|                             | (3.967) | (2.188) | (5.151)               | (3.931)             | (4.396)           | (6.104)       | (5.114)      |
| Outcome mean                | 620.7   | 175.8   | 107.7                 | 62.5                | 59.7              | 160.8         | 252.7        |
| <b>Three-child families</b> |         |         |                       |                     |                   |               |              |
| <i>Ref: First-born</i>      |         |         |                       |                     |                   |               |              |
| Second-born                 | -10.544 | -4.184  | -19.923**             | 7.610               | -0.711            | 27.785***     | -0.033       |
|                             | (7.137) | (3.309) | (8.012)               | (7.240)             | (7.813)           | (10.035)      | (8.968)      |
| Third-born                  | -4.806  | -2.833  | -41.260***            | 10.809              | 1.506             | 33.205***     | 3.378        |
|                             | (8.156) | (4.222) | (9.712)               | (9.407)             | (9.438)           | (12.178)      | (10.417)     |
| Outcome mean                | 621.1   | 175.1   | 101.4                 | 68.3                | 65.1              | 157.9         | 251.1        |

Notes: Sample sizes: Two-child families = 1,942; and Three-child families = 1,170. Robust standard errors in parenthesis, clustered at individual level. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . All estimations control for child's gender, and fixed-effects for child's age (in months), birth cohort, and time (year, month and day), and parental characteristics such as age at birth, marital status, employment and education status.

dren's behaviour (Black, Grönqvist and Öckert, 2018), we consider how parental engagement and rules relate to birth order differences in children's time use. We first explore how birth order influences *with whom* children spend time engaged in enrichment and digital media activities, splitting the time spent on these activities into three categories: (1) with parents, (2) alone, and (3) with others (which include other adults or children, such as grandparents, siblings, friends, or peers). In two-child families, on average, children spend the largest share of their enrichment activity time with parents (approximately 53%), followed by time spent alone (around 27%) and with others (about 20%). In three-child families, this pattern is 46%, 30%, and 24%, respectively, indicating a shift away from time spent on enrichment activities with parents. For digital media use, children in two-child families spend about 42% of their screen time with parents, 34% alone, and 23% with others, compared to 38%, 32%, and 30% in three-child families.

Table 7 presents the birth order estimates by whom the activity is undertaken with. We find that relative to first-born children, later-born children are less likely to engage in enrichment activities with their parents in both two- and three-child families. This reduction in parental engagement in activities, such as helping with homework or playing board games, is in line with earlier studies that have examined the impact of birth order on parental time use (Price, 2008). Importantly, we find the birth order effects on children's time use extend beyond reduced par-

ental involvement. Later-born children are also considerably less likely to engage in enrichment activities undertaken alone. For example, among three-child families, third-born children spend about 25% less time on enrichment activities alone, relative to first-borns, and spend about 19% less time on these activities with their parents. Time spent on enrichment activities with others also reduces with increasing birth order, but to a smaller extent.

In contrast to enrichment activities, birth order has little impact on the time that children spend with their parents on digital media activities. The increase in digital media activities among later-born children is largely driven by time spent on digital media alone. This further supports the idea that birth order influences children’s activities not just through differences in parental input but also through children’s own time allocations. This increase in alone time on digital media may be particularly concerning because it could also negatively impact the appropriateness of the content to which the child is exposed, in addition to the total time exposed to digital media (Mallawaarachchi et al., 2024).

Table 7: Birth order effects on enrichment and media activities by whom the activity is done with

|                             | Enrichment activities             |                                   |                                  | Digital media     |                                   |                                   |
|-----------------------------|-----------------------------------|-----------------------------------|----------------------------------|-------------------|-----------------------------------|-----------------------------------|
|                             | Parents                           | Alone                             | Others                           | Parents           | Alone                             | Others                            |
| <b>Two-child families</b>   |                                   |                                   |                                  |                   |                                   |                                   |
| <i>Ref: First-born</i>      |                                   |                                   |                                  |                   |                                   |                                   |
| Second-born                 | -5.799*** <sup>v</sup><br>(1.316) | -3.318*** <sup>v</sup><br>(1.088) | -2.104** <sup>v</sup><br>(0.945) | 2.015<br>(1.446)  | 11.673*** <sup>v</sup><br>(1.664) | -4.805*** <sup>v</sup><br>(1.278) |
| Outcome mean                | 52.1                              | 26.5                              | 19.7                             | 57.0              | 46.1                              | 31.5                              |
| <b>Three-child families</b> |                                   |                                   |                                  |                   |                                   |                                   |
| <i>Ref: First-born</i>      |                                   |                                   |                                  |                   |                                   |                                   |
| Second-born                 | -2.967<br>(1.860)                 | -5.174*** <sup>v</sup><br>(1.750) | -1.263<br>(1.606)                | 0.145<br>(2.131)  | 5.742** <sup>v</sup><br>(2.589)   | 0.071<br>(2.389)                  |
| Third-born                  | -7.689*** <sup>v</sup><br>(2.066) | -6.620*** <sup>v</sup><br>(1.876) | -3.827** <sup>v</sup><br>(1.662) | 4.217*<br>(2.453) | 17.805*** <sup>v</sup><br>(2.930) | -7.572*** <sup>v</sup><br>(2.584) |
| Outcome mean                | 40.5                              | 27.0                              | 21.4                             | 53.2              | 45.9                              | 42.6                              |

Notes: Sample size: Two-child families = 13,907; and Three-child families = 8,245. Robust standard errors in parenthesis, clustered at individual level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. A coefficient marked with a ‘v’ indicates that its corresponding effect is still considered significant at least at 5% level, even after accounting for multiple tests performed by using the Romano-Wolf stepdown method. Table A8 in the Online Appendix presents both standard p-values and adjusted p-values. All estimations control for child’s gender, and fixed-effects for child’s age (in months), birth cohort, residence area and time (year, month and day), and parental characteristics such as age at birth, marital status, employment and education status.

Next, we examine whether birth order affects parental rules, which may govern how much time children spend on certain activities. We consider this from both parent and child perspectives.

From the parent’s perspective, we focus on rules around content and time limits for watching TV and playing electronic games. We construct binary indicators of the presence of family rules using responses (Yes or No) to four questions from the main parent. For TV-related rules, we use two indicators: (1) whether they have rules about the types of TV programs or movies the child is allowed to watch at home or elsewhere; and, (2) whether they have rules about how much time the child can spend watching TV programs or movies at home or elsewhere. These measures are available from age 6 onward. Similarly, for electronic games, we use two indicators: (1) whether they have rules about which type of electronic game the child is allowed to play at home or elsewhere; and, (2) whether they have rules about how much time the child can spend playing electronic games at home or elsewhere. These indicators are available from age 8 onward.

From age 10 onward, children were asked: ‘Thinking about your mum/dad, does she/he expect you to follow family rules?’ Children could respond from a choice of five options, ranging from strongly agree to strongly disagree. We construct binary indicators of the child’s perception of their mother’s and father’s expectation to follow rules, which equals 1 if the child responded ‘strongly agree’ and 0 otherwise.

Table 8 presents the results for the early adolescence group (10-14 years), which is the age group who showed the largest birth order effects for digital media. We find that in two-child families, a higher birth order is significantly associated with a reduction in parental rules around both the type of content and the time spent on TV and electronic games (by about 6 to 8 percentage points). In three-child families, we also find birth order effects (around 6-12 percentage points in magnitude), but only for third-born children. Although data on parental rules is limited for younger children, we are able to produce estimates for TV rules for children aged 6 to 8 (see Appendix Table A10), and show that there is no evidence of any birth order effect for this age group. This is in line with the insignificant birth order effects found for children of this age group in Table 4, and supports the notion that parental rules is a likely mechanism through which birth order influences time spent on digital media. The last two columns in Table 8 show that from the child’s perspective, the expectation to follow rules from both their mother and father reduces with birth order, decreasing by approximately 5 to 8 percentage points. The

Table 8: Effect of birth order on parental rules - Early adolescence

|                             | Parents perspective               |                                   |                                   |                                   | Child perspective                 |                                   |
|-----------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
|                             | Rules on TV                       |                                   | Rules on Games                    |                                   | Follow rules                      |                                   |
|                             | Program types                     | Time limit                        | Game types                        | Time limit                        | Mum's expectation                 | Dad's expectation                 |
| <b>Two-child families</b>   |                                   |                                   |                                   |                                   |                                   |                                   |
| <i>Ref: First-born</i>      |                                   |                                   |                                   |                                   |                                   |                                   |
| Second-born                 | -0.063*** <sup>v</sup><br>(0.012) | -0.076*** <sup>v</sup><br>(0.018) | -0.076*** <sup>v</sup><br>(0.016) | -0.061*** <sup>v</sup><br>(0.017) | -0.053*** <sup>v</sup><br>(0.016) | -0.049*** <sup>v</sup><br>(0.017) |
| Outcome mean                | 0.85                              | 0.60                              | 0.72                              | 0.72                              | 0.50                              | 0.56                              |
| No. of observations         | 6,462                             | 5,591                             | 5,181                             | 4,316                             | 6,418                             | 6,407                             |
| <b>Three-child families</b> |                                   |                                   |                                   |                                   |                                   |                                   |
| <i>Ref: First-born</i>      |                                   |                                   |                                   |                                   |                                   |                                   |
| Second-born                 | -0.021<br>(0.015)                 | -0.036<br>(0.024)                 | -0.020<br>(0.022)                 | -0.025<br>(0.023)                 | -0.080*** <sup>v</sup><br>(0.024) | -0.066*** <sup>v</sup><br>(0.023) |
| Third-born                  | -0.094*** <sup>v</sup><br>(0.019) | -0.118*** <sup>v</sup><br>(0.028) | -0.063*** <sup>v</sup><br>(0.026) | -0.106*** <sup>v</sup><br>(0.028) | -0.031<br>(0.026)                 | -0.032<br>(0.027)                 |
| Outcome mean                | 0.86                              | 0.62                              | 0.74                              | 0.73                              | 0.50                              | 0.56                              |
| No. of observations         | 4,338                             | 3,774                             | 3,437                             | 2,876                             | 4,318                             | 4,315                             |

Notes: All variables are denoted as indicator variables. Robust standard errors in parenthesis, clustered at individual level. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . A coefficient marked with a 'v' indicates that its corresponding effect is still considered significant at least at 5% level, even after accounting for multiple tests performed by using the Romano-Wolf stepdown method. Table A9 in the Online Appendix presents both the model p-values and adjusted p-values. All estimations control for child's gender, and fixed-effects for child's age (in months), birth cohort, residence area and time (year, month and day), and parental characteristics such as age at birth, marital status, employment and education status.

effect appears to be driven by second-born children in both two- and three-child families.

Overall, our results suggest that parents tend to adopt a more lenient approach with later-born children, with less rules and expectations to follow rules. This increased leniency may lead later-born children to spend less time on enrichment activities and more time on activities that provide more immediate gratification, such as playing video games or watching television. Our results are consistent with Hotz and Pantano (2015), who show that higher birth order children are less likely to experience strict parental supervision regarding homework and rules on TV watching.

## 5 Discussion and Conclusion

This study contributes new evidence on the impact of birth order on children's time allocation. Using rich time use diary data from Australian children aged 2 to 15 years, we find that compared to first-born children, second and third-born children spend 11 to 18 minutes per day less

on enrichment activities and around 9 to 14 minutes per day more on digital media activities, with the effects increasing monotonically with birth order.

The results are robust to several alternative model specifications. Importantly, similar birth order effects are found across different countries of analysis (Australia and US) and birth cohorts (2000-2004 and 1985-1997), suggesting that our estimates of birth order effects on time use are generalisable findings. Furthermore, the average impacts we find are observed at critical thresholds, where later-born children are much less likely to meet the recommended time on enrichment activities and much more likely to exceed the recommended limits for digital media. We additionally show that early adolescence (age 10-14 years) is a period of particular concern for higher parity children as for them, the increase in time spent on digital media and reduction on time spent on enrichment activities are generally greater.

Our results are inline with previous research, which has found that later-born children spend less time with their parents ([Price, 2008](#)), receive less supervision from their parents with their homework ([Hotz and Pantano, 2015](#)) and spend less time doing their homework ([Black, Grönqvist and Öckert, 2018](#)). Our results, based on time use diaries that help minimise measurement errors that may vary with birth order, provide new and important evidence that birth order influences how children allocate their time. We further show that differences in direct parental involvement only partially explain this pattern. About half of the birth order effect on children's time spent in enrichment activities is linked to parental participation, while the other half reflects differences in children's independent choices or opportunities, occurring without parental involvement. Our findings are therefore not just mirroring the results of previous research investigating parent time use, rather they highlight an additional channel by which birth order can affect cognitive outcomes beyond parent's own time decisions.

In further investigation of parental influence, we find that parents adopt more lenient parenting styles and have less rules with later-born children - a finding which is supported by the existing literature on birth order and parental involvement ([Hotz and Pantano, 2015](#); [Price, 2008](#)). We also find that parents become more lenient with rules for later-born children when they are older which corresponds with later-born children also spending more time with digital media, a finding only found for older children. Together with results on parent time use, these suggest

important pathways behind our findings.

Our findings of a relationship between birth order and how children allocate their time provides improved understanding of how birth order affects human capital development. The striking estimated effects of birth order on time spent on enrichment and digital media activities imply that as birth order increases, children are investing less of their time on activities that are shown to be valuable for human capital, in particular cognitive achievement ([Black, Jayawardana and Heckley, 2024](#); [Conti, Mason and Poupakis, 2019](#); [Del Boca, Monfardini and Nicoletti, 2017](#); [Fiorini and Keane, 2014](#); [Heckman, 2007](#); [Nguyen et al., 2022](#)). Given the cumulative impacts of enrichment activities, even small reductions in time spent on these activities have the potential to have large cumulative effects with long term economic and social consequences.

Given parental time with children and rules around digital media decrease as birth order increases, support for parents to enable them to have sufficient time to actively engage with, supervise and set rules around digital media for their later-born children may be fruitful avenues to explore to help reduce birth order inequalities in human capital outcomes.

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## Online Appendix

Table A1: Sample descriptives

|                     | Full sample |      | Two-child families |      | Three-child families |      |
|---------------------|-------------|------|--------------------|------|----------------------|------|
|                     | Mean        | SD   | Mean               | SD   | Mean                 | SD   |
| First-born          | 0.44        | 0.50 | 0.51               | 0.50 | 0.32                 | 0.47 |
| Second-born         | 0.43        | 0.50 | 0.49               | 0.50 | 0.34                 | 0.47 |
| Third-born          | 0.13        | 0.34 |                    |      | 0.35                 | 0.48 |
| No. of observations | 22,152      |      | 13,907             |      | 8,245                |      |

*Notes:* This table presents the proportion of first-, second-, and third-born children in the full sample, as well as within two- and three-child families.

Table A2: Comparison of OLS and FE estimates in previous studies

| Paper  | Dataset  | Outcomes   | Estimates            |                      |                      |                      |
|--|--|--|----------------------|----------------------|----------------------|----------------------|
|  |  |  | Second-born (dummy)  |                      | Third-born (dummy)   |                      |
|  |  |  | OLS                  | FE                   | OLS                  | FE                   |
| Black et al., 2016<br>(Economics and<br>Human Biology) | Norwegian<br>admin data<br>and health<br>survey data | High blood pressure                                  | -0.033***<br>(0.002) | -0.031***<br>(0.004) | -0.048***<br>(0.004) | -0.046***<br>(0.007) |
|  |  | High cholesterol                                     | -0.004<br>(0.002)    | -0.002<br>(0.004)    | -0.005<br>(0.004)    | -0.001<br>(0.007)    |
|  |  | High triglycerides                                   | -0.017***<br>(0.002) | -0.015***<br>(0.004) | -0.019***<br>(0.004) | -0.017**<br>(0.006)  |
|  |  | Height   | -0.117***<br>(0.033) | -0.196***<br>(0.042) | -0.212***<br>(0.057) | -0.383***<br>(0.075) |
|  |  | High BMI   | -0.044***<br>(0.003) | -0.038***<br>(0.004) | -0.062***<br>(0.005) | -0.060***<br>(0.008) |
|  |  | Obese  | -0.021***<br>(0.002) | -0.022***<br>(0.003) | -0.031***<br>(0.003) | -0.033***<br>(0.005) |
|  |  | No. cigarettes daily                                 | 0.513***<br>(0.042)  | 0.551***<br>(0.065)  | 0.703***<br>(0.070)  | 0.957***<br>(0.116)  |
|  |  | Daily smoker   | 0.038***<br>(0.003)  | 0.048***<br>(0.004)  | 0.053***<br>(0.005)  | 0.082***<br>(0.008)  |
|  |  | No. of drinks in 2 weeks                             | -0.084<br>(0.050)    | -0.164<br>(0.114)    | -0.072<br>(0.077)    | -0.110<br>(0.210)    |
|  |  | Heavy drinker  | -0.001<br>(0.001)    | -0.001<br>(0.003)    | -0.000<br>(0.002)    | -0.003<br>(0.005)    |
|  |  | Weekly exercise                                      | -0.000<br>(0.004)    | 0.014<br>(0.009)     | -0.003<br>(0.006)    | 0.029<br>(0.017)     |
|  |  | Breining et al., 2020<br>(Jr of Labour<br>Economics) | Danish<br>admin data | Convictions          | 1.370***<br>(0.259)  | 1.616***<br>(.307)   |
| Sentenced to prison                                    | 0.732***<br>(0.152)                                  |  |                      | 0.917***<br>(0.174)  |                      |                      |
| Incarcerated   | 0.246***<br>(0.059)                                  |  |                      | 0.311***<br>(0.068)  |                      |                      |
| Lehmann et al., 2016<br>(Jr of Human<br>Resources)     | National<br>Longitudinal<br>Study of Youth           | HS Graduate  | -0.026**<br>(0.012)  | -0.032**<br>(0.016)  | -0.060**<br>(0.026)  | -0.096***<br>(0.036) |
|  |  | Education years                                      | -0.389**<br>(0.152)  | -0.496**<br>(0.200)  | -0.652**<br>(0.290)  | -0.998***<br>(0.375) |
|  |  | Crime  | 0.042**<br>(0.017)   | 0.058**<br>(0.024)   | 0.067**<br>(0.034)   | 0.075<br>(0.049)     |
|  |  | Teenage childbearing                                 | 0.054**<br>(0.026)   | 0.075<br>(0.052)     | 0.079<br>(0.050)     | 0.206**<br>(0.086)   |

Notes: This table summarises the coefficient estimates for the main outcomes reported in [Black, Devereux and Salvanes \(2016\)](#); [Breining et al. \(2020\)](#) and [Lehmann, Nuevo-Chiquero and Vidal-Fernandez \(2018\)](#).

Table A3: Multiple Hypothesis Testing - Time Use

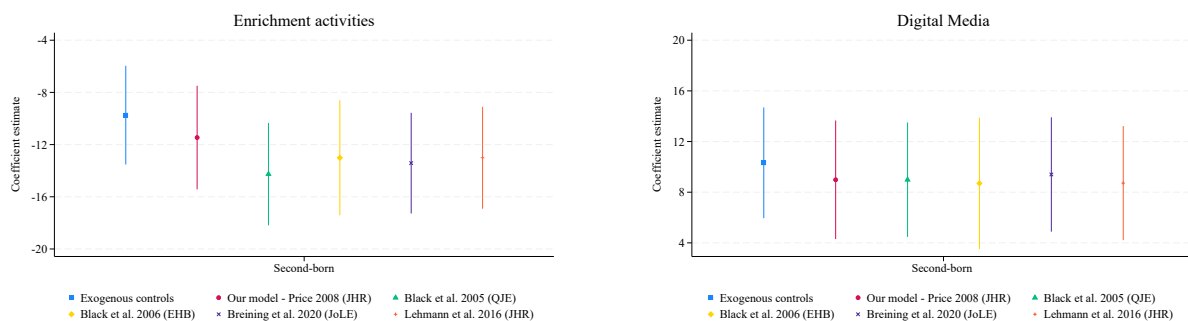
|                              | Two-child families |          |             | Three-child families |          |             |
|------------------------------|--------------------|----------|-------------|----------------------|----------|-------------|
|                              | Model              | p-value  |             | Model                | p-value  |             |
|                              |                    | Resample | Romano-Wolf |                      | Resample | Romano-Wolf |
| <i>Sleep</i>                 |                    |          |             |                      |          |             |
| Second-born                  | 0.006              | 0.020    | 0.020       | 0.873                | 0.843    | 0.961       |
| Third-born                   |                    |          |             | 0.521                | 0.412    | 0.922       |
| <i>School</i>                |                    |          |             |                      |          |             |
| Second-born                  | 0.468              | 0.451    | 0.451       | 0.609                | 0.451    | 0.961       |
| Third-born                   |                    |          |             | 0.479                | 0.294    | 0.922       |
| <i>Enrichment activities</i> |                    |          |             |                      |          |             |
| Second-born                  | 0.000              | 0.020    | 0.020       | 0.002                | 0.020    | 0.020       |
| Third-born                   |                    |          |             | 0.000                | 0.020    | 0.020       |
| <i>Physical activities</i>   |                    |          |             |                      |          |             |
| Second-born                  | 0.076              | 0.020    | 0.039       | 0.711                | 0.647    | 0.961       |
| Third-born                   |                    |          |             | 0.660                | 0.588    | 0.961       |
| <i>Social activities</i>     |                    |          |             |                      |          |             |
| Second-born                  | 0.000              | 0.020    | 0.020       | 0.065                | 0.020    | 0.137       |
| Third-born                   |                    |          |             | 0.212                | 0.157    | 0.529       |
| <i>Digital media</i>         |                    |          |             |                      |          |             |
| Second-born                  | 0.000              | 0.020    | 0.020       | 0.125                | 0.059    | 0.314       |
| Third-born                   |                    |          |             | 0.001                | 0.020    | 0.020       |
| <i>General care</i>          |                    |          |             |                      |          |             |
| Second-born                  | 0.045              | 0.020    | 0.020       | 0.376                | 0.392    | 0.863       |
| Third-born                   |                    |          |             | 0.644                | 0.549    | 0.961       |

*Notes:* We adjust for multiple hypothesis testing using Romano-Wolf stepdown adjusted p-values. Unlike traditional corrections such as Bonferroni, the Romano-Wolf procedure accounts for the joint dependence structure among test statistics (Romano and Wolf, 2005). As a result, adjusted p-values can occasionally be lower than the unadjusted p-values.

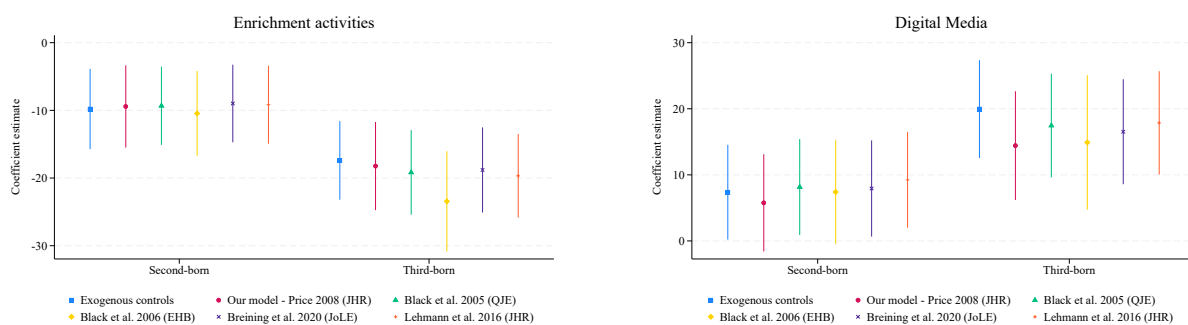
Table A4: Multiple Hypothesis Testing - Type of activities

|                            | Two-child families |          |             | Three-child families |          |             |
|----------------------------|--------------------|----------|-------------|----------------------|----------|-------------|
|                            | Model              | p-value  |             | Model                | p-value  |             |
|                            |                    | Resample | Romano-Wolf |                      | Resample | Romano-Wolf |
| <i>Learning activities</i> |                    |          |             |                      |          |             |
| Second-born                | 0.000              | 0.020    | 0.020       | 0.234                | 0.118    | 0.471       |
| Third-born                 |                    |          |             | 0.000                | 0.020    | 0.020       |
| <i>Leisure</i>             |                    |          |             |                      |          |             |
| Second-born                | 0.000              | 0.020    | 0.020       | 0.002                | 0.020    | 0.020       |
| Third-born                 |                    |          |             | 0.000                | 0.020    | 0.020       |
| <i>Games</i>               |                    |          |             |                      |          |             |
| Second-born                | 0.017              | 0.020    | 0.020       | 0.887                | 0.863    | 0.980       |
| Third-born                 |                    |          |             | 0.081                | 0.059    | 0.177       |
| <i>Passive media</i>       |                    |          |             |                      |          |             |
| Second-born                | 0.022              | 0.020    | 0.020       | 0.070                | 0.020    | 0.157       |
| Third-born                 |                    |          |             | 0.003                | 0.020    | 0.020       |
| <i>Other media</i>         |                    |          |             |                      |          |             |
| Second-born                | 0.027              | 0.020    | 0.020       | 0.549                | 0.569    | 0.804       |
| Third-born                 |                    |          |             | 0.903                | 0.941    | 0.980       |

*Notes:* We adjust for multiple hypothesis testing using Romano-Wolf stepdown adjusted p-values. Unlike traditional corrections such as Bonferroni, the Romano-Wolf procedure accounts for the joint dependence structure among test statistics (Romano and Wolf, 2005). As a result, adjusted p-values can occasionally be lower than the unadjusted p-values.



### Two-child families



### Three-child families

Figure A1: Coefficient Stability Plot

*Notes:* This figure presents the coefficient estimates for enrichment and digital media activities, separately for two- and three-child families. Vertical lines denote 95% confidence intervals. The exogenous controls are: child's gender, age, birth cohort, residence area, and time (year, month and day) fixed-effects (FE). Our model controls are: exogenous controls + parental characteristics such as age at birth, marital status, employment and education status. Controls used in [Black, Devereux and Salvanes \(2005\)](#) are: child's gender, age, birth cohort and time FE, mother and father's age and education at birth. Controls used in [Black, Devereux and Salvanes \(2016\)](#) are: child's gender, age, birth cohort and time FE, mother's age, mother's age at first birth. Controls used in [Breining et al. \(2020\)](#) are child's gender, age, birth cohort and time FE, mother and father's age at birth, marital status, migrant status of parents, area fixed effects, parent's education, employment status and household income at birth, ethnicity. Controls used in [Lehmann, Nuevo-Chiquero and Vidal-Fernandez \(2018\)](#) are: child's gender, age, birth cohort, state and time FE, mother's age at birth and its square, household income, mother's education and employment status at birth.

Table A5: Effect of birth order on time use by age: Two-child families

|  | Sleep                 | School            | Physical activity    | Social activity      | General care      |
|--|-----------------------|-------------------|----------------------|----------------------|-------------------|
| <b>Preschool (2-4 years)</b>           |                       |                   |                      |                      |                   |
| <i>Ref: First-born</i>                 |                       |                   |                      |                      |                   |
| Second-born                            | -9.296***<br>(3.259)  | -0.672<br>(2.878) | 3.072<br>(3.366)     | 10.484***<br>(3.120) | 5.215<br>(4.260)  |
| Outcome mean                           | 718.4                 | 106.0             | 92.8                 | 52.8                 | 261.0             |
| <b>Early school age (6-8 years)</b>    |                       |                   |                      |                      |                   |
| <i>Ref: First-born</i>                 |                       |                   |                      |                      |                   |
| Second-born                            | -10.440***<br>(3.380) | -2.641<br>(1.876) | 1.535<br>(4.058)     | 7.457*<br>(3.881)    | 7.434*<br>(4.486) |
| Outcome mean                           | 664.0                 | 174.5             | 107.2                | 61.4                 | 246.4             |
| <b>Early adolescence (10-14 years)</b> |                       |                   |                      |                      |                   |
| <i>Ref: First-born</i>                 |                       |                   |                      |                      |                   |
| Second-born                            | 1.388<br>(2.335)      | 1.573<br>(1.443)  | -9.569***<br>(2.871) | 1.998<br>(2.787)     | 4.484<br>(3.678)  |
| Outcome mean                           | 584.3                 | 143.4             | 97.9                 | 65.6                 | 275.8             |
| <b>Joint test of equality</b>          |                       |                   |                      |                      |                   |
| Chi2                                   | 14.52                 | 2.98              | 11.90                | 4.69                 | 0.24              |
| p-value                                | 0.00                  | 0.23              | 0.00                 | 0.10                 | 0.89              |

*Notes:* Sample size: 2-4 years = 3,851, 6-8 years = 3,582 and 10-14 years = 6,474. Robust standard errors in parenthesis, clustered at individual level. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . All estimations control for child's gender, and fixed-effects for child's age (in months), birth cohort, residence area and time (year, month and day), and parental characteristics such as age at birth, marital status, employment and education status. The joint test of equality reports the results of a joint Wald test evaluating whether the birth order coefficients are equal across the three age groups.

Table A6: Effect of birth order on time use by age: Three-child families

|  | Sleep             | School            | Physical activity   | Social activity      | General care      |
|--|-------------------|-------------------|---------------------|----------------------|-------------------|
| <b>Preschool (2-4 years)</b>           |                   |                   |                     |                      |                   |
| <i>Ref: First-born</i>                 |                   |                   |                     |                      |                   |
| Second-born                            | 0.153<br>(7.071)  | -6.161<br>(6.607) | -0.008<br>(8.590)   | 11.706<br>(7.753)    | 3.900<br>(10.668) |
| Third-born                             | 0.780<br>(8.355)  | -0.670<br>(7.221) | -11.547<br>(10.386) | 22.407***<br>(8.035) | 0.864<br>(12.513) |
| Outcome mean                           | 714.0             | 101.1             | 108.5               | 50.1                 | 261.4             |
| <b>Early school age (6-8 years)</b>    |                   |                   |                     |                      |                   |
| <i>Ref: First-born</i>                 |                   |                   |                     |                      |                   |
| Second-born                            | 0.298<br>(5.134)  | 2.794<br>(3.501)  | -2.071<br>(6.237)   | 12.419*<br>(6.472)   | -5.515<br>(7.061) |
| Third-born                             | -4.879<br>(5.380) | 0.233<br>(3.042)  | 0.411<br>(6.681)    | 16.729**<br>(6.589)  | 7.623<br>(8.008)  |
| Outcome mean                           | 664.6             | 170.3             | 117.3               | 54.9                 | 248.9             |
| <b>Early adolescence (10-14 years)</b> |                   |                   |                     |                      |                   |
| <i>Ref: First-born</i>                 |                   |                   |                     |                      |                   |
| Second-born                            | 1.668<br>(3.210)  | 1.136<br>(1.948)  | 0.320<br>(4.092)    | 3.322<br>(3.847)     | -4.796<br>(5.241) |
| Third-born                             | -1.654<br>(3.576) | 1.463<br>(2.084)  | -4.165<br>(4.827)   | -4.467<br>(4.317)    | 3.525<br>(6.208)  |
| Outcome mean                           | 588.9             | 141.9             | 106.4               | 66.4                 | 271.4             |
| <b>Joint test of equality</b>          |                   |                   |                     |                      |                   |
| Chi2                                   | 0.70              | 3.05              | 2.15                | 15.18                | 2.51              |
| p-values                               | 0.95              | 0.55              | 0.71                | 0.00                 | 0.64              |

*Notes:* Sample size: 2-4 years = 1,599, 6-8 years = 2,297 and 10-14 years = 4,349. Robust standard errors in parenthesis, clustered at individual level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. All estimations control for child's gender, and fixed-effects for child's age (in months), birth cohort, residence area and time (year, month and day), and parental characteristics such as age at birth, marital status, employment and education status. The joint test of equality reports the results of a joint Wald test evaluating whether the birth order coefficients are equal across the three age groups.

Table A7: Robustness checks: Accounting for the high proportion of zeros and extreme values

| <b>Panel A - Tobit Estimates</b>                  |                       |                   |                     |                      |                     |
|---|-----------------------|-------------------|---------------------|----------------------|---------------------|
|   | Enrichment            | Physical          | Social              | Media                |                     |
| <b>Two-child families</b>                         |                       |                   |                     |                      |                     |
| <i>Ref: First-born</i>                            |                       |                   |                     |                      |                     |
| Second-born                                       | -13.635***<br>(1.134) | -2.498<br>(1.828) | 6.038***<br>(1.562) | 9.077***<br>(2.102)  |                     |
| <b>Three-child families</b>                       |                       |                   |                     |                      |                     |
| <i>Ref: First-born</i>                            |                       |                   |                     |                      |                     |
| Second-born                                       | -10.793***<br>(2.739) | 1.679<br>(2.926)  | 1.674<br>(2.413)    | 7.105**<br>(3.355)   |                     |
| Third-born  | -19.781***<br>(3.030) | -1.010<br>(3.397) | 2.133<br>(2.700)    | 16.043***<br>(3.643) |                     |
| <b>Panel B: Estimates accounting for extremes</b> |                       |                   |                     |                      |                     |
|   | Enrichment            | Physical          | Social              | Media                | Sleep               |
| <b>Two-child families</b>                         |                       |                   |                     |                      |                     |
| <i>Ref: First-born</i>                            |                       |                   |                     |                      |                     |
| Second-born                                       | -9.962***<br>(1.848)  | -2.901<br>(1.883) | 5.059***<br>(1.573) | 7.865***<br>(2.205)  | -4.128**<br>(1.650) |
| <b>Three-child families</b>                       |                       |                   |                     |                      |                     |
| <i>Ref: First-born</i>                            |                       |                   |                     |                      |                     |
| Second-born                                       | -8.972***<br>(2.894)  | 0.354<br>(3.016)  | 3.618<br>(2.398)    | 5.181<br>(3.577)     | 0.847<br>(2.370)    |
| Third-born  | -16.551***<br>(3.067) | -3.682<br>(3.473) | 3.222<br>(2.602)    | 12.850***<br>(4.025) | -1.772<br>(2.680)   |

*Notes:* Sample size: *Panel A:* Two-child families = 13,907, Three-child families = 8,245. *Panel B:* Two-child families = 13,047, Three-child families = 7,763. Robust standard errors in parenthesis, clustered at individual level. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . All estimations control for child's gender, and fixed-effects for child's age (in months), birth cohort, residence area and time (year, month and day), and parental characteristics such as age at birth, marital status, employment and education status. We do not estimate Tobit model for sleep since the data contain no zero values.

Table A8: Multiple Hypothesis Testing - With whom

|                              | Two-child families |          |             | Three-child families |          |             |
|------------------------------|--------------------|----------|-------------|----------------------|----------|-------------|
|                              | Model              | p-value  |             | Model                | p-value  |             |
|                              |                    | Resample | Romano-Wolf |                      | Resample | Romano-Wolf |
| <b>Enrichment activities</b> |                    |          |             |                      |          |             |
| <i>With parents</i>          |                    |          |             |                      |          |             |
| Second-born                  | 0.000              | 0.020    | 0.020       | 0.111                | 0.039    | 0.078       |
| Third-born                   |                    |          |             | 0.000                | 0.020    | 0.020       |
| <i>Alone</i>                 |                    |          |             |                      |          |             |
| Second-born                  | 0.002              | 0.020    | 0.020       | 0.003                | 0.020    | 0.020       |
| Third-born                   |                    |          |             | 0.000                | 0.020    | 0.020       |
| <i>With others</i>           |                    |          |             |                      |          |             |
| Second-born                  | 0.026              | 0.020    | 0.020       | 0.432                | 0.333    | 0.608       |
| Third-born                   |                    |          |             | 0.021                | 0.020    | 0.020       |
| <b>Digital media</b>         |                    |          |             |                      |          |             |
| <i>With parents</i>          |                    |          |             |                      |          |             |
| Second-born                  | 0.163              | 0.098    | 0.098       | 0.946                | 0.922    | 0.980       |
| Third-born                   |                    |          |             | 0.086                | 0.039    | 0.059       |
| <i>Alone</i>                 |                    |          |             |                      |          |             |
| Second-born                  | 0.000              | 0.020    | 0.020       | 0.027                | 0.020    | 0.020       |
| Third-born                   |                    |          |             | 0.000                | 0.020    | 0.020       |
| <i>With others</i>           |                    |          |             |                      |          |             |
| Second-born                  | 0.000              | 0.020    | 0.020       | 0.976                | 0.941    | 0.980       |
| Third-born                   |                    |          |             | 0.003                | 0.020    | 0.020       |

*Note:* We adjust for multiple hypothesis testing using Romano-Wolf stepdown adjusted p-values. Unlike traditional corrections such as Bonferroni, the Romano-Wolf procedure accounts for the joint dependence structure among test statistics (Romano and Wolf, 2005). As a result, adjusted p-values can occasionally be lower than the unadjusted p-values.

Table A9: Multiple Hypothesis Testing - Mechanisms

|  | Two-child families |                     |             | Three-child families |                     |             |
|--|--------------------|---------------------|-------------|----------------------|---------------------|-------------|
|  | Model              | p-value<br>Resample | Romano-Wolf | Model                | p-value<br>Resample | Romano-Wolf |
| <b>Parents perspective</b>               |                    |                     |             |                      |                     |             |
| <i>Rules on TV program types</i>         |                    |                     |             |                      |                     |             |
| Second-born                              | 0.000              | 0.020               | 0.020       | 0.161                | 0.039               | 0.275       |
| Third-born                               |                    |                     |             | 0.000                | 0.020               | 0.020       |
| <i>Rules on TV watching time limit</i>   |                    |                     |             |                      |                     |             |
| Second-born                              | 0.000              | 0.020               | 0.020       | 0.139                | 0.059               | 0.275       |
| Third-born                               |                    |                     |             | 0.000                | 0.020               | 0.020       |
| <i>Rules on types of games</i>           |                    |                     |             |                      |                     |             |
| Second-born                              | 0.000              | 0.020               | 0.020       | 0.351                | 0.157               | 0.353       |
| Third-born                               |                    |                     |             | 0.014                | 0.020               | 0.020       |
| <i>Rules on time playing games</i>       |                    |                     |             |                      |                     |             |
| Second-born                              | 0.000              | 0.020               | 0.020       | 0.281                | 0.196               | 0.353       |
| Third-born                               |                    |                     |             | 0.000                | 0.020               | 0.020       |
| <b>Child perspective</b>                 |                    |                     |             |                      |                     |             |
| <i>Mum's expectation to follow rules</i> |                    |                     |             |                      |                     |             |
| Second-born                              | 0.001              | 0.020               | 0.020       | 0.001                | 0.020               | 0.020       |
| Third-born                               |                    |                     |             | 0.238                | 0.137               | 0.353       |
| <i>Dad's expectation to follow rules</i> |                    |                     |             |                      |                     |             |
| Second-born                              | 0.004              | 0.020               | 0.020       | 0.005                | 0.020               | 0.020       |
| Third-born                               |                    |                     |             | 0.238                | 0.137               | 0.353       |

*Note:* We adjust for multiple hypothesis testing using Romano-Wolf stepdown adjusted p-values. Unlike traditional corrections such as Bonferroni, the Romano-Wolf procedure accounts for the joint dependence structure among test statistics (Romano and Wolf, 2005). As a result, adjusted p-values can occasionally be lower than the unadjusted p-values.

Table A10: Effect of birth order on parental rules - Early school age

|                             | Rules on TV       |                   |
|-----------------------------|-------------------|-------------------|
|                             | Program types     | Time limit        |
| <b>Two-child families</b>   |                   |                   |
| <i>Ref: First-born</i>      |                   |                   |
| Second-born                 | 0.014<br>(0.013)  | 0.010<br>(0.029)  |
| Outcome mean                | 0.93              | 0.53              |
| <b>Three-child families</b> |                   |                   |
| <i>Ref: First-born</i>      |                   |                   |
| Second-born                 | 0.030<br>(0.023)  | 0.039<br>(0.046)  |
| Third-born                  | 0.041*<br>(0.022) | -0.045<br>(0.047) |
| Outcome mean                | 0.94              | 0.56              |

*Note:* All variables are denoted as indicator variables. Sample size: Two-child families = 3,582; Three-child families = 2,299. Robust standard errors in parenthesis, clustered at individual level. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . All estimations control for child's gender, and fixed-effects for child's age (in months), birth cohort, residence area and time (year, month and day), and parental characteristics such as age at birth, marital status, employment and education status.