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**GENDER DIFFERENCES IN TIME ALLOCATION  
CONTRIBUTE TO DIFFERENCES IN DEVELOPMENTAL  
OUTCOMES IN CHILDREN AND ADOLESCENTS**

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## NON-TECHNICAL SUMMARY

In most OECD countries, females tend to have higher educational attainment and achievement than males. This paper hypothesises gender disparity in time investments as a potential explanation for gender differences in cognitive and non-cognitive outcomes. To test this hypothesis, we investigate whether males and females in Australia use their time differently and how the gender disparity in time investments contributes to explaining the gender gaps in various development outcomes.

Using over 50 thousand time-use diaries from two cohorts of children from the Longitudinal Survey of Australian Children (LSAC), we document significant gender differences in time allocation in the first 16 years in life. Relative to males, females spend more time on personal care, chores and educational activities and less time on physical and media related activities. These gender gaps in time allocation appear at very young ages and widen overtime. We provide novel evidence that gender differentials in time investment are quantitatively important in explaining a female advantage in most cognitive and non-cognitive skills. Moreover, gender disparity in educational time outside of school is the most important factor contributing to gender test score gaps and its contribution is more pronounced for higher performing students. By contrast, gender differences in media time are the main factor explaining gender gaps in non-cognitive skills. As children age, gender differences in time allocation play an increasing role in explaining gender gaps in both cognitive and non-cognitive skills.

The results presented in this study may have several potentially important implications for policies that aim to improve developmental outcomes for male and female students. For example, our finding that time allocations, especially educational time outside of school, play a significant role in explaining gender test score gaps observed in standardised cognitive testing suggests that policies aimed at increasing the time spent on educational activities outside of school by male students could reduce the gender test score gaps, especially in non-numeracy subjects. Similarly, our finding of the significant contribution that the time spent on media makes to male disadvantage in non-cognitive skills suggests scope for policy interventions to reduce non-educational media time among males to narrow the gender gap in non-cognitive skills. Such policies are particularly relevant given increasing concerns about a “boy crisis”.



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## ABSTRACT

Using over 50 thousand time-use diaries from two cohorts of children, we document significant gender differences in time allocation in the first 16 years in life. Relative to males, females spend more time on personal care, chore and educational activities and less time on physical and media related activities. These gender gaps in time allocation appear at very young ages and widen overtime. We provide novel evidence that gender differentials in time investment are quantitatively important in explaining a female advantage in most cognitive and non-cognitive skills. Moreover, gender disparity in educational time outside of school is the most important factor contributing to gender test score gaps and its contribution is more pronounced for higher performing students. By contrast, gender differences in media time are the main factor explaining gender gaps in non-cognitive skills. As children age, gender differences in time allocation play an increasing role in explaining gender gaps in both cognitive and non-cognitive skills.

Keywords: Time Allocation; Time Use Diary; Gender Gap; Human Capital; Child Development.

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## 1. Introduction

One of the main findings emerging from research on gender gaps in educational achievement is that, in most developed countries, females tend to have higher educational attainment and achievement than males (Fortin *et al.* 2015; OECD 2019).<sup>1</sup> Studies in this literature have also identified possible factors underpinning gender gaps in educational achievement. For instance, females typically mature earlier (Lim *et al.* 2013). They tend to have stronger verbal skills (Kimura 2000; Baron-Cohen 2007) and these skills are particularly valuable for later educational attainment (Aucejo & James 2019). Findings also highlight a female advantage in non-cognitive skills that contribute to the gender test score gap that advantages females (Jacob 2002; Duckworth & Seligman 2006; Christopher *et al.* 2013; Golsteyn & Schils 2014). Differentials in parental investments in favour of daughters in early childhood provide another potential explanation for girls' better educational outcomes (Lundberg *et al.* 2007; Baker & Milligan 2016; Kaushal & Muchomba 2018).

Delaney and Devereux (2021) note several other potential factors contributing to educational gender gaps that include: assessment methods (Baldiga 2014; Iriberry & Rey-Biel 2021); teacher's gender bias in grading (Lavy & Sand 2018; Carlana 2019); peers or school environment effects (Booth *et al.* 2018; Dustmann *et al.* 2018); differences in risk preferences (Croson & Gneezy 2009; Marianne 2011); gendered differences in sleep cycles (Lusher & Yasenov 2018), and gender disparity in performance under competitive pressure (De Paola & Gioia 2016).<sup>2</sup>

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<sup>1</sup> This pattern has been referred as “the boy problem” (see, for instance, Delaney and Devereux (2021) for a recent review on patterns and potential sources of gender gaps in educational outcomes). Another well documented and relevant gender gap are gender differences in fields of study, whereby females disproportionately choose less highly paid fields – “the girl problem” (Kahn & Ginther 2018; Landaud *et al.* 2020).

<sup>2</sup> As detailed in Delaney and Devereux (2021), given the mixed evidence from the current literature, not all of these factors always act consistently in favour of one gender over the other.

The extant literature demonstrates that time investments by parents and their children are prime factors that foster child development (Fiorini & Keane 2014; Del Boca *et al.* 2017; Lee & Seshadri 2019). Largely absent in this literature though, is a focus on how children themselves invest their own time in activities that prompt, facilitate or constrain subsequent academic performance differentially in males and females. This paper contributes by investigating the likely role of children's time investment (Heckman & Mosso 2014).<sup>3</sup> We build on this literature to explore two primary research questions (i) What do males and females spend their time doing during childhood and adolescence? and (ii) To what extent do gender differences in their time investments explain the gender gaps in their cognitive and non-cognitive skills?

We bring to these questions rich panel time-use diaries representing two cohorts of Australian children in their first 16 years of life to provide the most comprehensive picture to date on the relative time allocations of males and females in a contemporary Western setting. Our study yields three main findings. First, as compared to males, females allocate more time to personal care, chores and educational activities and less of their time to physical and media related activities. Moreover, these gender differences in time allocation appear first at very young ages and then widen as children age.

Second, and more importantly, we provide new evidence that gender differentials in time investment are quantitatively important in explaining the gender gaps observed in cognitive and non-cognitive skills. Specifically, gender differentials in time investment, especially in educational activities outside of school, favour females and explain up to 16% of the overall gender test score gap. Our results further reveal that the contribution of gender differences in time allocation is more pronounced for higher performing students. We also uncover that gender disparity in time allocation, particularly to time spent on media activities, favours non-

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<sup>3</sup> This paper also contributes to a larger literature on the gender gaps in various outcomes, including test scores (Fryer & Levitt 2010), socio-emotional behaviours (Bertrand & Pan 2013) and wages (Blau & Kahn 2017; Le & Nguyen 2018b).

cognitive skills in females contributing up to 5% towards the gender gap. Third, the results additionally suggest that as children grow older gender differences in time allocation play an increasing role in explaining the gender gap in cognitive and non-cognitive skills.

The remainder of this paper proceeds as follows: Section 2 describes our data and Section 3 presents gender differences in time allocation from birth to mid adolescence. Section 4 attempts to quantify the contribution of gender differences in time allocation to the gender gaps in cognitive and non-cognitive skills. Section 5 presents results from various robustness checks while Section 6 concludes.

## **2. Data**

To document the evolution of time allocation by gender, we use time-use diaries (TUD) from two cohorts of children surveyed in the Longitudinal Study of Australian Children (LSAC). The LSAC is a biennial nationally representative survey with a sampling frame of all children born between March 2003 and February 2004 (Birth or B-Cohort, 5,107 infants aged 0–1 year in 2004) and between March 1999 and February 2000 (Kindergarten or K-Cohort, 4,983 children aged 4–5 years in 2004). The LSAC was initiated in 2004 and the most recent wave 9 was surveyed in 2020 (Mohal *et al.* 2021).

TUDs were also collected biennially with four major changes to TUDs during the study period worth noting. First, from wave 1 to wave 3, families were given two TUDs to complete so each child had up to two TUDs (one on a weekday and one on a weekend day) each wave. However, from wave 4 to wave 8, each child was given one TUD to fill in, on either a weekday or a weekend day, each wave. Second, while children’s activities are reported according to the 96 15-minute periods of each 24-hour block in the first three waves of data, children’s activities are listed in the form of an “activity episode” diary in the remaining waves (See Corey *et al.* (2014) for examples of TUDs). Third, while the parent completed the TUD in paper in the first three waves, the study child was supposed to complete the TUD via computer assisted



interview from wave 4 onwards. Fourth, K cohort children were asked to complete the TUD in the first six waves while B cohort children were not asked to do so in waves 4, 5 and 9. The available TUDs thus allow us to examine the topic over a 16-year period for individuals aged from birth (for B cohort) or 4/5 years old (for K cohort) up to 15/16 years old (for both cohorts). Because activities that the study child undertook during the time diary day are listed slightly differently across waves to reflect age-specific activities, we necessarily aggregate the pre-coded activities into a smaller set of activities to make them reasonably comparable across the two cohorts over 16 years. Moreover, we aim to distinguish activities that have been shown to have important implications to the child developmental outcomes (Fiorini & Keane 2014; Del Boca *et al.* 2017; Nguyen *et al.* 2020).

Our resulting aggregated activities include sleep, personal care, school, education, physical, chores, media and travel. Specifically, sleep consists of time spent on sleeping and napping. Personal care includes awaking in bed, eating/drinking, showering/bathing and doing non-physical non-educational activities. School relates to time allocated to organised school lessons or day care centre/playgroup while education, in contrast, refers to the time spent on the child's own educational activities *outside of school*, including reading or being read to, doing homework and attending private lessons. We include time spent on walking, cycling or attending organised sport/physical activities as physical. Chores relates to the time allocated to household chores or (paid or unpaid) work. Media consists of time watching TV programs or movies/videos, playing video games, using computer and internet (unrelated to doing homework) and communicating via electronic devices. Travel refers to time spent in transit both by private and public transport. Appendix Table B1 and Appendix Table B2 describe activity classifications in detail.<sup>4</sup>

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<sup>4</sup> Following previous studies (Fiorini & Keane 2014; Nguyen *et al.* 2020), we do not differentiate between the main and any concurrent activity, resulting in the total of time allocated to all grouped activities during the diary

From an initial sample of about 55,000 TUDs, we exclude TUDs with obviously incorrect entries or incomplete information. These restrictions lead to a sample of 54,961 TUDs. We also exclude TUDs with missing information on basic explanatory variables that we control for in the regressions (see Section 3). Our final sample includes 54,479 complete TUDs from 8 waves and 9,126 unique children (with 4,561 from B cohort).

### 3. Gender differences in time allocation from birth to mid adolescence

We document the “adjusted” gender gap in time allocation by regressing the time allocated to each grouped activity ( $A$ ) of individual  $i$  at time/age  $t$  on a dummy variable ( $Male_i$ ) indicating if the individual’s gender is male and a list of other covariates ( $X_i$ ). Specifically, we employ the following model:

$$A_{it} = \alpha_{0t} + \alpha_{1t}Male_i + X_{it}\alpha_{2t} + \varepsilon_{it} \quad (1)$$

where  $\alpha$ s are parameters to be estimated and  $\varepsilon_i$  is the idiosyncratic error term. We estimate equation (1) separately for each of eight biennial age groups, which accommodate the biennial survey design of TUDs over the first eight waves of LSAC. The estimates of  $\alpha_1$  from equation (1) are of interest because they measure the direction and magnitude of the gender gap in various activities from births to 14/15 years old. Consistent with other studies examining young individuals’ time allocation (Hofferth & Sandberg 2001; Nguyen *et al.* 2021), we include in  $X_i$  the individual's characteristics (i.e., age, Indigeneity and low birth weight), family environment (maternal education, maternal migration status, living with both parents and number of siblings) and indicators of neighbourhood characteristics.<sup>5</sup> We also include in  $X_i$  a series of

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date exceeding 24 hours. Likewise, we do not distinguish the child’s activities by who is present during each activity due to the ambiguity of the actual participation intensity of the nearby person(s) (if any) with the child (Baxter 2007).

<sup>5</sup> These include percentages of individuals having an Aboriginal/Torres Strait Islands origin, completing year 12, speaking English, or being born in Australia in linked areas, percentages of households with household income less than AU\$1,000/week in linked areas, a metropolitan dummy and state/territory dummies. We do not include some commonly included variables such as mother’s age or family income because they entail many missing values. See Appendix Table A1 for variable description.

day-of-week dummies to capture possible changes in time use throughout the week and month and year indicators to control for trends in time allocation over seasons and years.

Table 1 reports mean “unadjusted” time allocation by males and females, suggesting notable gender differences in time use over the 16-year study period. Specifically, males spend considerably more time on physical (on average, 13 minutes per day) or media related (23 minutes per day) activities but less time on personal care (17 minutes per day), education (6 minutes per day), and chores (4 minutes per day). However, there are no observable gender differences in the time allocated to sleep, school or travel during the same study period. These “static” gender differences in time allocation to various grouped activities are consistent with that reported in previous Australian studies (Nguyen *et al.* 2020; Nguyen *et al.* 2021).<sup>6</sup> Our findings also mirror those in a study by Baker and Milligan (2016) who find that parents of preschool age children in Canada, the United States (US) and the United Kingdom (UK) spend more time on educational activities with girls. The similarity in our findings is consistent with the idea that the time allocations of parents and those of their children, especially very young children, are highly correlated.<sup>7</sup>

Figure 1, which reports the estimates of the male indicator (and its 95% confidence intervals), reveals considerable temporal differences in the gender gap in time allocation.<sup>8</sup> For example, the fact that males allocate less time to personal care activities or chores is only observed from 6/7 years of age and the gap in the time allocated to these grouped activities in favour of females

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<sup>6</sup> Existing studies only look at the static aspects of the gender gap in time allocation of children and have not explored temporal dimensions of the gap as we do here.

<sup>7</sup> Their measures of parental time allocations are derived from questions asking parents about activities such as reading, playing action games, and teaching letters and numbers with their children. Mammen (2011) uses parents’ TUDs which are thought to be the most precise in quantifying time use. We, by contrast, use children’s TUDs. These data differences, among others, may make our findings less comparable.

<sup>8</sup> For demonstration purposes, we estimated Equation (1) for a pooled sample of all TUDs and reported the results in Appendix Table A3. Estimates of included variables are as expected and largely similar to those described in prior studies (Nguyen *et al.* 2020; Nguyen *et al.* 2021). To have a sufficiently large sample to provide more reliable estimates, we do not distinguish TUDs by whether they are recorded on weekends or weekdays. Nevertheless, unreported results show very similar patterns of gender differences in time allocation either on weekends or weekdays.

widens as children age. Similarly, the gender difference in the time allocated to media activities in favour of males is observed from 4/5 years old and this gender gap increases substantially as children age. Moreover, the pattern of males being more physically active than females appears from birth, and increases to 12/13 years of age, remaining similar at age 14/15 years.

The gender gap in educational activities outside of school is even more pronounced when temporal dimensions are taken into consideration (See Figure 1 – Panel 4). Specifically, at the age of 2/3 years, boys spend statistically significantly more time (12 minutes per day) on educational activities than girls. As expected, at these young ages, educational activities, which occur outside of school and are undertaken by children, are often associated with parental involvement in the form of reading a story to the child or teaching the child to read. To this end, the pattern that boys spend more time on educational activities at these young ages is in line with evidence from the US that fathers of boys invest more time in their children than those who have daughters (Mammen 2011).

Conversely, Figure 1 – Panel 4 reveals that the gender gap in educational activities reverses once children reach the age of 4/5 years as females now spend statistically significantly more time on educational activities. Furthermore, the gender gap in the time allocated to educational activities appears to increase, especially after the age of 10/11 years, as children grow. For instance, on a typical day, the gender gap in educational time in female advantage is 6 minutes per day at 4/5 years of age, while it is 22 minutes at 14/15 years of age. In relative terms, the gender gap in educational time in favour of females is also quantitatively important as it represents a large proportion of the time that both males and females spend on educational activities in our sample.<sup>9</sup> Specifically, on average, between the ages of 4/5 and 14/15 years, the gender gap accounts for about 21% of the sample mean (See statistics reported on right-hand-

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<sup>9</sup> Figure 1 reports mean of the dependent variable for each age group in dark green numbers (presented above the blue horizontal line). These mean statistics show noticeable fluctuations in time allocations across various activities as children grow.

side axes of Figure 1). More importantly and interestingly, in relative terms, the gender gap in educational time steadily increases as children grow: the gap only represents 4% of the sample mean at the age of 4/5 years while the figure is 42% by the age of 14/15 years. Similarly, Figure 1 indicates gender differentials in the time allocated to personal, physical and media activities also account for a substantial and increasing share of the corresponding sample mean as children old. However, with two exceptions noted for the age of 6/7 years (for travel) or 8/9 years (for sleep), we observe no noticeable gender difference in the time allocated to sleep, school and travel and this is the case for all age groups.

In summary, the above analysis shows significant and widening differences in the time that males and females spend on personal, educational, physical, chores and media activities. To the best of our knowledge, this age-profile analysis of the gender gap in time allocation has not been documented in the literature. These findings, when observed with evidence of gender gaps in cognitive and non-cognitive skills (Bertrand & Pan 2013; Le & Nguyen 2018a; Delaney & Devereux 2021), suggest a potential role for gender time investment differentials in contributing to gender differences in developmental outcomes. We will investigate this possibility below.

#### **4. Contribution of gender gap in time allocation to gender development differences**

##### **4.1. Regression and decomposition models**

We employ a decomposition method to quantify the contribution of the gender time allocation gap to the gender gap in development outcomes. We first apply the following regression model to explore the effect of time allocation ( $B$ ) on outcome ( $Y$ ) of individual  $i$  at test grade/age  $k$ :

$$Y_{ik} = \beta_{0k} + B_{ik}\gamma\beta_1 + C_{ik}\beta_{2k} + \epsilon_{ik} \quad (2)$$

where  $\epsilon_i$  is the error term and  $\beta$ s are sets of parameters to be estimated.  $C_{ik}$  is a list of explanatory variables representing the individual, household and local area characteristics. In

Equation (2),  $B$  is a list of time allocation variables as defined in Section 3. We measure the time allocations on a daily basis and do not distinguish whether the TUDs were recorded on weekdays or weekends.<sup>10</sup> Moreover, we follow prior studies (Fiorini & Keane 2014; Nguyen *et al.* 2020) to set sleeping time as the omitted activity, resulting in all other activities to be compared with this activity.

We consider both cognitive and non-cognitive development outcomes. To measure cognitive outcomes, we employ scores from adapted Peabody Picture Vocabulary Test (PPVT), Matrix Reasoning (MR) and the National Assessment Program – Literacy and Numeracy (NAPLAN) tests. The PPVT is an interviewer-administered test to measure a child's knowledge of the meaning of spoken words for standard English (Dunn & Dunn 1997). The MR is a subtest of the Weschler Intelligence Scale for Children, which is also conducted by an interviewer, to measure a child's non-verbal visuospatial ability. The NAPLAN test is administered to all Australian students in grades 3, 5, 7 and 9 in the five domains of reading, writing, spelling, grammar and numeracy. The test scores range from 0 to 1000 and are comparable across students and over time. The NAPLAN test results were collected via data linkage with the LSAC data (Daraganova *et al.* 2013).<sup>11</sup> The linked data have NAPLAN test scores from all test

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<sup>10</sup> An alternative approach is to measure the time allocation on a weekly basis (e.g., by multiplying time use measures from a weekday by 5 and a weekend day by 2). This approach requires that each child has at least two TUDs per wave to be included in the final sample. As previously discussed, this is only possible in the first three waves of LSAC when later child development outcomes are not widely available (See Appendix Table A2 for timeline of TUDs and child development outcomes in the LSAC).

<sup>11</sup> We prefer using the “raw” scores of cognitive and non-cognitive skills to converting each of them into a standardized scale (with mean 0 and standard deviation 1). The main reason is that, due to missing information and model specifications, we will use different samples in various parts of the analysis and each of them may have a different sample mean and standard deviation for each of these measures. Hence, standardizing a sub-scale of a developmental outcome in one sample does not necessarily mean that the same sub-scale is standardized in another sample, resulting in different interpretations of “standard deviations” in different parts of the same analysis. See Appendix Table A1 for summary statistics, including sample mean and standard deviation, of main development outcomes used in this paper. Because the NAPLAN test dates and LSAC survey dates are usually different, test results and survey data were merged in the way that survey dates pre-date the NAPLAN test dates (See Appendix Table A2). This matching practice is selected to mitigate the concern that time allocations are driven by test scores (i.e., the reverse causality issue).

grades for both cohorts. For brevity purposes, we will focus on NAPLAN reading and numeracy in this section.<sup>12</sup>

The LSAC systematically collected information on the social and emotional (non-cognitive) development of the children using the Strengths and Difficulty Questionnaire (SDQ) (Goodman *et al.* 2004). The SDQ contains five sub-scales: pro-social behaviour (hereafter called Pro-social), hyperactivity and inattention (Hyperactivity), emotional symptoms (Emotional), conduct problems (Conduct), and peer-relationship problems (Peer). Each SDQ sub-scale is scored as the summation of the item scores (from 0 (Not true), 1 (Somewhat true) to 2 (Certainly true)) on each of the five sub-items, so each has values from zero to 10. Our interests in this study are not in clinical outcomes but rather in indexing non-cognitive development. Consequently, we follow previous studies (Cunha & Heckman 2008; Fiorini & Keane 2014; Nghiem *et al.* 2015; Le & Nguyen 2017) using responses to the SDQ and rescaled the SDQ measures so that higher SDQ scores indicate more desirable outcomes. We also construct an overall non-cognitive measure which is the average sum of all five sub-scales described above. In a practical sense, this means that as scores increase the children have fewer emotional problems and higher strengths. The LSAC data contain responses to the same set of the SDQ asked separately of parents for all children aged 4 years and over, and teachers for children at school from 4 to 15 years of age, and the children themselves from age 10. To maximize the sample size to have more reliable estimates, we use SDQ measures reported by Parent 1, mostly the mother of the study child, in this section. For similar reasoning and for brevity purposes, for all outcomes, we apply the above regression and decomposition model to pooled data from all waves/test grades.

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<sup>12</sup> Table 1 and unreported results show very similar patterns between the gender gap in writing, spelling or grammar and the reported gender gap in reading.

We apply an Ordinary Least Squares (OLS) to explore the determinants of all development outcomes at the mean. For cognitive outcomes, to explore the potential heterogeneity in the gender gap and its contributing factors along the test score distribution, we employ an unconditional quantile regression (UQR) approach to estimate Equation (2) at selected percentiles. The UQR method proposed by Firpo *et al.* (2009) is appealing because it recovers the marginal impact of the explanatory variables on the unconditional quantile of  $Y$  without assuming that the rank-preserving condition holds. Another attractive feature of the UQR method is that its regression results can be applied directly to a Oaxaca-Blinder (OB) decomposition method to examine the contribution of each factor to the gender gap across the whole distribution (Fortin *et al.* 2011). Specifically, the factors contributing to the gender gap at the mean and at selected percentiles are examined by applying an OB type of decomposition of the form:

$$\hat{Y}_m - \hat{Y}_f = \underbrace{(\hat{Z}_m - \hat{Z}_f)\hat{\mu}^*}_{\text{"characteristic effect"}} + \left\{ \underbrace{\hat{Z}_m(\hat{\mu}_m - \hat{\mu}^*) + \hat{Z}_f(\hat{\mu}^* - \hat{\mu}_f)}_{\text{"return effect"}} \right\} \quad (3)$$

where  $\hat{Y}$  is the average development outcome of males ( $m$ ) or females ( $f$ ),  $\hat{Z}$  is a vector of the average observed characteristics,  $\hat{\mu}_m$  ( $\hat{\mu}_f$ ) is a set of the estimates of the list of explanatory variables for male (female) sample and  $\hat{\mu}^*$  is a set of the estimates from a pooled sample of males and females. We include a male dummy variable when estimating the reference structure ( $\hat{\mu}^*$ ) to obtain unbiased estimates on other covariates (Fortin *et al.* 2011).

We focus on detailed decomposition of the “characteristic effect” (i.e., first component on the right-hand side of Equation (3)) because it is well documented that detailed decomposition results of the “return effect” (i.e., the second component on the right-hand side of Equation (3), sometimes interpreted as “unexplained” or “discrimination”) are influenced by the arbitrary scaling of continuous variables (Jones & Kelley 1984). To facilitate the interpretation of the



results, we separate the contributing variables into four groups: (i) children’s characteristics, (ii) families’ characteristics, (iii) time allocations, and (iv) other factors.

#### **4.2. Decomposition results**

Tables 2, 3, and 4 show that, consistent with the “raw” gap<sup>13</sup> reported in Table 1 and previous evidence (Bertrand & Pan 2013; Le & Nguyen 2018a), at the mean, females excel at non-numeracy cognitive subjects or non-emotional non-cognitive skills whereas males outperform in numeracy and emotionally. Specifically, females are better (i.e., the “estimated total gap” in Tables 2, 3, and 4 is negative and statistically significant) at PPVT, MR, Reading, Writing, Spelling, Grammar, Pro-sociality, Hyperactivity, Conduct, Peer and SDQ Overall. By contrast, males advance in Numeracy and Emotional problems. The results, represented in Table 2, Table 3, Figure 2, and Figure 3, also indicate noticeable heterogeneity in gender test score gaps over the distribution of student performance. Specifically, females outperform males at the lower end of the PPVT distribution only. Moreover, females advance over virtually the whole distribution of MR and the gender gap appears more pronounced at the middle of the test score distribution. Furthermore, female advantage in Reading is more visible at the lower end of the test score distribution. By contrast, the gender numeracy test score gap in favour of males is more pronounced at the upper end of the distribution.

We additionally observe from Tables 2, 3, and 4 that gender disparities in time investment can explain a significant part of the gender gaps in academic performance in all test domains. In particular, at the mean, estimates of the characteristic part of time allocation are highly statistically significant (at least at 5% level) and typically dominant in magnitude. Moreover,

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<sup>13</sup> Notwithstanding the results are from different specifications and samples. Regression results for a pooled sample of males and females, reported in Appendix Table A4, are generally as expected and in line with that in previous studies. For example, we observe better development outcomes for children with better health (as measured by having normal birthweight), non-Indigenous background, Asian migrant mothers, or more educated mothers (Nguyen *et al.* 2019, 2020). The regression results also suggest that time spent on educational activities is the most productive input for academic development in children because estimates for educational time are more statistically significant and usually greater in magnitude than that of other time allocation variables (Fiorini & Keane 2014; Nguyen *et al.* 2020).

the estimates are always negative, either at means or along the entire test score distribution, indicating that gender differences in time allocation predict an advantage in favour of females in all test subjects. The results suggest that, at the mean, gender differences in time allocation contribute 10%, 5%, 10% and (minus) 16% to the overall gender test score gap in PPVT, MR, Reading and Numeracy, respectively. The decomposition results further reveal that the contribution of time allocation is more pronounced, in terms of the statistical significance and magnitude, at the higher end of the test score distribution, particularly for MR, Reading and Numeracy. For example, while gender differences in time allocation are statistically significant (at 1% level) and explain 26% of the observed total gender gap in Reading for students at the 90<sup>th</sup> percentile of the distribution, they contribute nothing to the aggregated gender gap for those at the 10<sup>th</sup> percentile.

Detailed decomposition results of time allocation variables in Tables 2 and 3 indicate that the contribution of time allocation is mostly attributable to the gender differences in educational time outside of school. The finding that gender disparity in educational time makes the greatest contribution to the gender gap, especially for subjects measured at older ages such as MR, Reading and Numeracy, is consistent with two observations: (i) females allocate more time to educational activities outside of school (as shown in Table 1) and (ii) educational time is the most productive input for academic development (see Appendix Table A4). The quantile decomposition results additionally suggest the contribution of gender differences in educational time is more pronounced for top-performing students, particularly in MR, Reading and Numeracy. The increasing contribution of educational time to the aggregated gender test score gap for higher performing students is consistent with two observations: (i) children with higher test scores tend to spend more time on educational activities and (ii) returns to

educational time are greater for students at the higher end of the test score distribution, especially in Reading and Numeracy.<sup>14</sup>

Turning to decomposition results for non-cognitive skills (reported in Table 4), we observe that gender differences in time allocation also help explain the typical gender gap in non-cognitive skills. For instance, estimates of the contribution of time allocation to the characteristic part are statistically significant at 1% level for all observed non-cognitive skills, except Peer, and negative, indicating that gender differences in time allocation predict an advantage in favour of females in these skills. Moreover, gender differences in time allocation contribute to explain from 3% (for Pro-sociality and Hyperactivity) to 5% (Conduct) of the total gender gap in respective non-cognitive skills. The contribution of the gender gap in time allocation, while relatively smaller than that to the gender gap in cognitive skills observed above, is highest among all grouped factors contributing to the characteristic part of gender gaps in non-cognitive skills.

Detailed decomposition of the characteristic part of time allocation variables suggests that gender heterogeneity in media time is the most important factor explaining the gender gap in non-cognitive skills because estimates of media time are statistically significant at 1% level for all observed non-cognitive outcomes and typically dominant in magnitude. Furthermore, estimates of media time are always negative, revealing the observation that males spend more time on media activities (Table 1) and the negative association between media time and non-cognitive development (see Appendix Table A4). Numerically, gender differences in media time explain from 3% (as in Hyperactivity) to (minus) 12% (Emotional problems) of the total gender gap in corresponding non-cognitive skills. Table 4 additionally shows that gender

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<sup>14</sup> Specifically, unreported quantile regression results of test scores show that estimates of educational time, which are statistically significant (at least at 5% level) and positive over the whole distribution of student performance, are typically higher at the upper end of the distribution. This illustrates the dynamic complementarity and self-productivity of the activity.

differences in personal care, physical and educational time also help explain the gender gap in non-cognitive development. However, their contributions are much less pronounced, in terms of statistical significance or size, as compared to that of gender heterogeneity in media time. Moreover, while gender differences in personal care and physical time predict a male advantage in non-cognitive skills, the opposite holds true for gender disparity in educational time.

Decomposition results further indicate that gender differences in household characteristics appear to contribute to explaining the gender gap in cognitive and non-cognitive skills in a similar pattern as observed for gender differences in time allocation.<sup>15</sup> No other factors are found to be statistically significant in explaining the developmental differences observed between males and females. The results also show that the return component is substantially larger than the characteristic component and this is the case for all developmental outcomes, especially for non-cognitive outcomes. The pattern that the return component accounts for a large proportion of the gender gap in cognitive and non-cognitive skills suggests that much of the gender gap remains “unexplained”. This pattern is also consistent with that from current relevant literature which finds it challenging to identify and quantify sources of gender differentials in development outcomes (Delaney & Devereux 2021).

#### **4.3. *Decomposition results by age groups***

We next explore how gender differences in time allocation contribute to the gender development gap along children’s ages/grades. To do so, we apply our original empirical regression and decomposition models separately for each of the previously identified biennial

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<sup>15</sup> Unreported decomposition results indicate that gender differences in family structure (as measured by living with two parents) is the main contributing factor to the grouped household variables. The negative contribution of family structure (reported in panel B of Figure 2 and Figure 3) to the gender gap reflects two patterns: (i) boys are less likely to live with both parents and (ii) the positive association between living with both parents and child development outcomes. Our finding of the statistically significant and negative contribution of family structure to the gender development gaps is consistent with prior evidence that the gender gaps are larger amongst children from families with absent fathers (Bertrand & Pan 2013; David *et al.* 2019). Our results further suggest that family structure contributes much less to the gender gap than that of children’s time allocation.

age groups or test grades. Results from this experiment, reported in Appendix Figure A1 and Appendix Figure A2, show three interesting patterns. First, consistent with previous studies (Bertrand & Pan 2013; Le & Nguyen 2018a; Borgonovi *et al.* 2021), we find that the relative development of males and females changes as children age. For instance, the “total gap” estimates show that the (adjusted) gender gap in female advantage in PPVT observed at the age of 4/5 years reverses at older ages. Furthermore, the female advantage in Reading tends to decrease from Grade 5 to Grade 7, before flattening out. Moreover, the gender gap in Numeracy in favour of males and that of Writing in female advantage widens from Grade 3 to Grade 9. We also observe from Appendix Figure A2 that the gender gap in Emotional symptoms in favour of males increases from 8/9 years of age. However, for all other non-cognitive skills, the gender gap in female advantage appears to increase from the age of 4/5 years up to the age of 8/9 years, before decreasing.

Second, detailed decomposition of the characteristic part (reported on right-hand-side panels of Appendix Figure A1 and Appendix Figure A2) suggests that the contribution of gender differences in time allocation to the gender gap in development observed previously for the pooled sample of all children might have been driven by (the changes that occur in the time investments of) older children. Particularly, estimates of the characteristic part of time allocation are more statistically significant and greater for higher age groups. For instance, the contribution of gender differences in time allocation to the mean gender gap in Numeracy increases from 10% at Grade 3 to 32% at Grade 9. Similarly, the estimates of time allocation for Overall SDQ are not statistically significant between the age of 4/5 years to the age of 8/9 years. Afterwards, the estimates become statistically significant (at 1% level) and increase substantially in size. Specifically, differences in the way that males and females allocate time among the various activities account for only 5% of the gender gap in Overall SDQ at the age of 10/11 years while it contributes up to 21% at the age of 14/15 years. To our best knowledge,

the finding that gender differences in time allocation play an increasing role in explaining the gender gap in developmental outcomes as children age is new to the literature.

Third, detailed decomposition results of time allocation variables indicate that the contribution of gender differences in time allocation to the gender gap in cognitive skills is mostly attributable to the gender differences in educational time outside of school. The results also suggest an increasing role of gender differences in educational time in explaining the gender gap in cognitive skills over time, which is consistent with two observations: (i) the gender gap in educational time in favour of females is more pronounced at older ages (see Figure 1) and (ii) the return to educational time is higher for older children.<sup>16</sup> By contrast, Appendix Figure A2 suggests that gender disparity in media time is the most important factor contributing to the gender gap in non-cognitive skills. We additionally find that gender differences in media time explain considerably more of the gender gap in non-cognitive skills for older children. This finding is in line with two patterns: (i) the widening gender gap in media time in male advantage over time (see Figure 1) and (ii) decreasing returns to media time as children grow.

## 5. Robustness checks

Above, we applied a “contemporaneous” regression and decomposition model to quantify the contribution of gender differences in time allocation to the gender gap in cognitive and non-cognitive outcomes. There is a concern that children’s time allocation as a choice variable may be endogenous in Equation (2), possibly due to unobservable individual characteristics or reverse causality. To mitigate the concern about unobservable characteristics, including children’s ability, in addition to a rich list of controls ( $C_{ik}$ ), we include a one-period lag of the

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<sup>16</sup> Specifically, unreported regression results of cognitive outcomes show estimates of the education time variable, which are positive and highly statistically significant in all regressions, typically greater for older ages/grades. By contrast, estimates of the media time variable, which are statistically significant and negative in all cases, are more negative for older age groups. These results are available upon request. To have a reasonably large sample size for each age group/grade to obtain more reliable estimates, we refrain from applying a quantile regression and decomposition method in this sub-section.

respective development outcome as an additional explanatory variable in Equation (2). The inclusion of the individual's lagged development outcome also reflects the dynamic skill formation theory (Cunha *et al.* 2010). Moreover, to ease the concern about reverse causality (i.e., it is unclear whether the allocation of time affects development or *vice versa*), we follow previous studies (Fiorini & Keane 2014; Del Boca *et al.* 2017) to additionally control for a one-period lag of time allocation in Equation (2). The resulting “augmented valued added” model, which is very data demanding as it requires longitudinal data in both TUDs and development outcomes, is arguably the most robust model employed by current literature to explore the contribution of children's time allocation to their development (Fiorini & Keane 2014; Del Boca *et al.* 2017).

Decomposition results (reported in Appendix Table A5) show that gender disparities in time allocation play a largely similar role, although at a slightly smaller magnitude and statistical significance, in explaining the overall gender gaps in development. For instance, gender differences in time investment, especially in educational activities, contribute from 4% (Reading) to (minus) 13% (PPVT) to the respective total gender test score gap. Likewise, gender heterogeneity in time allocation, particularly to media activities, explains up to 4% (in the case of Conduct) of the gender gap in non-cognitive skills.

We additionally investigate the robustness of the results using non-cognitive skills reported by teachers. Despite a significant reduction in sample size, reported results in Appendix Table A6 show little sensitivity in the findings.<sup>17</sup>

## **6. Conclusion**

In most OECD countries, females tend to have higher educational attainment and achievement than males. This paper has hypothesised gender disparity in time investments, that is, the

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<sup>17</sup> The sample size for each non-cognitive outcome as reported by teachers is about 33 thousand, as compared to a corresponding sample of more than 41 thousand as reported by Parent 1.

differences in the way the males and females distribute and expend their available time among varying activities, as a potential explanation for gender differences in cognitive and non-cognitive outcomes. To test this hypothesis, we have investigated whether males and females in Australia use their time differently and how the gender heterogeneity in these time investments contributes to explaining the gender gaps that arise in various developmental outcomes.

We presented three main findings. First, we documented that, compared to females, males spend less time on their personal care, doing chores and educational activities outside of school and males spend more time on physical and media related activities. We also showed that these gender differentials in time allocation increase as children age.

Second, we found that these gender differences in children's time allocation developmentally favour females and account for a substantial portion of the differences between females and males in their cognitive and non-cognitive skills. Particularly, we found that gender differentials in time allocation, especially to educational activities outside of school, explain up to 16% of the gender gaps in cognitive skills. Moreover, gender differences in time allocation explained more of the gender gap for students at the higher end of the test score distribution. We also discovered that gender disparity in time allocation, particularly to media activities, contributes up to 5% to the gender gaps in non-cognitive skills. Third, our results indicate that gender differences in time allocation account for an increasing share of the gender gaps in cognitive and non-cognitive skills as children get older.

The results presented in this study may have several potentially important implications for policies that aim to improve developmental outcomes for male and female students. For example, our finding that time allocations, especially educational time outside of school, play a significant role in explaining gender test score gaps observed in standardised cognitive testing (NAPLAN) suggests that policies aimed at increasing the time spent on educational activities



outside of school by male students could reduce the gender test score gaps, especially in non-numeracy subjects. Similarly, our finding of the significant contribution that the time spent on media makes to male disadvantage in non-cognitive skills suggests scope for policy interventions to reduce non-educational media time among males to narrow the gender gap in non-cognitive skills. Such policies are particularly relevant given increasing concerns about a “boy crisis” (Bertrand & Pan 2013; David *et al.* 2019; Lei & Lundberg 2020).

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Table 1: Summary statistics by gender

	Male	Female	Male - Female
	(1)	(2)	(3)
Child age (months)	87.78	88.82	-1.035**
Low birth weight	0.06	0.07	-0.009***
Indigenous	0.02	0.02	0.001
Mother ESB	0.10	0.10	0.000
Mother NESB	0.16	0.15	0.009***
Mother has a certificate/diploma	0.39	0.39	0.004
Mother has a graduate degree	0.37	0.37	-0.003
Live with both parents	0.84	0.85	-0.007**
Number of siblings	1.42	1.41	0.003
Sleep (minutes per day)	642.00	642.17	-0.167
Personal care (minutes per day)	303.01	320.32	-17.306***
School (minutes per day)	109.44	111.26	-1.825
Education (minutes per day)	94.05	100.49	-6.438***
Physical (minutes per day)	178.52	165.90	12.624***
Chores (minutes per day)	19.88	23.69	-3.807***
Media (minutes per day)	158.36	135.26	23.098***
Travel (minutes per day)	82.43	83.21	-0.777
PPVT	70.86	71.15	-0.286***
MR	10.49	10.87	-0.379***
Reading	498.01	528.54	-30.53***
Spelling	515.42	531.50	-16.073***
Grammar	524.25	547.84	-23.587***
Numeracy	538.40	528.53	9.87***
Pro-sociality	7.86	8.48	-0.613***
Hyperactivity	6.46	7.45	-0.985***
Emotional	8.44	8.24	0.199***
Conduct	8.43	8.70	-0.27***
Peer	8.45	8.68	-0.227***
Overall SDQ	7.93	8.31	-0.379***
Number of observations	27,814	26,665	

Notes: Figures are sample means. Statistics are reported for the pooled sample of B- and K-cohort children who have a valid TUD in any wave. Tests are performed on the significance of the difference between the sample mean for males and females. The symbol \*denotes significance at the 10% level, \*\* at the 5% level, and \*\*\* at the 1% level.

Table 2: Decomposition of the gender gap at mean and selected percentiles – PPVT and MR

	PPVT				MR			
	Q10th	Q50th	Q90th	Mean	Q10th	Q50th	Q90th	Mean
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Estimated total gap</b>	-2.24***	0.30	0.48***	-0.29***	-0.37***	-0.61***	-0.42***	-0.38***
<b>Characteristic part</b>								
Child	-0.04	-0.05	-0.04	-0.04	0.01	0.01	0.02	0.01
	[2]	[-17]	[-8]	[14]	[-3]	[-2]	[-5]	[-3]
Household	-0.09***	-0.02**	-0.02*	-0.03**	-0.01**	-0.01*	-0.01	-0.01**
	[4]	[-7]	[-4]	[10]	[3]	[2]	[2]	[3]
Others	0.02	0.01	-0.06*	-0.01	-0.01	-0.01	-0.02	-0.01
	[-1]	[3]	[-13]	[3]	[3]	[2]	[5]	[3]
Time allocation	-0.06**	-0.00	-0.04**	-0.03***	-0.01	-0.02***	-0.03**	-0.02**
	[3]	[0]	[-8]	[10]	[3]	[3]	[7]	[5]
<i>Personal care</i>	0.00	-0.00	-0.01**	-0.01**	-0.01	-0.02***	-0.02**	-0.02***
	[0]	[0]	[-2]	[3]	[3]	[3]	[5]	[5]
<i>School</i>	-0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
	[0]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
<i>Education</i>	-0.06***	-0.01***	-0.02***	-0.02***	-0.02***	-0.02***	-0.04***	-0.03***
	[3]	[-3]	[-4]	[7]	[5]	[3]	[10]	[8]
<i>Physical</i>	0.05***	0.00	-0.01	0.01*	0.00	-0.00	-0.01	0.00
	[-2]	[0]	[-2]	[-3]	[0]	[0]	[2]	[0]
<i>Chores</i>	-0.00	-0.00*	-0.00	-0.00*	0.00	0.00	0.01	0.00*
	[0]	[0]	[0]	[0]	[0]	[0]	[-2]	[0]
<i>Media</i>	-0.05***	0.01	0.00	-0.00	0.01	0.01	0.02	0.02***
	[2]	[3]	[0]	[0]	[-3]	[-2]	[-5]	[-5]
<i>Travel</i>	0.00	0.00	0.00	0.00	-0.00	0.00	0.00	0.00
	[0]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
Total	-0.18	-0.06	-0.15*	-0.11	-0.02	-0.04***	-0.05**	-0.04***
	[8]	[-20]	[-31]	[38]	[5]	[7]	[12]	[11]
<b>Return part</b>								
Total	-2.06***	0.36*	0.63***	-0.18***	-0.35***	-0.57***	-0.37***	-0.34***
	[92]	[120]	[131]	[62]	[95]	[93]	[88]	[89]

Notes: Estimates are from regression model (2) and decomposition model (3). PPVT refers to “Peabody Picture Vocabulary Test” while MR indicates “Matrix Reasoning”. “Estimated total gap” is estimated difference in the respective outcome between males and females so a positive value indicates a male advantage in that outcome (and *vice versa*). Grouped variables: Child: age, Indigeneity, birth weight; Household: maternal migration status, maternal completed qualification, living with both parents, number of siblings; Others: local socio-economic background variables, states, and survey quarter and year dummies; Time allocation: Current time allocation among various grouped activities. Values in squared brackets are percentage of the estimated total gap. Percentages may not add up to 100 % due to rounding. Standard errors (not reported for brevity) are obtained using 500 bootstrap replications. The symbol \*denotes significance at the 10% level, \*\*at the 5% level, and \*\*\*at the 1% level.

Table 3: Decomposition of the gender gap at mean and selected percentiles – NAPLAN Reading and Numeracy

	Reading				Numeracy			
	Q10th	Q50th	Q90th	Mean	Q10th	Q50th	Q90th	Mean
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Estimated total gap</b>	-20.49***	-21.19***	-11.21***	-17.02***	0.17	8.06***	19.85***	9.87***
<b>Characteristic part</b>								
Child	-2.12**	-0.98*	-0.00	-0.95*	-1.91*	-0.90	-0.55	-1.05
	[10]	[5]	[0]	[6]	[-1124]	[-11]	[-3]	[-11]
Household	-0.39	-0.37*	-0.36	-0.38*	-0.27	-0.39*	-0.15	-0.31
	[2]	[2]	[3]	[2]	[-159]	[-5]	[-1]	[-3]
Others	0.86	0.16	-0.14	0.28	1.25**	0.42	-0.23	0.43
	[-4]	[-1]	[1]	[-2]	[735]	[5]	[-1]	[4]
Time allocation	-0.65	-2.06***	-2.89***	-1.72***	-0.40	-1.25***	-2.46***	-1.55***
	[3]	[10]	[26]	[10]	[-235]	[-16]	[-12]	[-16]
Personal care	-0.79**	-0.76***	-0.43***	-0.58***	-0.41	-0.65***	-0.39**	-0.59***
	[4]	[4]	[4]	[3]	[-241]	[-8]	[-2]	[-6]
School	0.00	0.03	0.09	0.04	-0.00	0.00	0.08	0.02
	[0]	[0]	[-1]	[0]	[0]	[0]	[0]	[0]
Education	-0.52***	-1.51***	-1.94***	-1.35***	-0.63***	-1.10***	-1.97***	-1.32***
	[3]	[7]	[17]	[8]	[-371]	[-14]	[-10]	[-13]
Physical	0.13	-0.05	-0.33***	-0.07	0.16	0.22**	-0.04	0.08
	[-1]	[0]	[3]	[0]	[94]	[3]	[0]	[1]
Chores	0.02	0.13	0.34**	0.17**	-0.04	-0.02	0.41**	0.08
	[0]	[-1]	[-3]	[-1]	[-24]	[0]	[2]	[1]
Media	0.47	0.10	-0.62**	0.04	0.51	0.30	-0.57*	0.18
	[-2]	[0]	[6]	[0]	[300]	[4]	[-3]	[2]
Travel	0.03	0.01	-0.00	0.01	0.00	0.00	0.02	0.00
	[0]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
Total	-2.31*	-3.25***	-3.39***	-2.77***	-1.33	-2.11*	-3.39***	-2.48**
	[11]	[15]	[30]	[16]	[-782]	[-26]	[-17]	[-25]
<b>Return part</b>								
Total	-18.18***	-17.94***	-7.82***	-14.25***	1.49	10.18***	23.23***	12.35***
	[89]	[85]	[70]	[84]	[876]	[126]	[117]	[125]

Notes: Estimates are from regression model (2) and decomposition model (3). Grouped variables: Child: age, Indigeneity, birth weight; Household: maternal migration status, maternal completed qualification, living with both parents, number of siblings; Others: local socio-economic background variables, NAPLAN test state and NAPLAN test year dummies; Time allocation: Current time allocation among various grouped activities. Values in squared brackets are percentage of the estimated total gap. Percentages may not add up to 100 % due to rounding. Standard errors (not reported for brevity) are obtained using 500 bootstrap replications. The symbol \*denotes significance at the 10% level, \*\*at the 5% level, and \*\*\*at the 1% level.

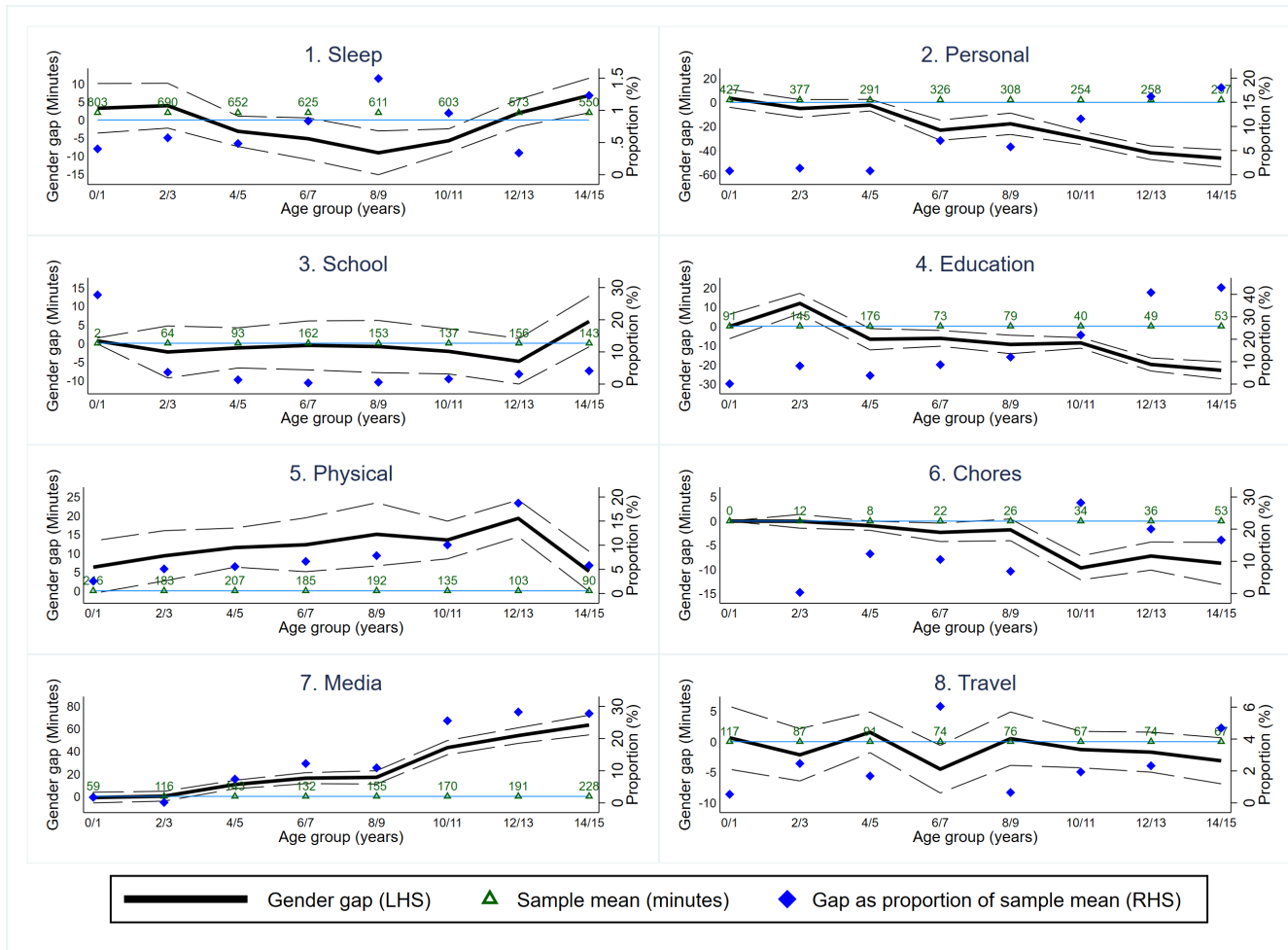
Table 4: Decomposition of the gender gap in non-cognitive skills

	Pro-sociality	Hyperactivity	Emotional problems	Conduct	Peer problem	Overall
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Estimated total gap</b>	-0.6130***	-0.9849***	0.1987***	-0.2703***	-0.2274***	-0.3795***
<b>Characteristic part</b>						
Child	-0.0040**	-0.0051	0.0025***	-0.0141**	0.0015*	-0.0038*
	[1]	[1]	[1]	[5]	[-1]	[1]
Household	-0.0028**	-0.0046	-0.0025	-0.0044**	-0.0052**	-0.0039**
	[0]	[0]	[-1]	[2]	[2]	[1]
Others	-0.0006	-0.0022	0.0012	0.0044	-0.0027	0.0000
	[0]	[0]	[1]	[-2]	[1]	[0]
Time allocation	-0.0210***	-0.0257***	-0.0090***	-0.0138***	-0.0045	-0.0148***
	[3]	[3]	[-5]	[5]	[2]	[4]
<i>Personal care</i>	0.0085***	0.0127***	0.0129***	0.0093***	0.0053***	0.0097***
	[-1]	[-1]	[6]	[-3]	[-2]	[-3]
<i>School</i>	0.0001	0.0008	0.0003	0.0005	-0.0002	0.0003
	[0]	[0]	[0]	[0]	[0]	[0]
<i>Education</i>	-0.0000	-0.0075***	-0.0002	-0.0026***	0.0008	-0.0019***
	[0]	[1]	[0]	[1]	[0]	[1]
<i>Physical</i>	0.0020**	-0.0009	0.0017*	0.0002	0.0071***	0.0020***
	[0]	[0]	[1]	[0]	[-3]	[-1]
<i>Chores</i>	-0.0051***	0.0014	-0.0006	0.0006	0.0015*	-0.0004
	[1]	[0]	[0]	[0]	[-1]	[0]
<i>Media</i>	-0.0265***	-0.0322***	-0.0232***	-0.0221***	-0.0190***	-0.0246***
	[4]	[3]	[-12]	[8]	[8]	[6]
<i>Travel</i>	0.0001	0.0002	0.0002	0.0002	-0.0000	0.0001
	[0]	[0]	[0]	[0]	[0]	[0]
Total	-0.0283***	-0.0376***	-0.0078	-0.0279***	-0.0109**	-0.0225***
	[5]	[4]	[-4]	[10]	[5]	[6]
<b>Return part</b>						
Total	-0.5847***	-0.9474***	0.2065***	-0.2424***	-0.2164***	-0.3569***
	[95]	[96]	[104]	[90]	[95]	[94]

Notes: Estimates are from regression model (2) and decomposition model (3). Grouped variables: Child: age, Indigeneity, birth weight; Household: maternal migration status, maternal completed qualification, living with both parents, number of siblings; Others: local socio-economic background variables, states, and survey quarter and year dummies; Time allocation: Current time allocation among various grouped activities. Values in squared brackets are percentage of the estimated total gap. Percentages may not add up to 100 % due to rounding. Standard errors (not reported for brevity) are obtained using 500 bootstrap replications. The symbol \*denotes significance at the 10% level, \*\*at the 5% level, and \*\*\*at the 1% level.

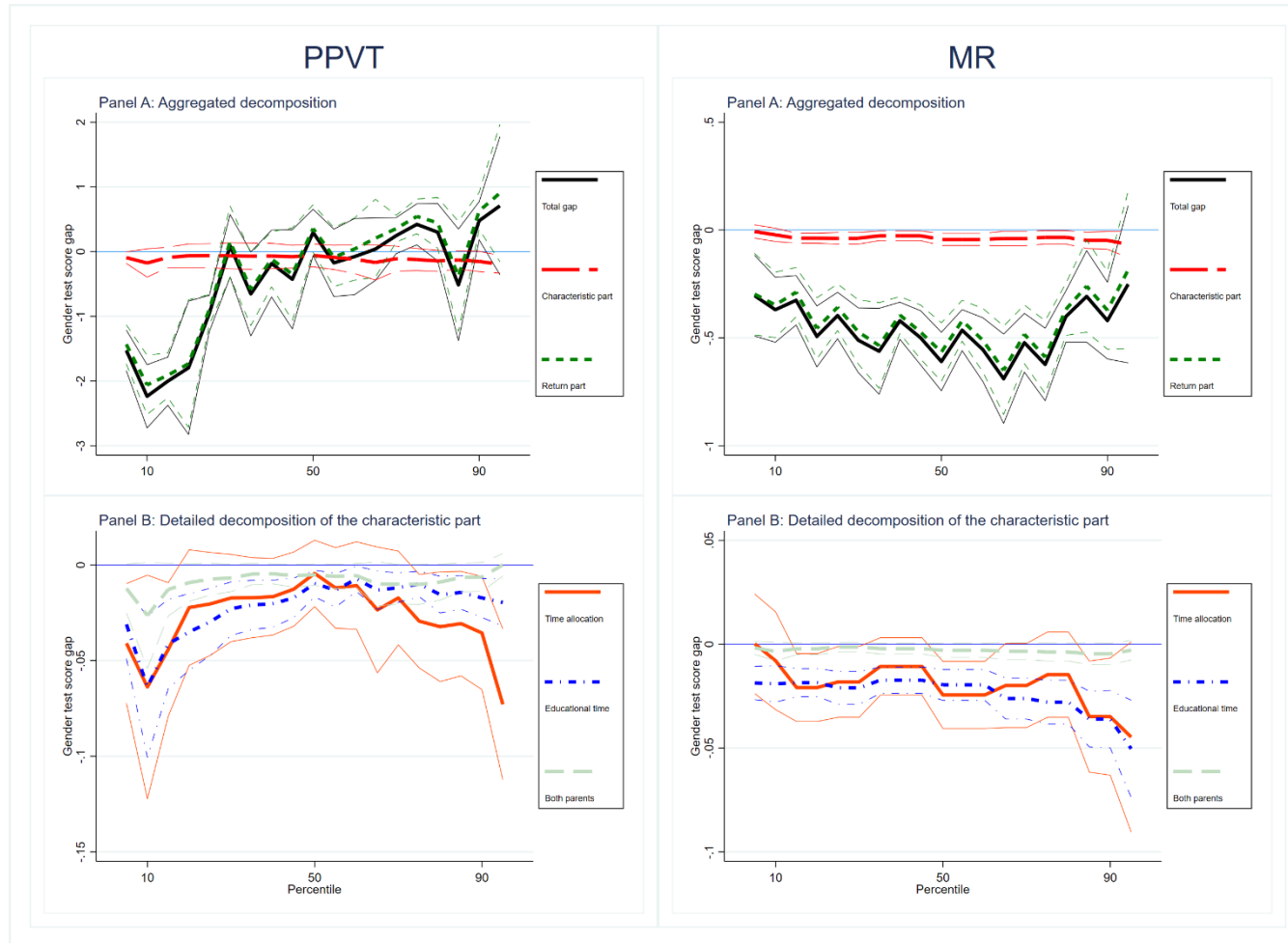


Figure 1: Gender gap in time allocation by age group



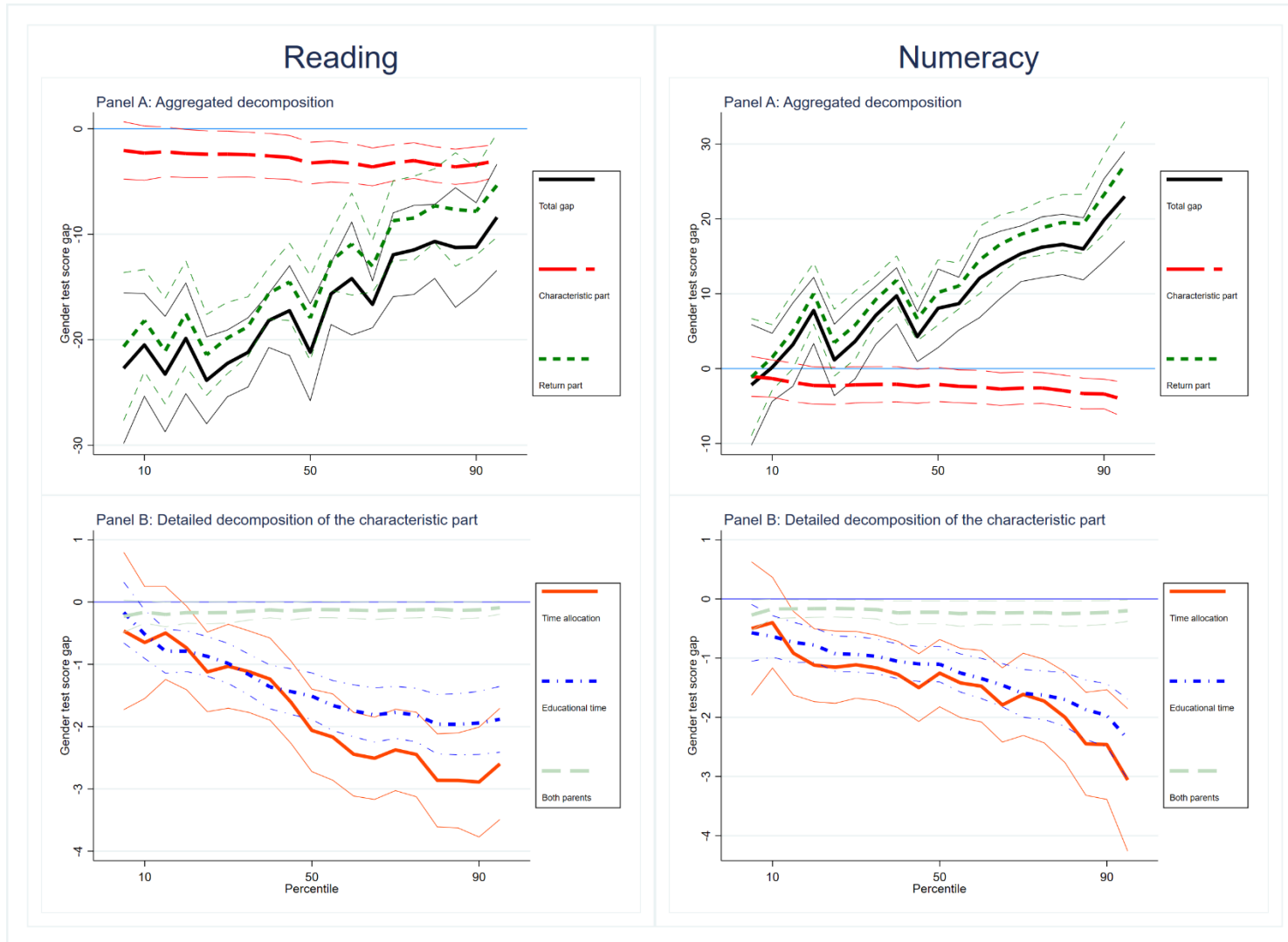
Notes: This figure reports gender gap in time allocation by age groups. Results for each activity and each age group are obtained from a separate OLS estimation of Equation (1). Sample size for each regression ranges from 5,270 to 11,561. The solid (dash) line, displayed on left-hand-side axis, shows the estimate (95% confidence interval) of the dummy variable for males from Equation (1). “Sample mean” statistics, reported above the blue horizontal line and scaled free, indicate mean of the dependent variable for each age group. “Gap as proportion of sample mean”, measured in percentage and displayed on right-hand-side axis, is calculated by dividing “Gender gap” (in absolute value) by “Sample mean”.

Figure 2: Decomposition of the gender test score gap in PPVT and MR



Notes: See Table 2.

Figure 3: Decomposition of the gender test score gap - NAPLAN Reading and Numeracy



Notes: See Table 3.

## **Online Appendixes**

For refereeing purposes and to be published online

Appendix Table A1: Variable description and summary statistics

Variable	Description	Mean	Min	Max	SD		
					Overall	Between	Within
Male	Dummy = 1 if male, = 0 if female	0.51	0.00	1.00	0.50	0.50	0.00
Child age	Child age at the survey time (months)	88.29	3.00	193.00	53.50	37.76	41.48
Low birth weight	Dummy: = 1 if child's birth weight is 2500 grams or less, = 0 otherwise	0.06	0.00	1.00	0.24	0.25	0.00
Indigenous	Dummy: = 1 if child has Aboriginal/Torres Strait Islander origin, = 0 otherwise	0.02	0.00	1.00	0.15	0.17	0.00
Mother ESB migrant	Dummy: = 1 if mother was born overseas in an English-Speaking Background (ESB) country, = 0 otherwise	0.10	0.00	1.00	0.29	0.29	0.02
Mother NESB migrant	Dummy: = 1 if mother was born overseas in a Non-English-Speaking Background (NESB) country, = 0 otherwise	0.16	0.00	1.00	0.36	0.33	0.18
Mother has a certificate or diploma	Dummy: = 1 if mother has advanced diploma/diploma, = 0 otherwise	0.39	0.00	1.00	0.49	0.47	0.16
Mother has a graduate degree	Dummy: = 1 if mother has a bachelor degree or higher, = 0 otherwise	0.37	0.00	1.00	0.48	0.46	0.12
Lived with both parents	Dummy: = 1 if lived with both parents at the survey time, = 0 otherwise	0.85	0.00	1.00	0.36	0.34	0.16
Number of siblings	Number of siblings	1.42	0.00	11.00	1.01	0.98	0.41
Sleep (minutes)	Total time spent on sleep per day (minutes)	642.08	0.00	1440.00	131.96	100.03	102.46
Personal care (minutes)	Total time spent on personal care per day (minutes)	311.48	0.00	1320.00	155.53	114.20	121.56
School (minutes)	Total time spent on school per day (minutes)	110.33	0.00	1185.00	167.44	108.63	134.64
Education (minutes)	Total time spent on educational activities outside school per day (minutes)	97.20	0.00	960.00	120.20	84.52	95.51
Physical (minutes)	Total time spent on physical activities per day (minutes)	172.34	0.00	1440.00	148.82	112.40	113.67
Chores (minutes)	Total time spent on chore per day (minutes)	21.74	0.00	795.00	47.78	27.72	39.66
Media (minutes)	Total time spent on media related activities per day (minutes)	147.05	0.00	1260.00	130.49	90.88	101.72
Travel (minutes)	Total time spent on travel per day (minutes)	82.81	0.00	1245.00	84.81	64.32	66.83
PPVT	Peabody Picture Vocabulary Test score	71.00	32.49	100.74	7.95	6.76	4.95
MR	Matrix reasoning score	10.68	1.00	19.00	3.00	2.77	1.39
Reading	NAPLAN reading score	534.40	0.00	907.50	95.40	84.97	52.37
Writing	NAPLAN writing score	513.01	89.00	807.20	88.07	76.26	51.36
Spelling	NAPLAN spelling score	523.32	185.80	835.30	92.66	82.68	49.78
Grammar	NAPLAN grammar score	535.84	135.00	894.00	97.14	85.58	53.89
Numeracy	NAPLAN numeracy score	533.56	0.00	922.80	96.92	85.56	53.17
Pro-sociality	SDQ Pro-social behaviour scale - P1	8.16	0.00	10.00	1.75	1.56	0.98
Hyperactivity	SDQ Hyperactivity and inattention scale (reversed) - P1	6.94	0.00	10.00	2.29	2.07	1.12
Emotional	SDQ Emotional symptoms scale (reversed) - P1	8.34	0.00	10.00	1.76	1.51	1.03
Conduct	SDQ Conduct problems scale (reversed) - P1	8.56	0.00	10.00	1.63	1.50	0.94
Peer	SDQ Peer-relationship problems scale (reversed) - P1	8.56	0.00	10.00	1.59	1.40	0.91
Overall SDQ	Mean of above five SDQ sub-scales - P1	8.11	1.60	10.00	1.22	1.13	0.58

Notes: Statistics are reported for the pooled sample of B- and K-cohort children who have a valid TUD in any wave. English-Speaking Background (ESB) countries include UK, Ireland, Canada, New Zealand, South Africa and USA. "P1" indicates Parent 1's reported measures.

Appendix Table A2: LSAC contents by wave and cohort

LSAC wave	1	2	3	4	5	6	7	8	9
LSAC survey year	2004	2006	2008	2010	2012	2014	2016	2018	2020
Age (years)									
B cohort	0/1	2/3	4/5	6/7	8/9	10/11	12/33	14/15	16/17
K cohort	4/5	6/7	8/9	10/11	12/13	14/15	16/17	18/19	20/21
TUD									
B cohort	Y	Y	Y			Y	Y	Y	
K cohort	Y	Y	Y	Y	Y	Y			
PPVT (ITV)									
B cohort			Y	Y	Y				
K cohort	Y	Y	Y						
MR (ITV)									
B cohort				Y	Y	Y			
K cohort		Y	Y	Y					
NAPLAN test grade assigned									
B cohort				3	5	7	9		
K cohort		3	5	7	9				
SDQ (P1)									
B cohort			Y	Y	Y	Y	Y	Y	
K cohort	Y	Y	Y	Y	Y	Y	Y		
SDQ (TC)									
B cohort			Y	Y	Y	Y	Y	Y	
K cohort	Y	Y	Y	Y	Y	Y			

Notes: “Y” indicates information is available in respective survey wave. SDQ = Strengths and Difficulties Questionnaire; PPVT = Peabody Picture Vocabulary Test; MR = Matrix Reasoning; NAPLAN = National Assessment Program – Literacy and Numeracy test score; P1 - reported by Parent 1; TC - reported by Teacher; ITV – assessed by Interviewer.

Appendix Table A3: Determinants of time allocation – Pooled regression results

	Sleep	Personal care	School	Education	Physical	Chores	Media	Travel
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male	-1.21 [0.96]	-18.22*** [1.25]	-1.00 [1.18]	-7.09*** [0.97]	11.80*** [1.15]	-3.54*** [0.38]	23.69*** [1.03]	-1.00 [0.71]
Child age (months)	-1.64*** [0.02]	-1.62*** [0.03]	1.36*** [0.03]	-0.48*** [0.02]	-0.13*** [0.03]	0.17*** [0.01]	0.94*** [0.02]	-0.13*** [0.02]
Low birthweight	4.74** [2.06]	3.57 [2.68]	-3.16 [2.49]	-5.75*** [1.93]	-2.41 [2.40]	-2.45*** [0.71]	-0.37 [2.21]	-5.58*** [1.47]
Indigenous	-1.56 [3.58]	3.42 [4.64]	-3.87 [3.91]	-14.02*** [3.02]	5.52 [4.42]	-1.88 [1.43]	9.32*** [3.62]	-4.07 [2.55]
Mother ESB migrant <sup>(a)</sup>	-3.20* [1.66]	0.33 [2.22]	1.40 [2.05]	4.25** [1.72]	1.80 [1.98]	0.09 [0.62]	-0.62 [1.72]	2.46** [1.22]
Mother NESB migrant <sup>(a)</sup>	-9.28*** [1.70]	-0.14 [2.14]	0.13 [2.05]	9.27*** [1.68]	-19.97*** [1.92]	-1.05* [0.58]	10.13*** [1.81]	-3.25*** [1.23]
Mother with certificate/diploma <sup>(b)</sup>	-1.21 [1.29]	3.36** [1.65]	1.03 [1.53]	5.99*** [1.23]	2.00 [1.54]	0.73 [0.49]	-2.94** [1.38]	1.93** [0.96]
Mother with bachelor or higher degree <sup>(b)</sup>	-1.57 [1.32]	13.80*** [1.73]	3.03* [1.61]	26.75*** [1.36]	9.55*** [1.61]	3.15*** [0.53]	-22.02*** [1.39]	4.37*** [0.99]
Living with both parents	2.03 [1.36]	-2.12 [1.83]	-9.64*** [1.73]	10.25*** [1.26]	10.97*** [1.61]	1.74*** [0.59]	-12.67*** [1.65]	1.68* [0.99]
Number of siblings	-2.66*** [0.51]	-0.00 [0.66]	-3.67*** [0.59]	0.26 [0.48]	2.91*** [0.59]	1.14*** [0.20]	-1.46*** [0.54]	-1.35*** [0.38]
Monday <sup>(c)</sup>	-20.93*** [1.69]	6.33*** [2.18]	140.28*** [2.05]	7.28*** [1.65]	-69.93*** [2.00]	-6.07*** [0.69]	-27.24*** [1.85]	-6.13*** [1.25]
Tuesday <sup>(c)</sup>	-24.04*** [1.64]	10.56*** [2.26]	166.45*** [2.13]	12.35*** [1.67]	-79.48*** [1.96]	-7.75*** [0.70]	-36.58*** [1.87]	-6.22*** [1.20]
Wednesday <sup>(c)</sup>	-23.80*** [1.66]	6.82*** [2.23]	169.64*** [2.14]	12.68*** [1.70]	-83.64*** [1.93]	-7.46*** [0.71]	-36.53*** [1.81]	-5.18*** [1.20]
Thursday <sup>(c)</sup>	-27.43*** [1.76]	5.58** [2.30]	169.37*** [2.23]	13.16*** [1.79]	-80.33*** [2.00]	-7.53*** [0.68]	-38.87*** [1.84]	-1.00 [1.27]
Friday <sup>(c)</sup>	-46.42*** [1.79]	9.29*** [2.33]	166.31*** [2.21]	3.89** [1.81]	-71.22*** [2.08]	-9.28*** [0.69]	-24.33*** [1.84]	4.05*** [1.31]
Saturday <sup>(c)</sup>	-27.82*** [1.68]	-7.41*** [1.94]	-2.40** [1.15]	2.32 [1.57]	12.43*** [2.20]	-0.74 [0.63]	5.36*** [1.66]	14.00*** [1.33]
Observations	54,479	54,479	54,479	54,479	54,479	54,479	54,479	54,479
R-squared	0.286	0.127	0.331	0.124	0.191	0.130	0.156	0.048
Mean of dependent variable	642.08	311.48	110.33	97.20	172.34	21.74	147.05	82.81

Notes: Estimates for each outcome are obtained from a separate Ordinary Least Squares (OLS) regression, using a pooled sample of all valid TUDs. Other variables include urban, local socio-economic background variables, state/territory dummies, TUD year dummies, and TUD month dummies. <sup>(a)</sup>, <sup>(b)</sup>, and <sup>(c)</sup> indicates Australia-born mother, mother with no post-school qualification, and Sunday as the base group, respectively. Robust standard errors are in parentheses. The symbol \*denotes significance at the 10% level, \*\*at the 5% level, and \*\*\*at the 1% level.

Appendix Table A4: Determinants of cognitive and non-cognitive development – Pooled regression results at mean

Variables	PPVT	MR	Reading	Writing	Spelling	Grammar	Numeracy	Pro-sociality	Hyperactivity	Emotional problems	Conduct	Peer problem	Overall
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Male	-0.18*** [0.07]	-0.34*** [0.04]	-14.25*** [1.02]	-27.78*** [0.99]	-13.63*** [0.96]	-21.00*** [1.08]	12.35*** [0.96]	-0.58*** [0.02]	-0.95*** [0.02]	0.21*** [0.02]	-0.24*** [0.02]	-0.22*** [0.02]	-0.36*** [0.01]
Personal care (hours) <sup>(a)</sup>	0.04*** [0.01]	0.04*** [0.01]	1.22*** [0.24]	0.49** [0.22]	0.61*** [0.22]	1.39*** [0.25]	1.26*** [0.22]	-0.02*** [0.00]	-0.03*** [0.00]	-0.03*** [0.00]	-0.02*** [0.00]	-0.01*** [0.00]	-0.03*** [0.00]
School (hours) <sup>(a)</sup>	-0.01 [0.01]	-0.00 [0.01]	-0.66*** [0.25]	-0.93*** [0.23]	-0.95*** [0.23]	-0.89*** [0.26]	-0.29 [0.23]	-0.00 [0.00]	-0.02*** [0.00]	-0.01** [0.00]	-0.02*** [0.00]	0.01* [0.00]	-0.01*** [0.00]
Education (hours) <sup>(a)</sup>	0.17*** [0.02]	0.19*** [0.02]	7.52*** [0.47]	5.46*** [0.42]	5.85*** [0.42]	7.73*** [0.48]	7.27*** [0.44]	0.00 [0.00]	0.04*** [0.01]	0.00 [0.00]	0.02*** [0.00]	-0.00 [0.00]	0.01*** [0.00]
Physical (hours) <sup>(a)</sup>	0.03** [0.01]	0.01 [0.01]	-0.26 [0.29]	-0.24 [0.26]	-0.69*** [0.26]	-0.39 [0.30]	0.29 [0.26]	0.01** [0.00]	-0.00 [0.01]	0.01* [0.00]	0.00 [0.00]	0.03*** [0.00]	0.01*** [0.00]
Chores (hours) <sup>(a)</sup>	0.12** [0.06]	-0.06* [0.03]	-1.64** [0.68]	-2.37*** [0.67]	-3.38*** [0.65]	-2.19*** [0.70]	-0.75 [0.63]	0.06*** [0.01]	-0.02 [0.01]	0.01 [0.01]	-0.01 [0.01]	-0.02* [0.01]	0.01 [0.01]
Media (hours) <sup>(a)</sup>	-0.02 [0.02]	0.04*** [0.01]	0.08 [0.30]	-0.91*** [0.29]	-0.05 [0.29]	0.16 [0.32]	0.30 [0.29]	-0.05*** [0.00]	-0.06*** [0.01]	-0.05*** [0.01]	-0.04*** [0.00]	-0.04*** [0.00]	-0.05*** [0.00]
Travel (hours) <sup>(a)</sup>	-0.04* [0.02]	-0.02 [0.02]	-0.82* [0.44]	-0.46 [0.42]	-0.67 [0.41]	-0.61 [0.46]	-0.13 [0.41]	-0.00 [0.01]	-0.01* [0.01]	-0.01* [0.01]	-0.02*** [0.01]	0.00 [0.01]	-0.01** [0.00]
Child age (months)	0.29*** [0.00]	-0.01 [0.01]	1.40*** [0.11]	1.48*** [0.11]	1.78*** [0.11]	1.28*** [0.11]	1.62*** [0.10]	0.00*** [0.00]	0.01*** [0.00]	-0.00 [0.00]	0.01*** [0.00]	0.00 [0.00]	0.00*** [0.00]
Low birthweight	-1.41*** [0.15]	-0.76*** [0.09]	-16.35*** [1.96]	-7.60*** [2.09]	-8.58*** [1.99]	-16.95*** [2.12]	-18.59*** [1.90]	-0.05 [0.03]	-0.30*** [0.05]	-0.19*** [0.04]	-0.10*** [0.03]	-0.19*** [0.03]	-0.17*** [0.03]
Indigenous	-0.98*** [0.22]	-0.83*** [0.14]	-26.47*** [3.67]	-30.82*** [4.09]	-23.32*** [3.97]	-36.04*** [4.05]	-30.07*** [3.32]	-0.14** [0.06]	-0.38*** [0.08]	-0.21*** [0.06]	-0.30*** [0.06]	-0.28*** [0.06]	-0.26*** [0.04]
Mother ESB migrant <sup>(a)</sup>	0.01 [0.12]	0.25*** [0.08]	4.70*** [1.69]	0.67 [1.69]	4.93*** [1.58]	2.30 [1.71]	3.12** [1.54]	0.03 [0.03]	-0.06 [0.04]	0.18*** [0.03]	0.05** [0.03]	0.07*** [0.03]	0.06*** [0.02]
Mother NESB migrant <sup>(a)</sup>	-1.80*** [0.13]	0.37*** [0.07]	8.54*** [1.62]	13.57*** [1.60]	23.00*** [1.61]	10.39*** [1.81]	18.44*** [1.72]	-0.07*** [0.03]	0.08** [0.03]	-0.09*** [0.03]	0.01 [0.02]	-0.32*** [0.03]	-0.08*** [0.02]
Mother with certificate/diploma <sup>(b)</sup>	0.41*** [0.09]	0.09 [0.05]	2.75** [1.33]	1.53 [1.30]	-1.17 [1.27]	-0.01 [1.41]	0.50 [1.27]	0.08*** [0.02]	0.16*** [0.03]	0.00 [0.02]	0.04** [0.02]	0.03 [0.02]	0.06*** [0.02]
Mother with bachelor or higher degree <sup>(b)</sup>	1.52*** [0.09]	0.72*** [0.06]	26.71*** [1.40]	21.25*** [1.35]	13.31*** [1.32]	24.72*** [1.49]	24.07*** [1.36]	0.06*** [0.02]	0.52*** [0.03]	0.09*** [0.02]	0.18*** [0.02]	0.17*** [0.02]	0.21*** [0.02]
Living with both parents	0.97*** [0.11]	0.31*** [0.06]	12.26*** [1.32]	17.45*** [1.41]	12.39*** [1.31]	15.32*** [1.44]	16.67*** [1.27]	0.23*** [0.02]	0.49*** [0.03]	0.37*** [0.03]	0.39*** [0.02]	0.36*** [0.02]	0.37*** [0.02]
Number of siblings	-0.53*** [0.04]	-0.07*** [0.02]	-3.33*** [0.49]	-2.20*** [0.53]	-1.94*** [0.49]	-2.94*** [0.55]	-1.17** [0.50]	-0.05*** [0.01]	0.13*** [0.01]	0.08*** [0.01]	-0.04*** [0.01]	0.07*** [0.01]	0.04*** [0.01]
Observations	22,428	18,309	20,177	20,176	20,205	20,201	20,091	41,210	41,205	41,207	41,208	41,210	41,198
R-squared	0.598	0.074	0.464	0.382	0.486	0.410	0.525	0.063	0.097	0.039	0.134	0.047	0.097
Sample mean	71.00	10.68	534.40	513.01	523.32	535.84	533.56	8.16	6.94	8.34	8.56	8.56	8.11

Notes: Estimates for each outcome are obtained from a separate Ordinary Least Squares (OLS) regression, using a pooled sample of males and females. Other variables include urban, local socio-economic variables, state/territory dummies, year dummies, and survey quarter dummies. For NAPLAN test scores, test states (in place of state/territory dummies), test years and test ages are also included. <sup>(a)</sup>, <sup>(b)</sup> and <sup>(c)</sup> indicates sleep time, Australia-born mother and mother with no post-school qualification as the base group, respectively. Robust standard errors are in parentheses. The symbol \*denotes significance at the 10% level, \*\*at the 5% level, and \*\*\*at the 1% level.



Appendix Table A5: Robustness - Decomposition of the gender gap in development using augmented valued added regression model

	PPVT				MR				Reading			
	Q10th (1)	Q50th (2)	Q90th (3)	Mean (4)	Q10th (5)	Q50th (6)	Q90th (7)	Mean (8)	Q10th (9)	Q50th (10)	Q90th (11)	Mean (12)
<b>Estimated total gap</b>	0.00	0.32**	-0.13	0.40***	-0.43***	-0.29***	-0.43***	-0.42***	-23.04***	-16.65***	-8.97***	-16.97***
<b>Characteristic part</b>												
Child	-0.02 N/A	-0.03 [-9]	-0.03 [23]	-0.03 [-8]	0.00 [0]	0.00 [0]	-0.00 [0]	0.00 [0]	-0.62 [3]	0.17 [-1]	0.60 [-7]	0.16 [-1]
Household	-0.03*** N/A	-0.03*** [-9]	-0.01 [8]	-0.02*** [-5]	-0.01 [2]	-0.01 [3]	0.01 [-2]	-0.00 [0]	-0.26 [1]	-0.21* [1]	-0.09 [1]	-0.18* [1]
Others	-0.00 N/A	0.02 [6]	-0.02 [15]	0.01 [3]	-0.01 [2]	-0.01 [3]	-0.02 [5]	-0.01 [2]	0.00 [0]	-0.20 [1]	0.20 [-2]	-0.07 [0]
Initial	-0.09* N/A	-0.12* [-38]	-0.13* [100]	-0.12** [-30]	-0.16*** [37]	-0.14*** [48]	-0.25*** [58]	-0.18*** [43]	-11.10*** [48]	-10.76*** [65]	-9.14*** [102]	-10.38*** [61]
Time allocation	0.01 N/A	-0.04 [-13]	-0.13*** [100]	-0.05*** [-13]	-0.00 [0]	-0.01 [3]	-0.01 [2]	-0.02 [5]	1.09 [-5]	-1.33*** [8]	-2.04*** [23]	-0.61** [4]
Personal care	0.02** N/A	-0.03*** [-9]	-0.04*** [31]	-0.02** [-5]	0.00 [0]	-0.02*** [7]	-0.01 [2]	-0.01*** [2]	-0.37 [2]	0.02 [0]	-0.12 [1]	-0.05 [0]
School	-0.00 N/A	-0.00 [0]	0.00 [0]	0.00 [0]	-0.00 [0]	0.00 [0]	0.00 [0]	0.00 [0]	-0.06 [0]	0.02 [0]	0.04 [0]	0.01 [0]
Education	-0.03** N/A	-0.06*** [-19]	-0.05*** [38]	-0.05*** [-13]	-0.00 [0]	-0.01** [3]	-0.01 [2]	-0.01** [2]	0.39 [-2]	-0.98*** [6]	-1.26*** [14]	-0.66*** [4]
Physical	0.02** N/A	0.00 [0]	-0.01 [8]	0.00 [0]	0.01 [-2]	0.01 [-3]	0.00 [0]	0.01** [-2]	-0.08 [0]	-0.15 [1]	-0.38** [4]	-0.18* [1]
Chores	0.00 N/A	0.01 [3]	-0.00 [0]	0.00 [0]	0.00 [0]	0.00 [0]	-0.00 [0]	0.00 [0]	-0.20 [1]	0.02 [0]	-0.09 [1]	0.01 [0]
Media	-0.01 N/A	0.04*** [13]	-0.03 [23]	0.01 [3]	-0.01 [2]	0.01 [-3]	-0.00 [0]	0.00 [0]	1.33* [-6]	-0.28 [2]	-0.23 [3]	0.23 [-1]
Travel	-0.00 N/A	0.00 [0]	0.00 [0]	0.00 [0]	0.00 [0]	-0.00 [0]	0.00 [0]	-0.00 [0]	0.08 [0]	0.02 [0]	0.01 [0]	0.02 [0]
Total	-0.13* N/A	-0.20*** [-63]	-0.31*** [238]	-0.22*** [-55]	-0.18*** [42]	-0.17*** [59]	-0.28*** [65]	-0.21*** [50]	-10.88*** [47]	-12.34*** [74]	-10.48*** [117]	-11.09*** [65]
<b>Return part</b>												
Total	0.14 N/A	0.51*** [159]	0.18 [-138]	0.62*** [155]	-0.25* [58]	-0.11* [38]	-0.15 [35]	-0.21*** [50]	-12.16*** [53]	-4.31** [26]	1.50 [-17]	-5.89*** [35]

Notes: Estimates from model (2) with lagged time allocation and previous test score as additional controls. Grouped variables: Child: age, Indigeneity, birth weight; Household: maternal migration status, maternal completed qualification, living with both parents, number of siblings; Others: local socio-economic background variables, NAPLAN test state and NAPLAN test year dummies; Time allocation: Lagged and current time allocation among various grouped activities; Initial: Lagged respective test score. Values in squared brackets are percentage of the estimated total gap. Percentages may not add up to 100 % due to rounding. N/A indicates “Not Applicable” because of division by zero. Standard errors (not reported for brevity) are obtained using 500 bootstrap replications. The symbol \*denotes significance at the 10% level, \*\*at the 5% level, and \*\*\*at the 1% level.

Appendix Table A5: Robustness - Decomposition of the gender gap in development using augmented valued added regression model  
(continued)

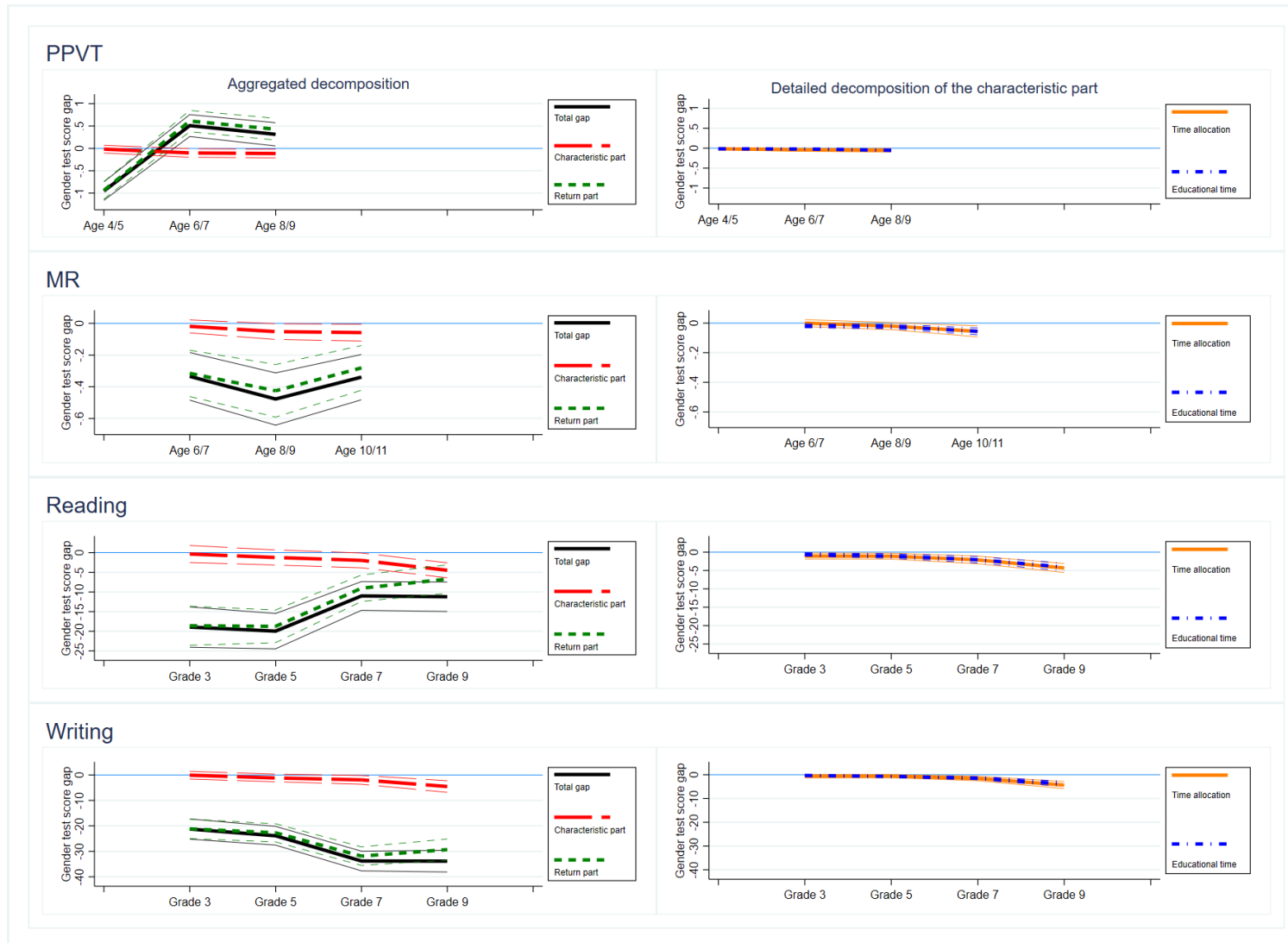
	Numeracy				Pro-sociality	Hyperactivity	Emotional problems	Conduct	Peer problem	Overall
	Q10th	Q50th	Q90th	Mean	Mean	Mean	Mean	Mean	Mean	Mean
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<b>Estimated total gap</b>	4.94	10.63***	19.66***	12.24***	-0.66***	-1.08***	0.25***	-0.28***	-0.25***	-0.41***
<b>Characteristic part</b>										
Child	-0.92 [-19]	0.04 [0]	0.65 [3]	-0.02 [0]	-0.00 [0]	0.00 [0]	-0.00 [0]	0.00 [0]	0.00 [0]	0.00 [0]
Household	-0.21 [-4]	-0.19 [-2]	0.19 [1]	-0.14 [-1]	-0.00** [0]	-0.00* [0]	-0.00 [0]	-0.00** [0]	-0.00* [0]	-0.00* [0]
Others	-0.13 [-3]	0.03 [0]	0.04 [0]	0.02 [0]	0.01 [-2]	-0.00 [0]	0.00 [0]	-0.00 [0]	-0.00 [0]	0.00 [0]
Initial	5.79*** [117]	7.76*** [73]	10.31*** [52]	7.85*** [64]	-0.36*** [55]	-0.70*** [65]	0.07*** [28]	-0.16*** [57]	-0.14*** [56]	-0.30*** [73]
Time allocation	0.26 [5]	-0.63 [-6]	-1.24 [-6]	-0.57** [-5]	-0.01*** [2]	-0.01 [1]	-0.01 [-4]	-0.01* [4]	0.01 [-4]	-0.00 [0]
Personal care	-0.78* [-16]	-0.32 [-3]	0.42 [2]	-0.07 [-1]	0.01*** [-2]	0.01** [-1]	0.02*** [8]	0.00 [0]	0.01*** [-4]	0.01*** [-2]
School	-0.05 [-1]	-0.02 [0]	0.04 [0]	-0.01 [0]	0.00 [0]	0.00 [0]	0.00 [0]	0.00 [0]	0.00 [0]	0.00 [0]
Education	-0.02 [0]	-0.51*** [-5]	-0.90*** [-5]	-0.55*** [-4]	0.00 [0]	-0.00 [0]	0.00* [0]	-0.00** [0]	0.01*** [-4]	0.00 [0]
Physical	0.51* [10]	-0.03 [0]	-0.28 [-1]	0.07 [1]	0.00 [0]	-0.00 [0]	0.00 [0]	0.00 [0]	0.00*** [0]	0.00 [0]
Chores	-0.32* [-6]	-0.05 [0]	0.56** [3]	0.11 [1]	-0.00 [0]	0.00 [0]	-0.00 [0]	0.00** [0]	0.00*** [0]	0.00* [0]
Media	0.96 [19]	0.33 [3]	-1.10* [-6]	-0.13 [-1]	-0.02*** [3]	-0.01** [1]	-0.03*** [-12]	-0.01*** [4]	-0.02*** [8]	-0.01*** [2]
Travel	-0.03 [-1]	-0.03 [0]	0.02 [0]	0.01 [0]	0.00 [0]	0.00 [0]	0.00 [0]	0.00 [0]	0.00 [0]	0.00 [0]
Total	4.78*** [97]	7.01*** [66]	9.95*** [51]	7.13*** [58]	-0.37*** [56]	-0.71*** [66]	0.07*** [28]	-0.16*** [57]	-0.14*** [56]	-0.30*** [73]
<b>Return part</b>										
Total	0.16 [3]	3.61 [34]	9.72*** [49]	5.10*** [42]	-0.30*** [45]	-0.36*** [33]	0.18*** [72]	-0.12*** [43]	-0.11*** [44]	-0.11*** [27]

Appendix Table A6: Robustness - Decomposition of the gender gap in teacher reported non-cognitive skills

	Pro-sociality	Hyperactivity	Emotional problems	Conduct	Peer problem	Overall
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Estimated total gap</b>	-1.1542***	-1.5971***	0.0511***	-0.4814***	-0.2925***	-0.6943***
<b>Characteristic part</b>						
Child	-0.0036*	0.0030	0.0044***	-0.0086***	-0.0013	-0.0013
	[0]	[0]	[9]	[2]	[0]	[0]
Household	-0.0062***	-0.0085**	-0.0028*	-0.0034**	-0.0034**	-0.0048**
	[1]	[1]	[-5]	[1]	[1]	[1]
Others	0.0006	-0.0069**	-0.0039**	0.0010	-0.0019	-0.0024
	[0]	[0]	[-8]	[0]	[1]	[0]
Time allocation	-0.0145***	-0.0269***	-0.0018	-0.0068**	0.0079**	-0.0083***
	[1]	[2]	[-4]	[1]	[-3]	[1]
<i>Personal care</i>	0.0052**	0.0021	0.0046***	0.0031**	0.0067***	0.0043***
	[0]	[0]	[9]	[-1]	[-2]	[-1]
<i>School</i>	-0.0001	0.0005	0.0000	0.0003	-0.0001	0.0002
	[0]	[0]	[0]	[0]	[0]	[0]
<i>Education</i>	-0.0016	-0.0108***	-0.0012	-0.0035***	0.0015*	-0.0030***
	[0]	[1]	[-2]	[1]	[-1]	[0]
<i>Physical</i>	0.0085***	0.0050***	0.0048***	0.0018	0.0074***	0.0055***
	[-1]	[0]	[9]	[0]	[-3]	[-1]
<i>Chores</i>	-0.0026*	-0.0018	-0.0018*	0.0015	0.0021**	-0.0005
	[0]	[0]	[-4]	[0]	[-1]	[0]
<i>Media</i>	-0.0241***	-0.0223***	-0.0081***	-0.0102***	-0.0099***	-0.0149***
	[2]	[1]	[-16]	[2]	[3]	[2]
<i>Travel</i>	0.0002	0.0003	-0.0001	0.0002	0.0001	0.0001
	[0]	[0]	[0]	[0]	[0]	[0]
Total	-0.0237***	-0.0394***	-0.0040	-0.0179***	0.0013	-0.0169***
	[2]	[2]	[-8]	[4]	[0]	[2]
<b>Return part</b>						
Total	-1.1305***	-1.5578***	0.0552***	-0.4635***	-0.2938***	-0.6774***
	[98]	[98]	[108]	[96]	[100]	[98]

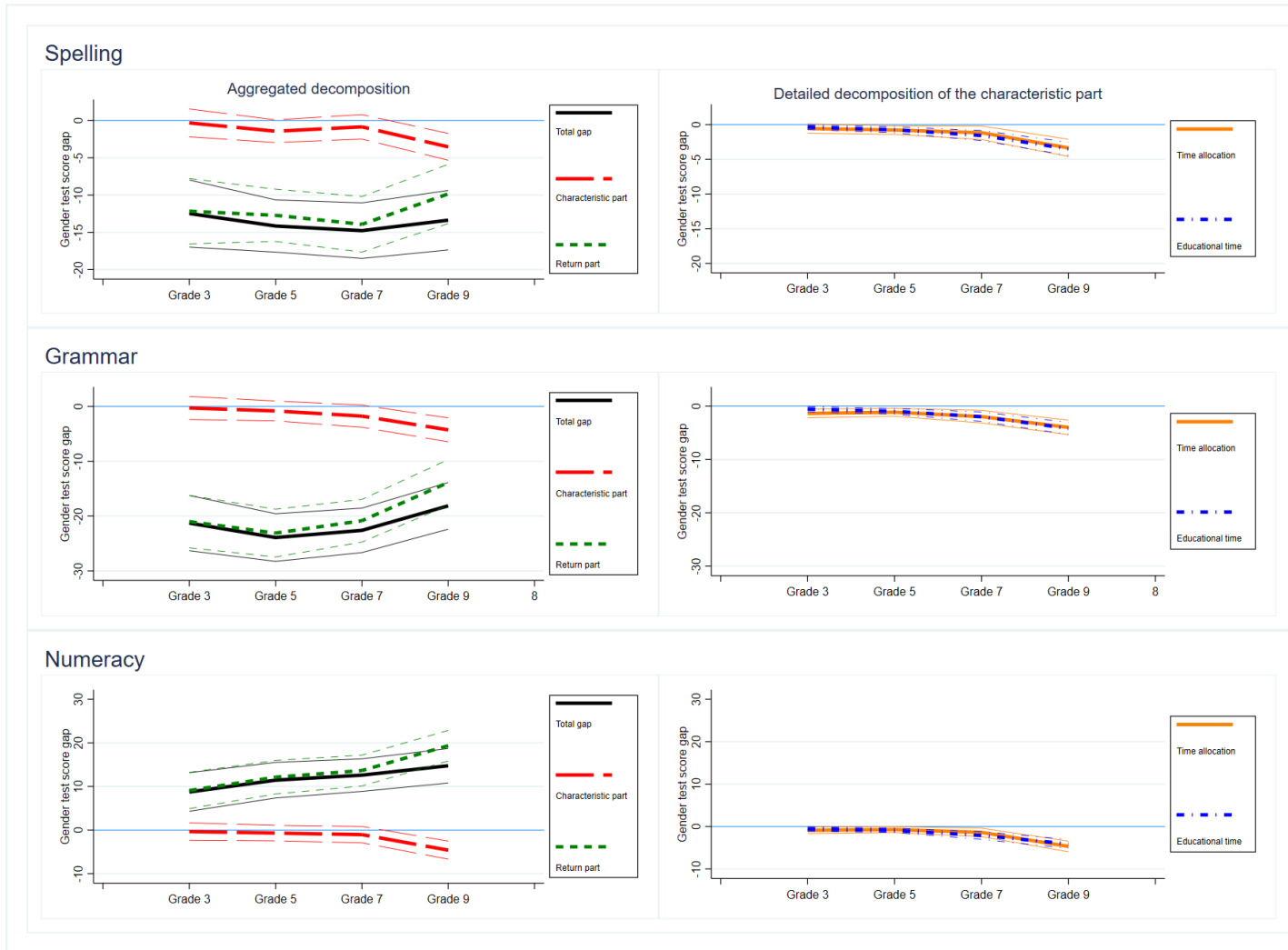
Notes: Estimates from model (2) are used. Grouped variables: Child: age, Indigeneity, birth weight; Household: maternal migration status, maternal completed qualification, living with both parents, number of siblings; Others: local socio-economic background variables, states, and survey quarter and year dummies; Time allocation: Current time allocation among various grouped activities. Values in squared brackets are percentage of the estimated total gap. Percentages may not add up to 100 % due to rounding. Standard errors (not reported for brevity) are obtained using 500 bootstrap replications. The symbol \*denotes significance at the 10% level, \*\*at the 5% level, and \*\*\*at the 1% level.

Appendix Figure A1: Decomposition results for cognitive skills by age groups or test grades



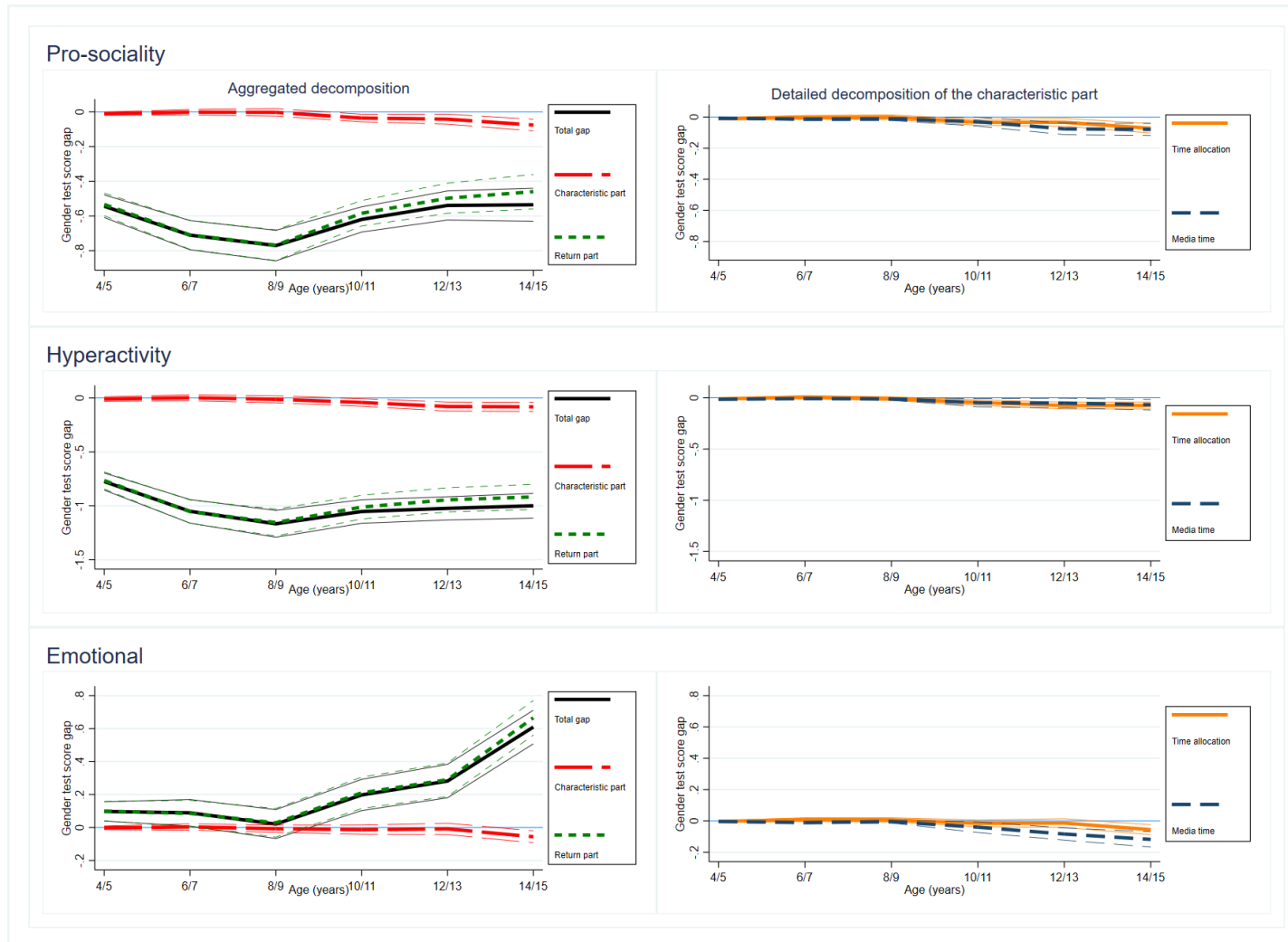
Notes: This figure reports decomposition of gender test score gaps. Estimates (95% CIs, which are obtained using 500 bootstrap replications) for each outcome and age group/test grade are from a separate regression model (2) and decomposition model (3). Other notes: See Table 2 and Table 3.

Appendix Figure A1: Decomposition results for cognitive skills by age groups or test grades (continued)



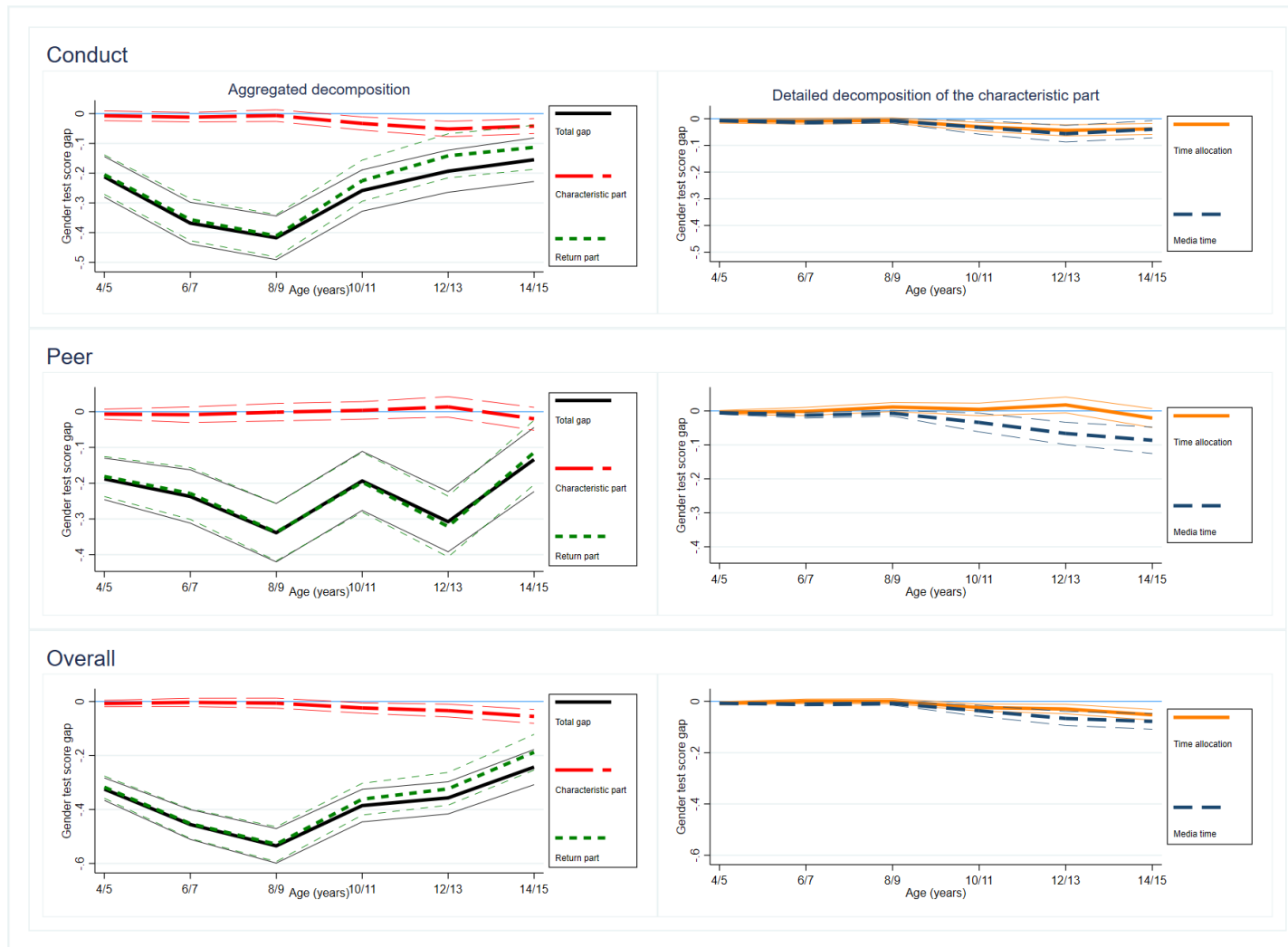
Notes: This figure reports decomposition of gender test score gaps. Estimates (95% CIs, which are obtained using 500 bootstrap replications) for each outcome and age group/test grade are from a separate regression model (2) and decomposition model (3). Other notes: See Table 2 and Table 3.

Appendix Figure A2: Decomposition results for non-cognitive skills by age groups



Notes: This figure reports decomposition of gender test score gaps. Estimates (95% CIs, which are obtained using 500 bootstrap replications) for each outcome and age group/test grade are from a separate regression model (2) and decomposition model (3). Other notes: See Table 4.

Appendix Figure A2: Decomposition results for non-cognitive skills by age groups (continued)



Notes: This figure reports decomposition of gender test score gaps. Estimates (95% CIs, which are obtained using 500 bootstrap replications) for each outcome and age group/test grade are from a separate regression model (2) and decomposition model (3). Other notes: See Table 4.

Appendix Table B1: Coding rules for activities by B cohort children

Grouping	Wave 1	Wave 2	Wave 3	Waves 6, 7 and 8
Sleep	Sleeping, napping	Sleeping, napping	Sleeping, napping	Sleeping/napping (not end of the day bed-time); Time between sleep (from response to the question "what time did you go to sleep?") and wake-up (next day, from response to the question "What time did you wake up?")
Personal care	Awake in bed / cot; Looking around, doing nothing; Bathe / nappy change, dress / hair care; Breastfeeding; Other eating, drinking, being fed; Crying, upset; Destroy things, create mess; Held, cuddled, comforted, soothed; Not sure what child was doing	Awake in bed; Eating, drinking, being fed; Bathing, dressing, hair care, health care; Doing nothing, bored/restless; Crying, upset, tantrum; Arguing, fighting; Destroy things, create mess; Being reprimanded; Being held, cuddled, comforted, soothed; Quiet free play; Not sure what child was doing;	Awake in bed; Eating, drinking, being fed; Bathing, dressing, hair care, health care; Doing nothing, bored/restless; Crying, upset, tantrum; Arguing, fighting; destroying things, creating mess; Being reprimanded; Being held, comforted, soothed; Quiet free play; Not sure what child was doing	Eating/drinking; Cleaning teeth; Showering/bathing; Getting dressed / getting ready; Personal care nec.; Doctor; Dentist/Orthodontist; Physiotherapist / Chiropractor; Medical/Health care; Personal care/Medical/Health Care nec.; Listening to music; Playing musical instruments or singing for leisure; Chess, card, paper and board games / crosswords; Games of chance / gambling; Hobbies, collections; Handwork crafts (excl. clothes making); Arts; Unstructured non-active play nec; Clubs; Religious groups; Doing nothing; Non-active activities nec.; Talking face-to-face; Talking on a landline phone; Non-verbal interaction; Negative face-to-face communication; Communication nec.; Illegal activities; Filling out the diary; Other; Uncodeable activity
School	Responses "Day care centre / playgroup" to the question "where was the child?"	Responses "Day care centre / playgroup" to the question "where was the child?"	Responses "Day care centre / playgroup" to the question "where was the child?"	School lessons, excluding Recess and Lunch



Grouping	Wave 1	Wave 2	Wave 3	Waves 6, 7 and 8
Education	Read a story, talked / sung to, sing / talk; Colour / draw, look at book, puzzles; Organised activities / playgroup	Read a story, told a story, sung to; Colour/draw, look at book, educational game; Organised lessons/activities	Read a story, talk/sing, talked/sung to; drawing/colouring, looking at book, etc.; organised lessons/activity	Private music lessons/practice, academic tutoring; Reading or being read to for leisure; Doing homework (not via electronic devices); Doing homework (electronic device); Attend courses (excluding school /university)
Physical	Crawl, climb, swing arms or legs; Other play, other activities; Visiting people, special event, party	Active free play; Visiting people, special event, party; Walking; Ride bicycle/trike	Active free play; visiting people, special event, outing; walking; travel in pusher/bicycle seat; ride bicycle, trike, etc.	Archery / Shooting sports; Athletics / Gymnastics; Fitness / Gym / Exercise; Ball Sports; Martial arts / Dancing; Motor Sports / Roller Sports / Cycling; Water/Ice/Snow Sports; Organised team sports and training other; Archery / Shooting sports (individual); Athletics / Gymnastics (individual); Fitness / Gym / Exercise (individual); Martial arts / Dancing (individual); Motor Sports / Roller Sports / Cycling (individual); Ball Sports (individual); Water/Ice/Snow Sports (individual); Organised individual sport and training other; Archery / Shooting sports (unstructured); Athletics / Gymnastics (unstructured); Fitness / Gym / Exercise (unstructured); Ball Sports (unstructured); Martial arts / Dancing (unstructured); Motor Sports / Roller Sports / Cycling (unstructured); Water/Ice/Snow Sports (unstructured); Unstructured active play Other; Walking pets/playing with pets; Active club activities; Shopping; Shopping; Purchasing consumer goods; Purchasing durable goods; Window shopping; Purchasing repair services; Purchasing administrative services; Purchasing personal care services; Purchasing other services; Attendance at movies / cinema; Attendance at concert/theatre; Attendance at museum / exhibition / art gallery; Attendance at zoo / animal park / botanic garden; Attendance at other mass events; Going out nec; Religious practice; Weddings, funerals, rites of passage; Religious activities / ritual ceremonies nec; Attending live sporting events; Active activities nec
Chores		Being taught to do chores	Being taught to do chores	Retailing; Hospitality (including fast food); Clerical/office; Labourers and related workers; Gardening / lawn mowing; Babysitting; Apprenticeships/trades persons; Working in a family business or farm; Work Other; Umpiring (work); Car washing (work); Animal care (work); Volunteering (work); Cleaning/tidying; Laundry/clothes care; Clothes making; Food/drink preparation; Food/drink clean up; Gardening (maintenance chores); Cleaning grounds/garage/shed/outside of house (chores); Pool care (chores); Animal care; Home maintenance; Design/Home Improvement; Heat/water/power upkeep; Car/boat/bike care; Selling/disposing of household assets; Rubbish/Recycling; Packing; Household management Other; Taking care of siblings (chores); Chores nec
Media	Watching TV, video or DVD; Listening to tapes, CD's, radio, music	Watching TV, video, DVD, movie; Listening to tapes, CDs, radio, music; Using computer, computer game	Watching TV, video, DVD, movie; listening to tapes, CDs, radio, music; using computer, computer game	Playing games (electronic device); Playing games (Electronic device) nfd; Watching TV programs or movies/videos; Spending time on social networking sites; Downloading/posting media; Internet shopping; General Internet browsing; Creating/maintaining websites; General application use; Electronic device use nec.; Talking on a mobile phone; Video chatting; Texting/emailing; Online chatting / Instant messaging

Grouping	Wave 1	Wave 2	Wave 3	Waves 6, 7 and 8
Travel	Taken places with adult (e.g. shopping); Taken out in pram or bicycle seat; Travel in car / other household vehicle; Travel on public transport, ferry, plane	Travel in car; Travel in a pusher/bicycle seat; Travel on public transport; Taken places with adult (e.g. Shopping)	Travel in car; travel on public transport; taken places with adult	Travel by foot; by bike, scooter, skateboard etc.; by private motor vehicle/bike; by public/chartered transport; Travel nec.

Appendix Table B2: Coding rules for activities by K cohort children

Grouping	Wave 1	Waves 2 and 3	Wave 4	Wave 5	Wave 6
Sleep	Sleeping, napping	Sleeping, napping	Sleeping/napping; Time between sleep (from response to the question "what time did you go to sleep?") and wake-up (next day, from response to the question "What time did you wake up?")	Sleeping/napping (not end of the day bed-time); Time between sleep (from response to the question "what time did you go to sleep?") and wake-up (next day, from response to the question "What time did you wake up?")	Sleeping/napping (not end of the day bed-time); Time between sleep (from response to the question "what time did you go to sleep?") and wake-up (next day, from response to the question "What time did you wake up?")
Personal care	Awake in bed; Eating and drinking; Bathe, dress, hair care, health care; Do nothing, bored/restless; Crying, upset, tantrum; Arguing, fighting, destroy things; Held, cuddled, comforted, soothed; Being reprimanded, corrected; Not sure what child was doing	Awake in bed; Eating and drinking; Bathe, dress, hair care, health care; Do nothing, bored/restless; Crying, upset, tantrum; Arguing, fighting, destroy things; Held, cuddled, comforted, soothed; Being reprimanded, corrected; Quiet free play; Not sure what child was doing	Eating/drinking; Bathing, dressing, toileting, teeth brushing, hair care; Dentist, Doctor, Chiropractor, Physio, Optometrist; Listening to music, CDs, playing music; Board or card games, puzzles, toys, art; Non-Active Club Activities i.e. Chess C; Doing nothing; Talking face to face; Other	Eating/drinking; Cleaning teeth; Showering/bathing; Getting dressed / getting ready; Personal care nec.; Doctor; Dentist; Physiotherapist / Chiropractor; Medical/Health care nec.; Listening to music, playing musical instruments or singing for leisure; Unstructured non-active play; Non-active club activities; Doing nothing; Non-active activities nec.; Talking face-to-face (in person not via electronic devices); Non-verbal interaction (e.g. cuddles); Negative face-to-face communication; Communication nec.; Filling out the diary; Other	Eating/drinking; Cleaning teeth; Showering/bathing; Getting dressed / getting ready; Personal care nec; Doctor; Dentist/Orthodontist; Physiotherapist / Chiropractor; Medical/Health care; Personal care/Medical/Health Care nec.; Listening to music; Playing musical instruments or singing for leisure; Chess, card, paper and board games / crosswords; Games of chance / gambling; Hobbies, collections; Handwork crafts (excl. clothes making); Arts; Unstructured non-active play nec; Clubs; Religious groups; Doing nothing; Non-active activities nec; Talking face-to-face; Talking on a landline phone; Non-verbal interaction; Negative face-to-face communication; Communication nec; Illegal activities; Filling out the diary; Other; Uncodeable activity
School	Responses "Day care centre / playgroup" to the question "where was the child?"	Responses "School, after/; before school; care" to the question "where was the child?"	School Lessons, excluding Recess and Lunch	School Lessons, excluding Recess and Lunch	School Lessons, excluding Recess and Lunch

Grouping	Wave 1	Waves 2 and 3	Wave 4	Wave 5	Wave 6
Education	Read a story, talk/sing, talked/sung to; colour, look at book, educational game; being taught to do chores, read, etc.; organised lessons / activities	Use computer/computer games (if this activity done for or as part of homework); Read a story, talk/sing, talked/sung to; Reading looking at book by self; Other organised lessons / activities	Private music, language, religion lessons, tutoring; Reading or being read to for leisure; Homework (not on computer) including music practice; Computer for homework - internet; Computer for homework - not internet	Private music lessons/practice, academic tutoring; Reading or being read to for leisure; Doing homework (not via electronic devices); Doing homework	Private music lessons/practice, academic tutoring; Reading or being read to for leisure; Doing homework (not via electronic devices); Doing homework (electronic device); Attend courses (excluding school /university)
Physical	Walk for travel or for fun; ride bicycle, trike etc. (travel or fun); other exercise - swim / dance/ run about; visiting people, special event, party; other play, other activities	Walk for travel or for fun; Ride bicycle, trike etc. (travel for fun); Visiting people, special event, party; Organised sport/physical activity; Other organised lessons / activities	Organised team sports and training i.e.; Organised individual sport i.e. swimming; Ball games, riding a bike, scooter, ska; Taking Pet for a walk; Scouts, girl guides, etc.; Shopping; Going out to museums, cultural events,; Cinema; Live Sporting Events	Organised team sports and training; Organised individual sport and training; Unstructured active play; Walking pets / playing with pets; Active club activities; Shopping; Going out to a concert, play, museum, art gallery, community or school event , an amusement park etc.; Religious activities / ritual ceremonies; Attending live sporting events; Active activities nec.	Archery / Shooting sports; Athletics / Gymnastics; Fitness / Gym / Exercise; Ball Sports; Martial arts / Dancing; Motor Sports / Roller Sports / Cycling; Water/Ice/Snow Sports; Organised team sports and training other; Archery / Shooting sports (individual); Athletics / Gymnastics (individual); Fitness / Gym / Exercise (individual); Martial arts / Dancing (individual); Motor Sports / Roller Sports / Cycling (individual); Ball Sports (individual); Water/Ice/Snow Sports (individual); Organised individual sport and training other; Archery / Shooting sports (unstructured); Athletics / Gymnastics (unstructured); Fitness / Gym / Exercise (unstructured); Ball Sports (unstructured); Martial arts / Dancing (unstructured); Motor Sports / Roller Sports / Cycling (unstructured); Water/Ice/Snow Sports (unstructured); Unstructured active play Other; Walking pets/playing with pets; Active club activities; Shopping; Purchasing consumer goods; Purchasing durable goods; Window shopping; Purchasing repair services; Purchasing administrative services; Purchasing personal care services; Purchasing other services; Attendance at movies / cinema; Attendance at concert/theatre;

Grouping	Wave 1	Waves 2 and 3	Wave 4	Wave 5	Wave 6
Chores		Helping with chores/jobs	Making own bed, tidying own room; Making, preparing own food; Getting self ready, packing own school; Cleaning, tidying other rooms; Cooking, meal preparation, making lunch; Washing dishes, stacking and emptying d; Gardening, putting out the bin; Taking care of siblings, other children; Taking care of pets (excluding Walking pets)	Retailing (including fast food); Pamphlet delivering; Umpiring/refereeing; Car washing; Gardening / lawn mowing; Babysitting; Animal care; Working in a family business or farm; Work nec.; Volunteering; Cleaning/tidying; Laundry/clothes care; Food/drink preparation; Food/drink clean up; Gardening / lawn mowing; Animal care (excluding active play); Home maintenance; Taking care of siblings; Chores nec	Attendance at museum / exhibition / art gallery; Attendance at zoo / animal park / botanic garden; Attendance at other mass events; Going out nec; Religious practice; Weddings, funerals, rites of passage; Religious activities / ritual ceremonies nec; Attending live sporting events; Active activities nec. Retailing; Hospitality (including fast food); Clerical/office; Labourers and related workers; Gardening / lawn mowing; Babysitting; Apprenticeships/trades persons; Working in a family business or farm; Work Other; Umpiring (work); Car washing (work); Animal care (work); Volunteering (work); Cleaning/tidying; Laundry/clothes care; Clothes making; Food/drink preparation; Food/drink clean up; Gardening (maintenance chores); Cleaning grounds/garage/shed/outside of house (chores); Pool care (chores); Animal care; Home maintenance; Design/Home Improvement; Heat/water/power upkeep; Car/boat/bike care; Selling/disposing of household assets; Rubbish/Recycling; Packing; Household management Other; Taking care of siblings (chores); Chores nec
Media	Watching TV, video, DVD, movie; Listening to tapes, CD's, radio, music; Use computer/computer games	Watching TV, video, DVD, movie; Listening to tapes, CD's, radio, music; Use computer/computer games (if this activity done NOT for or NOT as part of homework)	Electronic media, games, computer use; Computer games - internet; Computer games - not internet; Xbox, Playstation, Nintendo, WII etc.; Internet not covered elsewhere; TV/DVD; Talking on a landline phone; Talking on a mobile phone; Texting, email, social networking	Playing games; Watching TV programs or movies/videos; Spending time on social networking sites; Downloading/posting media (e.g. music, videos, applications); Internet shopping (excluding downloading/posting media); General Internet browsing (excluding homework); Creating/maintaining websites (excluding social networking profile); General application use (e.g. Microsoft Office; excluding homework); Electronic device use	Playing games (electronic device); Playing games (Electronic device) nfd.; Watching TV programs or movies/videos; Spending time on social networking sites; Downloading/posting media; Internet shopping; General Internet browsing; Creating/maintaining websites; General application use; Electronic device use nec; Talking on a mobile phone; Video chatting; Texting/emailing; Online chatting / Instant messaging

Grouping	Wave 1	Waves 2 and 3	Wave 4	Wave 5	Wave 6
Travel	Travel in pusher or on bicycle seat; travel in car / other household vehicle; travel on public transport, ferry, plane; taken places with adult (e.g. shopping)	Travel in car; Travel on public transport; Taken places with adult (e.g. Shopping)	- facebook/twitter; Skype or Webcam  Travel by foot; by bike, scooter, skateboard etc.; by private car; Travel by public transport such as bus	nec.; Talking on a landline phone (not video chat); Talking on a mobile phone (not video chat); Video chatting (e.g. Skype); Texting/emailing; Online chatting / Instant messaging  Travel by foot; by bike, scooter, skateboard etc.; by private motor vehicle/bike; by public/chartered transport such as bus, taxi or aeroplane; Travel nec.	Travel by foot; by bike, scooter, skateboard etc.; by private motor vehicle/bike; by public/chartered transport; Travel nec.