Parental Responses to Children's Achievement Test Results*

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We estimate the causal impact of providing parents with objective information about their children's academic achievement on their child investments. Identification comes from quasi-experimental variation in the timing of the release of national standardized test score reports. The release of these report leads to a 43 percent increase in private tutoring and a 22 percent reduction in extracurricular activities; it has no effect on other parental investments, including parenting style. The release of test reports also leads parents to have more modest perceptions of their child's school achievement. Using forecasted vs actual score comparisons, we show that the effect on parents' perceptions is driven by receiving unexpectedly "bad" child test performance news and is also stronger among children attending public schools. Our findings suggest that while test score information might help align parents' perception of their child's school achievement, these perceptions are not the key drivers of the effects of test score results on parental investments.

Keywords: Parental investments; test score information; parental perceptions; overconfidence
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1. Introduction

Parents are particularly consequential in shaping children's intellectual, emotional, and social development. Their decisions affect children's cognitive and noncognitive skill development by determining pre-school learning environments (e.g., Bono et al. 2016; Cunha & Heckman 2007; Delaney & Doyle 2012; Feinstein 2003; Heckman & Cunha 2010) and by reinforcing (or undermining) the educational investments children receive once they enter school (e.g., Bonesrønning 2004; Fredriksson et al. 2016; Gelber & Isen 2013; Pop-Eleches & Urquiola 2013).[1] The investment strategies that parents adopt depend not only on what they want for their children (i.e., their preferences) and the resources they have available to them (i.e., their constraints), but also on how well they understand their children's existing capabilities and the best options for extending them (Cunha 2015). Some parents have incorrect beliefs about their children's achievement and misallocate their investments as a result (Dizon-Ross 2019). Importantly, misinformation appears to be worse among more disadvantaged families, opening the door for heterogenous beliefs about children's achievement to help explain socio-economic disparities in human capital investments (Boneva & Rauh 2018; Dizon-Ross 2019). The provision of objective information on academic performance is a natural way to close any information gap; whether this also mitigates the disparity in child investments depends on how parents respond to the information they receive.

Our objective is to estimate the causal impact of objective information about children's academic achievement on the investments (i.e., time spent with children, books, tutoring, pocket money, extracurricular activities, and parenting style) that parents make in them. Identification comes from quasi-random variation in the timing of the release of national standardized test scores relative to interview dates in Growing Up in Australia: The Longitudinal Study of Australian Children (LSAC). The LSAC is a representative longitudinal study designed to provide an in-depth understanding of children's development. Importantly, LSAC data can be linked to standardized test scores from the National Assessment Program - Literacy and Numeracy (NAPLAN) which assesses all Australian students in grades 3, 5, 7, and 9 using a standardized test administered nationwide on the same dates. Once available, NAPLAN reports provide parents with objective information about their child's individual test results in several domains (e.g., literacy, numeracy, writing). Interviews occur in the same years

[1] If human capital is multidimensional, parents may simultaneously choose to compensate along some dimensions while reinforcing along others (Yi et al. 2015). Becker and Tomes (1976) note that parents' decisions to either compensate or reinforce any human capital disparities between children have the potential to undermine the public investment made in them.

as NAPLAN tests for most families in the LSAC, yet some parents are interviewed before they know their child's NAPLAN results (the control group) while others are interviewed afterwards (the treated group). We show that this treatment assignment is as good as random, providing us with quasi-experimental variation that can be used to identify the causal effect of test score information on parents' investment decisions using an event-study design.

We find that the release of NAPLAN results leads to a 44 percent increase in the use of private tutoring and a 22 percent reduction in the number of extracurricular activities (e.g., community groups, sports, religious activities) that children participate in. At the same time, NAPLAN results have no effect on the number of activities that parents and children do together; whether children have access to a lot of books at home or receive an allowance; nor do they affect parental monitoring and warmth. These results are confirmed in estimates that rely on children's time use data; parents' receipt of their child's NAPLAN report leads to children spending 21 minutes less in leisure time each week, which are mostly reallocated to educational activities.

Changes in parental investments can be understood in part through the way that NAPLAN reports alter parents' perceptions of their child's academic achievement. When asked directly, Australian parents are generally optimistic about their child's school achievement; only 5.1 percent of LSAC parents report that their child is either below or well below average, while fully 60 percent believe that their child is above or well above average. The receipt of NAPLAN results, however, leads parents to be more modest in their views of child's relative achievement. We also show that parents are overwhelmingly positive about their child's school and that receiving NAPLAN reports lowers their school satisfaction. Both these results are consistent with recent evidence of parents holding inaccurate beliefs about their child's school performance and their child's school quality, but then updating those beliefs in the face of new information (see Dizon-Ross 2019; Greaves et al. 2019).

The way that parents respond to their child's NAPLAN reports will likely depend on whether parents received good news, bad news, or no news regarding their children's test performance. To explore this, we begin by predicting each child's NAPLAN score using their prior NAPLAN score, parents' subjective reports of their child's achievement level and other predetermined characteristics. Based on their predicted NAPLAN scores (and the standard errors of the predictions) we then categorize each child's NAPLAN report as "good news", "bad news" or "no news" for their parents. We find that children's NAPLAN reports increase tutoring and decrease the time their children spend in extracurricular activities regardless of

whether the news is good or bad. Bad news alone, however, is at the heart of parents' increased pessimism about their child's achievement level. Together, these results suggest that while parental perception of their child's school achievement do react to the news embedded in NAPLAN report cards, changes in these perceptions are not linked to changes in tutoring and extracurricular activities. Instead, changes in these investments are likely the result of a priming effect from receiving the NAPLAN reports rather than the test score information included in them.

Finally, we explore the heterogeneity in parental responses to shed light on two key issues: i) the relative importance of information about the school and information about the child in NAPLAN reports; and ii) the differential responses depending on parental information at baseline. In the first exercise, we exploit the fact that in in some, but not all, jurisdictions, NAPLAN reports also include grade-level mean test scores at the school level. In these jurisdictions NAPLAN reports allow parents to learn not only about their child's academic achievement but also about the average NAPLAN performance in their child's school. We find evidence of stronger reductions in parental school satisfaction and larger increases in children's time spent in educational activities in states where school NAPLAN test performance in shown, yet interestingly we find no heterogeneous responses in other outcomes. This suggests that the school performance information in NAPLAN is not key for explaining our other results. In the second exercise, we estimate the heterogeneous effects of NAPLAN reports across public vs. private school sectors and in low- vs high-income families. We find that public-school parents have stronger responses to NAPLAN reports in terms of their perceptions of their child's achievement, suggesting that they may have less information about their children's achievement than do high-income and private-school parents. However, there is also little heterogeneity in the effects on other outcomes across private- vs public-school children. We also find no heterogeneity across income.

Our research represents an important extension of the existing literature on parental responses to new information. Previous researchers find that parents alter their child investments when they receive information about: i) school inputs (e.g., Das et al. 2013; Greaves et al. 2019); ii) the child development production function (Attanasio, Boneva, et al., 2019; Attanasio, Cunha, et al., 2019; Boneva & Rauh 2018; Carneiro et al. 2019); and iii) their child's achievement levels (Andrabi et al. 2017; Bergman 2021; Dizon-Ross 2019; Kinsler & Pavan 2016). Our results demonstrate the impact of providing parents in advanced economies with easily understandable information about children's academic achievement, extending

what is known in developing countries (Andrabi et al. 2017; Dizon-Ross 2019). The fact that the release of children's standardized test scores shifts parental investments and perceptions in our context—where parents have every oportunity to be well informed about their children's achivement—is remarkable and highlights the widespread improtance of information frictions even in advantaged settings with well developed educational institutions. Methodologically, our identification strategy mirrors that of Greaves et al. (2019) who use exogeneity in the timing of school inspection reports to estimate the causal impact of good news about school quality in reducing parental investments. One key difference is that we exploit information about both child and school test performance, and that we are able to link these information shocks to parents perceptions of their children's school achievement as well as their self-reported school satisfaction.

Our findings are particularly timely in light of the current debate about the value of standardized testing. Some stakeholders argue that tests have become "high stakes" leading to a distortion in schools' teaching and learning programs; others point to their role in making judgements about school and school system performance (Louden 2019). Notwithstanding this debate, Australia is among those countries making school-level test results public as part of a broader attempt to hold schools accountable for the educational outcomes their students achieve.[2] Our results show that parents do act on this information when making their decisions about how best to support their children's human development.

2. Data

2.1 The Longitudinal Survey of Australian Children (LSAC)

Our data come from the LSAC, a nationally representative study of Australian children and their families. The study is designed to provide detailed biennial information about the development of two cohorts of children. We restrict our analysis to the kindergarten or "K" cohort which sampled 4,983 children aged 4-5 years old in 2004, when the survey began (Soloff et al. 2005).[3]

[2] School-level student achievement data are available on publicly searchable website in many international jurisdictions. In some cases, public access is supported through legal requirements (United States) or government websites (Singapore, Canada), while in other cases access is restricted (Hong Kong) or has been discontinued (Wales, New Zealand). See Louden (2019) for a review.

[3] The LSAC birth or "B" cohort sampled 5,107 children aged 0-1 years old when the survey began. We do not use B cohort data in our analysis because those children do not begin to take NAPLAN tests until wave 5 of the LSAC.

Our data are extremely rich. They include linked information from i) detailed longitudinal interviews with children's parents, teachers, and later children themselves; ii) 24-hour time use diaries with extremely granular data on how children spend their time; and iii) linked standardized test scores from the National Assessment Program - Literacy and Numeracy (NAPLAN) for both children and in some cases the school they attend. The K cohort typically enters third grade in 2008 (LSAC wave 3) when they become old enough to take the NAPLAN for the first time. Our core analysis relies on waves 3 to 6 of the LSAC which coincide with all NAPLAN tests years through grades 3, 5, 7, and 9.

2.2 Educational Achievement: NAPLAN Test Scores

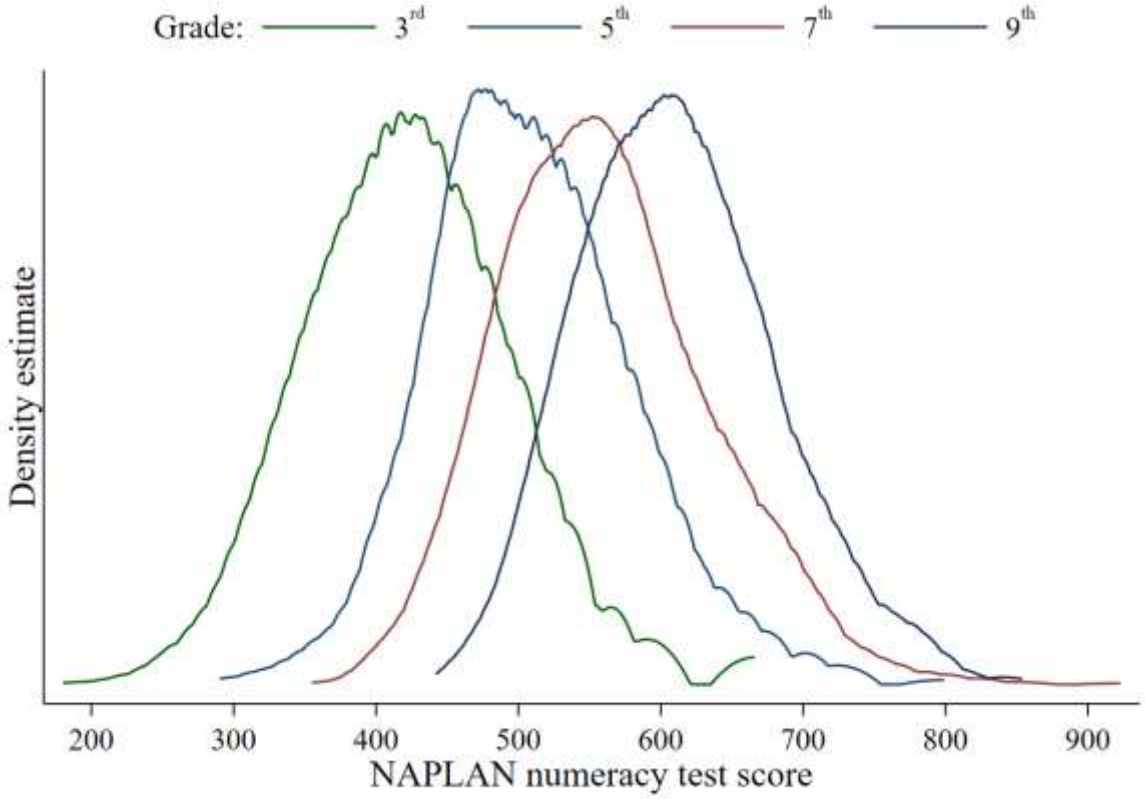
The NAPLAN is a national assessment designed to test essential skills. It was first introduced in 2008 and since then has been administered annually to all Australian students in grades 3, 5, 7 and 9. NAPLAN assesses skills in numeracy and in three areas of literacy (reading, writing, and language conventions) using a common test administered nationwide on the same dates.

NAPLAN test scores are designed to track student achievement levels and progress over time, and across cohorts, on a scale ranging from zero to 1,000.[4] Student achievement is benchmarked using a 10-band scale that spans across all grades; bands 1 through 6 are provided as benchmarks for grade 3 scores, bands 3 through 8 are provided for grade 5 scores, and so on. NAPLAN results are therefore very useful for monitoring the level of, and gain in, student achievement in each domain across cohorts and over time. Consequently, state and Commonwealth education departments, teachers, and parents use NAPLAN results to ensure academic standards are being met. The distribution of NAPLAN numeracy scores across different grade levels are shown in Figure 1. The within-grade variation and the natural grade progression in scores can be clearly seen in the figure.

All Australian students in the relevant grades take the NAPLAN test on the same three days in May each year. Once graded, individual NAPLAN reports with test results are then sent to schools for every student in August and September. Schools generally inform parents about the date they should expect the reports and then, when available, hand each child their NAPLAN report to take home to their parents.[5]

[4] For an in-depth description of the way NAPLAN assessment scales are constructed see Appendix A.
[5] The NAPLAN tests are centrally managed by The Australian Curriculum, Assessment and Reporting Authority (ACARA), an independent authority. ACARA works with individual test administration authorities in each state and territory to ensure that NAPLAN is administered in each jurisdiction in accordance with national protocols.

Figure 1. Distribution of NAPLAN Numeracy Test Scores Across Grades in the LSAC



NAPLAN reports present children's test results in an intuitive way with guidance on how to interpret the information in the report.[6] Each student's test performance is shown for four assessment components: Reading, Persuasive Writing, Language Conventions (with Spelling and Grammar & Punctuation subcomponents), and Numeracy. Performance in each domain is shown using diagrams for the portion of the assessment scale that is relevant for each student's current grade level (e.g., in grade 5 diagrams only show assessment bands 3 through 8). In each diagram indicators show the student score, the national average, and the 20th – 80th percentile score range. In the states of Queensland, Western Australia and South Australia, the report also shows the average result in across the child's school for each assessment component; in other states and territories information about school-level test results can be obtained online in the first quarter of the year following the test.[7]

This way, consistency across Australia is achieved, in each stage of the NAPLAN, from testing through to the provision of results (ACARA 2020).

[6] The achievement scale that parents would see for a student in grade 3 is shown in Appendix Figure A1.

[7] This information can be obtained through the *My School* website, which has been publishing school-level test data, including average test results, for every school in Australia since 2010. The website also allows parents to track the progress of their child's school cohort over time, benchmarked against all other Australian students in the same age cohort, and against students in the same age cohort and of a similar background—a measure that takes into account parental education and occupation, geographic location and Indigenous status.

2.3 Parental Investments and Controls

The LSAC allows us to construct several measures of parental investments, including the style of parenting itself, which economists now consider as a key input in home production models of child development (e.g., Cobb-Clark et al. 2019; Cunha 2015; Doepke & Zilibotti 2017). We broadly categorize our measures of parental investments as investments in time, money, and parenting style, using LSAC's detailed information about parent-child interactions to construct several measures in each category.[8]

Our three measures of parents' time investments combine: i) the total time parents spend with each child in a day (derived from time use diary data), ii) seven items capturing common parent-child activities at home, such as reading to the child or playing music together (measured in number of days in the previous week when each activity was done); and iii) four items capturing activities outside of the home, such as going to a swimming pool or library (measured in number of days in the previous month when this each activity was done). We construct the cumulative daily time each child spends with either parent, as well as summary measures of the cumulative time spent in at-home and out-of-home activities (measured as activity-days) separately. On average, parents spend 211 minutes per day with their children, and spend 9.11 activity-days per week doing in at-home activities and 1.64 activity-days per month in out-of-home activities with them.

In addition, time use diary data are used to construct measures of the way children allocate their time across various activities. These time-use measures are particularly interesting since the activities that children participate in may be directly influenced by parents. The LSAC includes 24-hour time use diaries that are filled out by each study child, describing how they spent their time on weekdays and weekends. Each child is asked to record their daily activities as well as the start and end times for each activity, from the moment they wake up in the morning to the moment they go to bed at night. In each wave, the list of activities that children can choose from includes: eating, doing chores, doing homework, listening to music, playing sports, etc. We aggregate these activities into four distinct categories: i) educational-related; ii) leisure; iii) sleep and personal care; and iv) other.[9] We then construct a measure of the cumulative daily time spent on all activities within each category. On average, children

[8] Details about the construction of each outcome and control measure are provided in Appendix Table B1 and B2, with summary statistics reported in Appendix Table B3.
[9] Appendix Table B2 describes the categorization of the activities in our studied waves.

spend 229 minutes per day on educational activities, 321 minutes on leisure activities, 642 minutes on sleeping and personal care, and 219 minutes on other activities in a typical day.

We characterize parents' financial investments in their children using four separate measures of money-intensive investments: i) having more than 30 books at home; ii) having a private tutor; iii) providing a weekly allowance; and iv) the number of extracurricular activities (e.g. team sports or art classes)—most likely financed by parents—the child participates in. We analyze the first three indicators and the continuous measure of cumulative weekly extra-curricular activities separately. Fully, 74 percent of the children in our sample have more than 30 books in their home; 37 percent receive pocket money from their parents; 15 percent of take private tutoring lessons; and the average child participates in 1.42 extracurricular activity-days per week.

Finally, we consider two key dimensions of parenting style: i) warmth and ii) control.[10] Parental warmth is assessed using five items that measure whether parents display acceptance and affection towards their children. Each item is answered on a 5-point scale (from "never" to "almost always"). Parenting control combines six items (also ranked on a 5-point scale) assessing how much parents know about, and engage with, their child's friends, whereabouts, and life. Summative scales of both dimensions are left-skewed and right-censored. We consider high-warmth parents to be those who score 20 or more points across the five warmth items, and strict-monitoring parents as those who score 24 or more points across the six control items. Among the parents in our sample, 72 percent are characterized as being high warmth, while 75 percent are strict monitors of their children.

In our preferred specification, we also control for several characteristics of children and their families, as well as for weather. Missing values for these variables are imputed and we include additional dummies to account for observations with imputed missing values when necessary.

[10] Baumrind (1966) initially proposed a typology of three parenting styles—"permissive", "authoritarian" and "authoritative" —which are distinguished mainly in terms of the relative importance parents attach to control of versus freedom for their children. Today it is common for parenting style to be characterized by two underlying processes: i) the number of demands made by parents; and ii) the contingency of parental reinforcement. These are often referred to as demandingness (control) and responsiveness (warmth) (see Darling & Steinberg 1993; Spera 2005 for reviews).

2.4 Estimation Sample

Our estimation sample includes all children and parents in LSAC's K cohort for whom we have complete information in waves 3 through 6, with two important exceptions. First, we exclude children who do not take their NAPLAN test in the same year that the LSAC interviews are conducted—i.e., predominantly children who take the test one year ahead or one year behind of their expected grade. Second, we exclude children whose parents are interviewed for LSAC in September. Both restrictions improve our ability to assign children to our quasi-experimental "control" and "treatment" groups, as described in Section 3.2.

We report summary statistics for our key outcome and control variables in Appendix Table B3 separately for our estimation sample and for all NAPLAN test-takers in LSAC. The last column of Table B3 displays results from unpaired two-sample t-tests of mean differences between the two groups. We find some statistically significant differences between the two samples, but none of them are economically large, indicating that the sample restrictions we make do not affect the generalizability of our results to the LSAC population.

3. Empirical Strategy

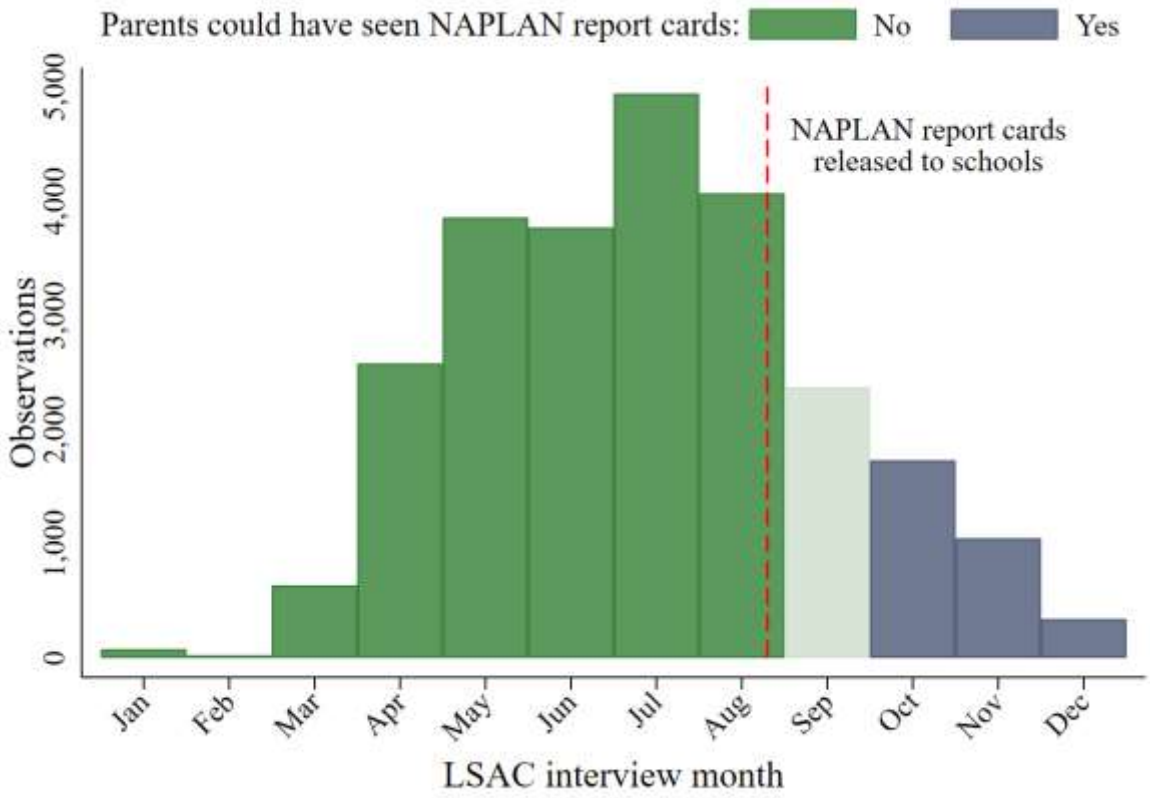
To estimate the causal effect of receiving information about children's academic achievement on parental investments and other outcomes, we use the exogenous timing in the release of NAPLAN reports relative to LSAC interview dates. Our research design exploits the fact that, while LSAC interviews are conducted throughout the year, NAPLAN results are released to schools in August and September by each state and territory's test administration authority. Schools subsequently send students' NAPLAN results to their parents. This implies that some parents are interviewed prior to the release of their child's NAPLAN results (the control group), while some are interviewed post-release (the treated group). In Section 3.3 we show that, conditional on a few key covariates, these two groups are as good as randomly assigned.

While we do not know exactly when parents receive NAPLAN results from their child's school, we do know that NAPLAN results only become available to schools in mid-August to September and there is likely some administrative delay as NAPLAN results are collated and analyzed by the teaching and administrative staff, and a process for giving students their individual reports to take home is established.[11] Consequently, we assume that schools do not

[11] See https://www.nap.edu.au/information/faqs/naplan--results-reports-performance for details.

work quickly enough to provide NAPLAN results to parents before the end of August. This implies that parents responding to LSAC in January through August have not yet received their child's NAPLAN results at the time of interview. Parents interviewed in October through December are assumed to have had access to their child's NAPLAN results before being interviewed. We drop all September interviews from our estimation sample since it is unclear whether those parents have received their child's NAPLAN reports. Our identifying variation is illustrated in Figure 2.

Figure 2. LSAC Interview Month Relative to NAPLAN Report Card Release Date



There is of course no guarantee that all students deliver their NAPLAN reports to their parents as intended. As we do not observe which parents receive a NAPLAN report and which do not, our results are best interpreted as intention-to-treat estimates.

3.1 Identification

Our quasi-experimental design results in causal estimates so long as two key identifying assumptions hole. The first is that the timing of LSAC interviews is unrelated to the date that individual schools release their students' NAPLAN reports to parents and to other determinants of parental investments. The sampling design of the LSAC gives us confidence that this is

likely to be the case. Sampling is not reliant on anything related to NAPLAN itself, and in fact, the sampling design was implemented years before NAPLAN existed.[12] In its field work, however, LSAC interviewers were likely to geographically cluster their face-to-face interviews, beginning in larger cities before moving towards more rural and remote areas. This is a cost-effective interviewing strategy that is, of course, unrelated to the dates that schools complete the in-school review of their overall NAPLAN results and release student reports to parents. At the same time, launching the interviewing process in urban areas may result in more advantaged families being interviewed earlier in the calendar year. We see some evidence of this in our data, and account for it flexibly using geographical region fixed effects.[13]

The second identifying assumption is that parental investments and other outcomes would not have evolved in a different way for pre- and post-September interviewed parents in the absence of NAPLAN reports. Long-run differences in parental investments will be accounted for by wave fixed effects, but pre- and post-September differences could still occur, for example, if the time that parents invest in their children doing outdoor activities (e.g., going to the park, playing sports) is markedly different towards the end of the calendar year. One important consideration here could therefore be the weather. In Australia, spring begins in September which means that the activities children engage in may systematically change in the later months of the year as the summer weather sets in. To account for this, we include monthly weather data at the state level (the average daily max temperature and number of rainy days in the interview month, and their 1-month lags) as controls in our specification.

With these controls in place, parents — within the same calendar year, within the same geographical region, and exposed to the same weather — interviewed in January through August act as our control group, while parents interviewed in October through December form our treatment group.

We investigate the empirical validity of our maintained identifying assumptions by running a series of balancing regressions to assess whether our treatment and control groups

[12] LSAC sampled children into their study in a stratified two-stage cluster design based on postcodes and then children within postcodes. For details on the LSAC sampling design and its implementation see Soloff et al. (2005).

[13] We define region at the Statistical Area Level 3 (SA3) level. This classification, defined in the Australian Statistical Geography Standard, divides Australia in 358 regions. The Australian Bureau of Statistics defines SA3 regions as areas that "[…] generally have a population of between 30,000 and 130,000 people [designed to] reflect regional identity. These are areas with both geographic and socio-economic similarities." See the Australian Statistical Geography Standard for further details (Australian Bureau of Statistics, 2016).

are similar in their pre-determined characteristics. Specifically, we estimate the following model:

$$Y_{iw} = \theta Post_{iw} + \gamma' Weather_{iw} + \delta_w + \delta_{Region} + \varepsilon_{iw} \quad (1)$$

where *i* indexes individuals, *w* indexes LSAC waves, and $Post_{iw}$ is our treatment indicator that takes the value 1 if parents are interviewed in the post-September period (October through December) and 0 if they are interviewed in January through August. In these balancing tests Y_{iw} are either i) pre-determined characteristics such as child gender or birthweight, or ii) pre-determined parental investment (i.e., parental investments in waves 1 and 2 when NAPLAN has yet to take place). We expect both to be unrelated to $Post_{iw}$. Additionally, $Weather_{iw}$ is a vector of weather controls, whereas δ_w and δ_{Region} capture unobserved time-invariant heterogeneity at the wave and region levels, which we account for via two-way fixed effects. We vary the controls included across specifications of our balancing regressions to illustrate their importance in isolating our identifying variation. Our interest is in $\hat{\theta}$ which captures the disparity in the pre-determined characteristics of parents interviewed pre- and post-September; small and insignificant disparities indicate that our treatment and control groups are balanced.

Balancing test results are reported in Table 1, with each cell in columns (2) – (5) corresponding to a $\hat{\theta}$ from a different version of equation (1). The first part of the table considers a range of pre-determined characteristics measured in waves 3 though 6 and finds significant differences between the treatment and control groups in only two characteristics: student age and household gross income. As expected, the disparity in household income across treatment and control groups disappears once we include region fixed effects that account for the spatial clustering affecting the timing of the LSAC fieldwork. Student age remains unbalanced even after including wave and region fixed effects. On average, children whose parents are interviewed post-September are 3 months older than children whose parents are interviewed earlier. This is purely mechanical, however: post-September interview children are older simply by virtue of the fact they are interviewed later in the calendar year. We will nevertheless account for these small age-at-interview differences by adding fixed effects for age in months to our preferred specification. A standard F-test fails to reject the null of no mean differences in our six pre-determined characteristics once we exclude child age (p-value = 0.572).

In the second part of Table 1, we consider whether there are any significant differences in the investments that treated and control parents make in waves 1 and 2, before children begin taking the NAPLAN. We also test for pre-NAPLAN differences in parents' perceptions of their

child's school achievement relative to their school peers, and on parents' satisfaction with their child's school, both measured on 5-point scales. We explore these as additional outcomes in Section 4.2. Although there are some differences in pre-NAPLAN parental investments, perceptions, or school satisfaction (see Table 1), once we control for wave and region fixed effects an F-test also fails to reject the null of no mean differences across these six pre-NAPLAN measures (p-value = 0.588).

Table 1. Balancing Regressions of Having a post-September LSAC Interview on Pre-determined Characteristics and Placebo Outcomes

	Mean	**Effect of post-September LSAC interview:**			
Pre-determined characteristics:					
Waves 3-6					
Child's age (months)	138	12.275***	4.520***	0.002	3.041***
		(1.079)	(0.163)	(1.338)	(0.161)
Female child	0.49	0.021	0.021	-0.016	-0.011
		(0.028)	(0.028)	(0.026)	(0.027)
Child birth weight (kilograms)	3.42	-0.047	-0.049	0.011	0.011
		(0.031)	(0.031)	(0.029)	(0.030)
2 biological parents in household	0.84	0.067	0.051	-0.104	-0.109
		(0.112)	(0.110)	(0.163)	(0.177)
Household gross income (AUD/week)	2,168	-241.184***	-314.610***	-81.100	-79.123
		(85.451)	(86.208)	(87.634)	(88.443)
University-educated parent(s)	0.46	-0.034	-0.043	-0.030	-0.030
		(0.027)	(0.028)	(0.024)	(0.025)
Migrant parent(s)	0.32	0.228	0.225	-0.016	-0.024
		(0.146)	(0.149)	(0.169)	(0.180)
Placebo outcomes:					
Waves 1-2					
At-home activity days per week	15.97	-1.817***	-0.477	-2.139***	-0.154
		(0.319)	(0.315)	(0.363)	(0.361)
Out-of-home activity days per month	2.29	-0.068	0.046	-0.131**	0.032
		(0.059)	(0.061)	(0.066)	(0.068)
30+ books at home	0.85	-0.036	-0.038*	-0.020	-0.019
		(0.022)	(0.022)	(0.023)	(0.024)
High warmth parent(s)	0.87	-0.037*	-0.024	-0.044*	-0.026
		(0.021)	(0.022)	(0.023)	(0.024)
Parents' perceptions of achievement	3.86	0.084	0.084	-0.058	-0.058
		(0.062)	(0.062)	(0.099)	(0.099)
Parent's satisfaction with school	4.54	-0.026	0.010	-0.046	0.005
		(0.043)	(0.044)	(0.051)	(0.052)
Weather controls		✓	✓	✓	✓
Wave fixed effects			✓		✓
Region fixed effects				✓	✓

OLS coefficients estimated using Correia's (2018) reghdfe *Stata package. Each cell shows an estimate from a different regression. Cluster-robust standard errors at the child level in parentheses. ***, ** and * mark estimates statistically different from zero at the 90, 95 and 99 percent confidence level.*

Taken together, the administrative arrangements behind the release of NAPLAN reports, the timing of LSAC interviews, and the empirical results of our balancing tests provide strong evidence that our treatment assignment is as good as random, validating our quasi-experimental design.

3.2 Estimation Model

To estimate the causal effect of parents receiving their child's NAPLAN score information on their parental investments, we estimate the following empirical model:

$$Investment_{iw} = \beta Post_{iw} + \tilde{\gamma}' X_{iw} + \tilde{\delta}_w + \tilde{\delta}_{Region} + \tilde{\delta}_{Age} + \tilde{\varepsilon}_{iw} \quad (2)$$

where $Investment_{iw}$ are the investments made by parent i in wave w and, in addition to the region and wave fixed effects discussed above, we account for child age differences $\tilde{\delta}_{Age}$ with fixed effects for child age in months. This ensures that our results are not confounded by differences in the age at which children are tested.[14] In addition to $Weather_{iw}$, the term X_{iw} includes several characteristics of children (birth weight, gender, and age in months) and their families (household gross income, number of children, two biological parents in the household, foreign-born parents, parents' language of birth is not English, and at least one parent has university education). While not central for our identification strategy, these additional controls increase the precision of our estimates. Our interest is in $\hat{\beta}$ which we interpret throughout as the casual effect of releasing NAPLAN test score reports to parents.

4. Parental Responses to Children's Achievement Test Scores

4.1 Parental Investments and children's time use

Parents respond to information about their child's academic achievement—conveyed in the NAPLAN test reports—by changing their investment choices. They increase the use of private tutoring and decrease the number of extracurricular activities that children engage in each week (see Table 2). Both responses are economically important. The chances of having a private tutor increase by 6.4 percentage points (43 percent) relative to an unconditional mean likelihood of having a private tutor of 15 percent. The drop in extracurricular activities is 0.321

[14] Prior to 2017, for example, the Queensland educational system did not have a compulsory preparatory school year (i.e., Kindergarten); students starting their formal schooling directly entered first grade. This results in Queensland students being one year younger on average—and at a different stage of development—when they take the NAPLAN test than the rest of Australian children. Most of these differences would be accounted for by region fixed effects, since regions are nested within states, yet the additional age in months fixed effects accounts for any differential developmental age trends within state non-parametrically.

activity days per week, which amounts to 22 percent of the unconditional mean of 1.43 activity days per week. Importantly, we can strongly reject the null hypothesis that our treatment has no joint effect on monetary investments overall (p-value < 0.001).

Table 2. The Effect of Releasing NAPLAN Report Cards on Parental Investments and Children's Time Use

	Effect of Post-September LSAC interview	Mean	Children	Obs.
Time investments:				
Hours per day with parents	-0.198	3.25	2,596	5,459
	(0.180)			
At-home activities per week	-0.445	9.20	2,592	4,240
	(0.354)			
Out-of-home activities per month	0.040	1.64	2,853	8,449
	(0.062)			
Monetary investments:				
30+ books at home	-0.016	0.74	2,592	4,243
	(0.032)			
Has private tutor	0.064***	0.15	2,667	5,901
	(0.023)			
Has allowance	-0.037	0.37	2,679	5,980
	(0.032)			
Extracurr. activities per week	-0.321***	1.43	2,352	3,740
	(0.099)			
Parenting style:				
High warmth	0.012	0.72	2,800	8,028
	(0.028)			
Strict monitoring	-0.012	0.75	2,836	8,303
	(0.025)			
Minutes per day of child time in:			2,596	5,459
Educational activities	13.328	283		
	(12.669)			
Leisure	-21.114*	304		
	(12.558)			
Sleeping & personal care	6.415	638		
	(5.885)			
Other activities	2.797	216		
	(7.479)			

OLS coefficients estimated using Correia's (2018) reghdfe *Stata package. Each row corresponds to a different outcome. All regressions include fixed effects for survey wave, region and age in months, and controls for weather, child and family characteristics. Child time use observations are weighted by 5/7 if taken on a weekday and by 2/7 if taken on a weekend day. Cluster-robust standard errors at the child level in parentheses. ***, ** and * mark estimates statistically different from zero at the 90, 95 and 99 percent confidence level.*

At the same time, we find little evidence that either parental time investments or parenting style are affected by the release of test score results. Although we do reject the null hypothesis that there is no joint effect on all three time investments (p-value = 0.041), we find

no statistically significant effect of the release of NAPLAN results on any single time investment measure. There is also no evidence that the release of test reports affects parenting style overall (p-value = 0.775).[15]

One interpretation of these results is that parents change their investment choices in the hopes of motivating children to put more time and effort into learning. Previous studies have adopted a similar perspective, modelling parents' investments through the lens of the incentives they provide to children (e.g., Laferrère & Wolff 2006; Doepke et al. 2019). Our results are consistent with Weinberg (2001) who models parents' use of financial investments to solve intra-household agency problems in children's provision of effort. Interestingly, our findings indicate that these parental responses are largely financial and do not involve other forms of parental investments.

At the same time, it is reasonable to expect that parents may also react to information about their children's academic achievement by restricting the way that children spend their own time (Becker 1965). Many of these reactions may be subtle and hard to capture in parental investment measures, but are likely to be revealed by looking at children's time use directly. To see this, consider that children generally have limited agency in the decisions affecting them, putting their time use squarely in the hands of their parents. Adolescent time use can also be curbed by parents, albeit with more complex incentives because they have greater agency in affecting family outcomes (Lundberg et al. 2009).[16] Examining children's time use can therefore be a fruitful way to explore the investments their parents make in them. Children's time use is also consequential for their cognitive and non-cognitive development (Fiorini & Keane 2014).

We explore the effects of the release of children's standardized test scores on their time use using the information provided by LSAC's 24-hour time use diaries.[17] This analysis is a major strength of our study. Few other studies have the advantage of such detailed information

[15] Note that the lack of evidence for parental responses in time investments or parenting style is not due to a lack of statistical power. Based on ex-post Minimum Detectable Effect (MDE) calculations with 95% confidence and 80% power we should be able to rule out effect sizes as small as 31 minutes a day of parent time spent with their child, less than one at-home activity day per week, or 7 percentage points in the probability of being a high-warmth parent. These are all relatively small effect sizes.

[16] See Kooreman (2007); Hao et al. (2008); and Lundberg et al. (2009) who model parents' interactions with their children using a non-cooperative game-theoretic approach. Some parent-child interactions can have unintended consequences on children's time use. Cosconati (2011), for example, provides evidence that parent-driven rather than child-driven curfews increases the study time of low-effort children but decreases the study time of high-effort children.

[17] See Mohal et al. (2020) for a detailed description of the time use diary data in the LSAC.

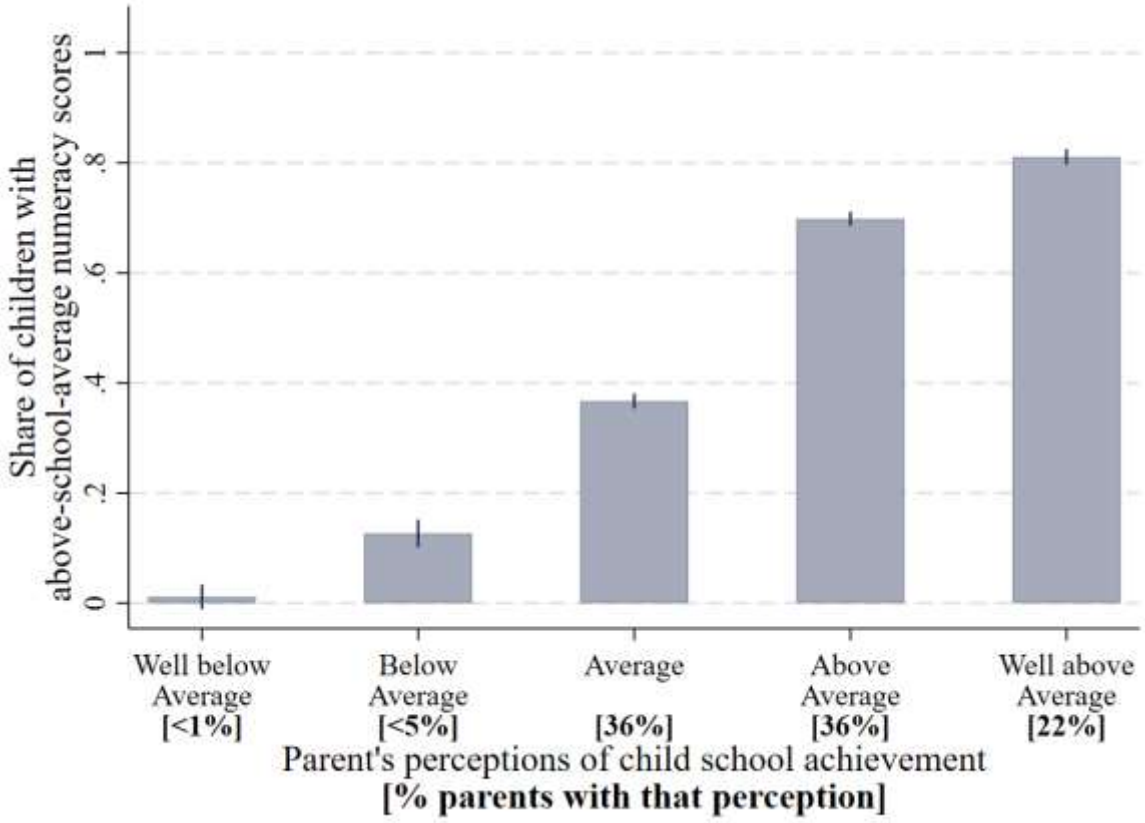
on the way children spend their time (Fiorini & Keane 2014). Given our research interests, out outcomes of interest are the cumulative time that children spend in four mutually exclusive types of activities: i) educational activities; ii) leisure; iii) sleeping and personal care; and iv) other activities. We then estimate the drivers of these outcomes using different specifications of the model in equation (2). Analytical weights of 5/7 and 2/7 are used to weight the weekday versus weekend observations. The total time spent across these four types of activities sums to 1440 minutes per day, and, as our activity categories are mutually exclusive, the marginal effects from these four models will sum to zero, allowing us to isolate the substitution of one activity for another.

There is some evidence that the release of test results leads children to reduce the time they spend in leisure activities by 21 minutes each day, and to reallocate this time to educational activities, sleeping and personal care, and other activities (see Table 2). The marginal effect of leisure activities is weakly statistically significant (with 90% confidence) and a joint F-test rejects the null hypothesis (p-value = 0.065) that there is no effect NAPLAN results on time use overall. Still, our effect sizes are small and there is no evidence we are limited by low power as our implied ex-post Minimum Detectable Effects are of reasonable size. Taken together, the effect of NAPLAN results on children's time use are very consistent with their corresponding effects on other parental investments (see Table 2).

4.2 Parental Perceptions of Achievement and School Satisfaction

Parents' views about their child's academic achievement and the quality of their school their children attend are key determinants of the investments that they make (Bergman 2021; Greaves et al. 2019; Kinsler & Pavan 2016). These investments may either compensate for or reinforce educational disparities. A parent who believes that their child is performing better than their peers may reinforce this academic advantage by investing additional resources in aimed at encouraging even higher achievement. At the same time, a parent who believes that their child is under-performing relative to their peers may seek to ameliorate this disparity by investing more educational resources as a way of compensating. These additional resources may come at the cost of a reduction in other non-educational investments (Quadlin 2015). New information allows parents to not only revise their beliefs, but also adjust their investments in response.

Figure 3. Children with Above-average NAPLAN Numeracy Test Scores, by Parents' Perceptions of Child School Achievement Relative to School Average



In LSAC, parents' perceptions of their child's relative school achievement are strongly correlated with children's actual NAPLAN performance. Figure 3, for example, shows the proportion of children with NAPLAN numeracy scores above the national average for their grade level (and 95 percent confidence intervals) relative to parents' perceptions of their child's relative school achievement.

At the same time, it seems that parents are overly optimistic about their child's achievement in school. This is most easily seen in the proportion of parents believing that their child is "well below average", "below average", "average", etc., which is reported in bold square brackets along the x-axis in Figure 3. Approximately 94 percent of parents believe their child is performing at or above their school average—a distribution that out of step with the bell-shaped distribution of NAPLAN scores (see Figure 1) and the random sampling in the LSAC. In fact, at least one fifth of children whose parents believe they are performing well above the school average actually have below-school-average NAPLAN numeracy scores. This pattern is very similar when measuring child academic achievement via reading scores.

Table 3. The Effect of Releasing NAPLAN Report Cards on Parent's Perceptions of Child School Achievement and on Satisfaction with School

	Effect of Post-September LSAC interview	Mean	Children	Obs.
Parental perceptions of child school achievement relative to school average:			2,852	8,444
Increasing 5-point scale	-0.086*	3.76		
	(0.051)			
Well below average	0.006	0.01		
	(0.005)			
Below average	0.023*	0.05		
	(0.013)			
At average	-0.020	0.35		
	(0.028)			
Above average	0.031	0.37		
	(0.029)			
Well above average	-0.041*	0.23		
	(0.025)			
Parental satisfaction with child school:			2,853	8,456
Increasing 5-point scale	-0.109**	4.44		
	(0.046)			
Very dissatisfied	0.004	0.01		
	(0.005)			
Dissatisfied	0.012	0.03		
	(0.010)			
Neither	-0.000	0.06		
	(0.014)			
Satisfied	0.056*	0.35		
	(0.029)			
Very satisfied	-0.073**	0.57		
	(0.030)			

*OLS coefficients estimated using Correia's (2018) reghdfe Stata package. Each row corresponds to a different outcome. All regressions include fixed effects for survey wave, region and age in months, and controls for weather, child and family characteristics. Cluster-robust standard errors at the child level in parentheses. ***, ** and * mark estimates statistically different from zero at the 90, 95 and 99 percent confidence level.*

This raises the question: Do parents update their perceptions of their child's relative school achievement when they are provided with accurate information about their child's performance on a standardized test? We address this question by estimating the impact of the release of NAPLAN reports on parents' perceptions of children's achievement. We find some evidence that the release of NAPLAN reports results in parents having less optimistic views about their child's performance relative to their classmates (top panel Table 3). On average, parents interviewed after the release of NAPLAN reports rate their child's relative achievement as 0.086 points (on a 5-point scale) lower than parents interviewed earlier, a statistically

significant effect with 90 percent confidence. This is a relatively small effect, corresponding to about 2 percent of the 3.76 point unconditional mean.

To better understand which parts of the belief distribution are being impacted by the release of NAPLAN reports, we also estimate separate models of the probability of reporting each of the five categories in the belief distribution. Since they are mutually exclusive categories, the marginal effects add to zero and should be interpreted as substitutions across categories. The release of test scores causes a decrease in parents' belief that their child performs "well above average" (4.1 percentage points) and an increase in the belief that their child performs "above average" (3.1 percentage points) of roughly equal magnitude. Releasing NAPLAN reports also has a smaller negative effect on parents' belief that their child performs "at the school average" (2 percentage points) as well as a corresponding increase in the belief that their child performs "below average" (2.3 percentage points). While we can only speculate, these results seem to suggest that test score information causes two types of parents to marginally adjust their perceptions of achievement downwards: those who believe their child is doing extremely well, and those who believe their child is performing at the school average. Since parents are, on average, likely to be overly optimistic about their child's relative achievement (see Figure 3), our results are consistent with NAPLAN reports partially correcting parents' informational bias.

Parents also revise their satisfaction with their child's school after receiving information on their child's academic achievement (Table 3 bottom panel). The release of NAPLAN results leads parents to reduce their overall satisfaction with their child's school by 0.109 points (on a 5-point scale). This is effect is relatively in magnitude; corresponding to about 2 percent of the unconditional mean of 4.44 points in school satisfaction. Unlike the disparate effects of test results on opposite ends of the belief distribution, the effect on school satisfaction only seems to be in altering parents' chances of being "very satisfied" or "satisfied" with their children's school. The probability of the former decreases by 7.3 percentage points (13 percent of its unconditional mean) and there is correspondingly increasing the probability of the latter by 5.6 percentage points (16 percent of the unconditional mean). Diminished school satisfaction is likely to be consequential for the way that parents interact with schools. Parents who are more involved with their children's schooling report higher satisfaction levels (Friedman et al. 2007). Although some researchers also find that parents who are more satisfied with their parent-teacher interactions are more likely to be involved in their child's education both in school and at home (Patrikakou et. al 2000), others conclude the opposite (Park & Holloway 2013). In

either case, while positive school–family relationships are a predictor of academic achievement, this relationship is mediated by the extent to which parents are satisfied with their child's school (Hampden-Thompson 2017).

5. The Information Content of NAPLAN

Parents' responses to their child's NAPLAN reports could fundamentally depend on the nature of the information they receive. Well-informed parents may learn little they did not already know, giving them no reason to adjust their investments. For other parents, NAPLAN reports bring either good or bad news about their child's academic achievement, leading them to perhaps rethink their investment strategy. These investment responses may be asymmetric depending on the nature of the information received. Haisken-DeNew et al. (2018), for example, estimate that the release of information about high-quality schools increases property prices by 3.6 percent, whereas the release of information about low-quality schools is unrelated to property prices.

In what follows, we investigate these issues by isolating more precisely the information content of children's NAPLAN reports and the investment changes that parents make in response to that information.

5.1 Good, Bad and No News

We first investigate the extent to which parents' investment responses depend on receiving new information, i.e., news, about their child's test performance. To isolate the news each parent receives, we forecast each child's current NAPLAN numeracy score using information about their previous test scores and parents' prior perceptions of their child's academic performance. By comparing these child-level forecasts to their realized NAPLAN test scores, we divide parents into three separate groups—those who received "good news", those who received "bad news", and those who received "no news".

Specifically, we use the following model to forecast parents' expectation for their child's NAPLAN scores:

$$NAPLAN_{i,w} = f(NAPLAN_{i,w-1}, Perceived\ Assessment_{i,w-1}, \theta_{Region}, \theta_w) + \varepsilon_{iw} \quad (3)$$

where $NAPLAN_{iw}$ is the NAPLAN numeracy score of child *i* in wave *w*. Our model allows for separate slopes of $NAPLAN_{i,w-1}$ across data cells defined by region, wave, and by parents' perceived assessment of their child ability one wave prior, $Perceived\ Assessment_{i,w-1}$. We estimate the model's parameters using the sample of non-treated parents (i.e., with pre-

September interviews) so that our estimates are not affected by recently released NAPLAN results. Using parameter estimates from equation (3), we construct child-specific forecasted scores $\widehat{NAPLAN}_{i,w}$ for the whole sample as well as standard errors of each forecast. We then create three new mutually exclusive categorical variables, $Good\ News_{i,w}$, $Bad\ News_{i,w}$, and $No\ News_{i,w}$. $Good\ News_{i,w}$ takes the value of 1 if the child's realized NAPLAN score is more than 1 standard error above the forecasted score, and 0 otherwise. Similarly, $Bad\ News_{i,w}$ takes the value of 1 if the child's realized NAPLAN score is more than 1 standard error below the forecasted score, and 0 otherwise, while $No\ News_{i,w}$ takes the value of 1 if the child's realized score is within 2 standard errors of their forecasted score. We implement this classification for each child observation in LSAC waves 4 through 6 since in these waves parent already have had access to previous NAPLAN scores. Our model results in 75 percent of these parents getting "no news" and the rest of parents getting either "good news" (13 percent) or "bad news" (12 percent).

Figure 4. Illustrating Good, Bad, and No News Based on NAPLAN Numeracy Score Forecasts and Realizations Across the Score Distribution

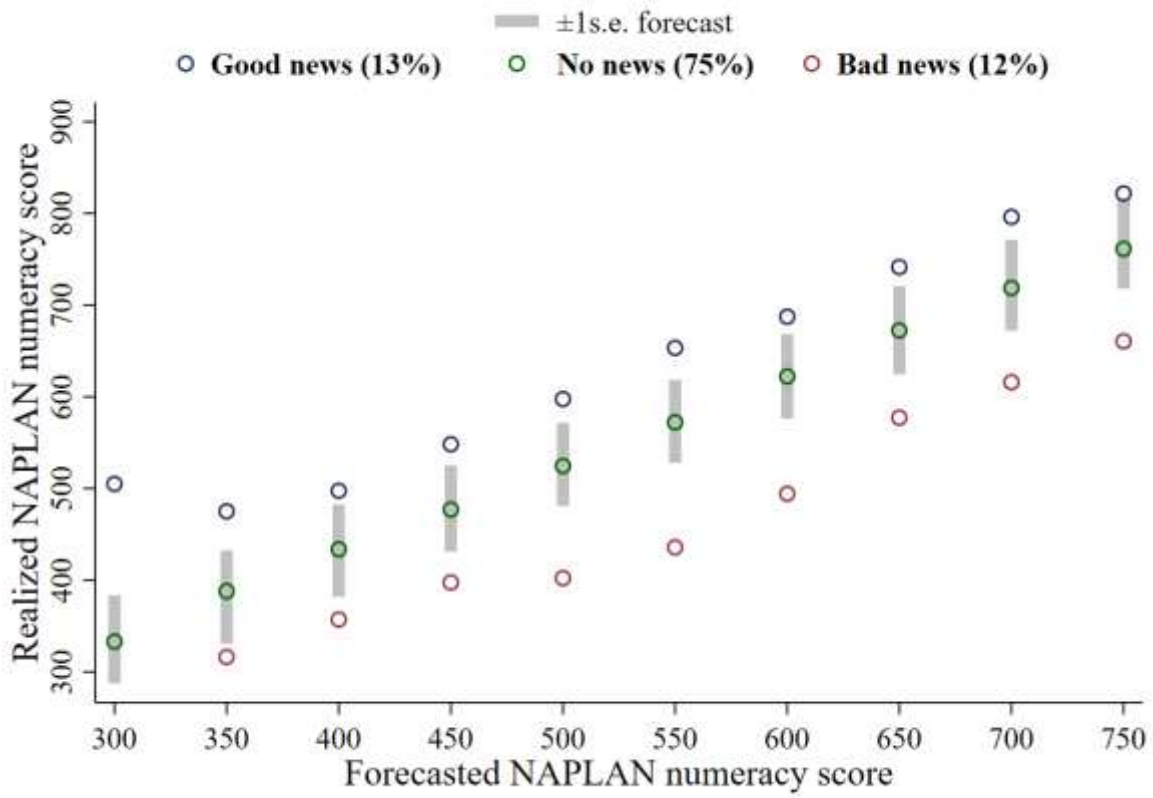


Figure 4 illustrates the relationship between forecasted and realized NAPLAN numeracy scores for a few instances across the score range, and how it helps us classily good and bad news. For each instance of the 10 forecasted scores along the x-axis, the grey bar present the 2-standard-forecast-error band around each forecast. These bars always straddle the 45-degree line showing that our model is forecast-unbiased across the entire score distribution. For each of these forecasted scores, Figure 4 also shows a representative instance of Good News (in blue), Bad News (in red), and No News (in green).

We then investigate how parental investment responses vary with the type of news that parents receive when their child's NAPLAN report arrives. We do this by estimating the following model:

$$\begin{aligned} Investment_{iw} &= \beta_0 Post_{iw} + \beta_1 Good\ News_{iw} + \beta_2 Bad\ News_{iw} \\ &+ \gamma_1[Post_{iw} \times Good\ News_{iw}] + \gamma_2[Post_{iw} \times Bad\ News_{iw}] \\ &\quad \breve{\gamma}' X_{iw} + \breve{\delta}_w + \breve{\delta}_{Region} + \breve{\delta}_{Age} + \breve{\varepsilon}_{iw} \end{aligned} \tag{4}$$

The model in equation (4) allows us to isolate the effect of both i) the timing (before vs. after the release of NAPLAN reports) and ii) the news content (good, bad and none) of the information that parents receive. $\hat{\gamma}_1 - \hat{\beta}_1$ identifies the difference in the investments of parents who *have* received a report card with good news (i.e., where child's test score performance exceeds its forecast) by the time of their LSAC interview relative to those of parents who *will* receive good news but have not yet done so because they were interviewed before NAPLAN reports are released. Similarly, the difference in the investments between parents who *have* and who *will* receive bad news is identified by $\hat{\gamma}_2 - \hat{\beta}_2$, whereas $\hat{\beta}_0$ captures the difference in investments of parents who *have* received no news (i.e., whose child performs within forecast) and who *will* receive no news. These estimated differences are reported in Tables 4 and 5. Note that these estimates come from triple-interaction models which limit the precision of our estimates; we view the differences in point estimates as informative but they are rarely statistically significant from one another and therefore our conclusions here will remain largely suggestive.[18]

[18] The average marginal effects reported in Tables 5 and 6 are obtained by using the *margins* command in Stata. The main effects in equation (4) themselves identify differences in parental group investments, for example between parents who will eventually receive good rather than no news ($\hat{\beta}_1$) or between parents who will eventually receive bad news rather than no news ($\hat{\beta}_2$). Appendix Table B4 maps the coefficients in equation (4) to the parental groups they isolate in the data.

Table 4. The Effect of Good, Bad, and No News Based on NAPLAN Numeracy Scores on Parental Investments and Children's Time Use

	Effect of post-September LSAC interview if based on numeracy scores parents receive:					
	good news	**no news**	**bad news**	Mean	Children	Obs.
Time investments:						
Hours per day with parents	-0.098	-0.174	-0.365	3.25	2,592	5,435
	(0.279)	(0.192)	(0.261)			
At-home activities per week	-0.470	-0.426	-0.518	9.21	2,586	4,215
	(0.512)	(0.380)	(0.579)			
Out-of-home activities per month	-0.128	0.031	0.044	1.55	2,676	5,953
	(0.100)	(0.071)	(0.111)			
Monetary investments:						
30+ books at home	-0.022	-0.006	-0.051	0.74	2,586	4,218
	(0.049)	(0.035)	(0.052)			
Has private tutor	0.080**	0.055**	0.093**	0.15	2,666	5,882
	(0.037)	(0.025)	(0.038)			
Has allowance	-0.068	-0.023	-0.058	0.37	2,676	5,953
	(0.047)	(0.034)	(0.048)			
Extracurr. Activities per week	-0.259*	-0.357***	-0.297**	1.43	2,345	3,727
	(0.145)	(0.101)	(0.144)			
Parenting style:						
High warmth	0.016	0.016	0.033	0.70	2,647	5,829
	(0.048)	(0.033)	(0.046)			
Strict monitoring	-0.002	-0.022	-0.013	0.71	2,659	5,862
	(0.043)	(0.030)	(0.043)			
Minutes per day of child time in:					2,592	5,435
Educational activities	34.554*	-2.173	53.440***	283		
	(19.514)	(13.509)	(19.317)			
Leisure	-45.803**	-10.689	-37.952*	304		
	(20.325)	(13.227)	(19.613)			
Sleeping & personal care	0.483	9.690	-3.371	638		
	(9.333)	(6.272)	(9.330)			
Other activities	11.711	4.136	-8.652	216		
	(11.211)	(8.064)	(11.345)			

Average marginal effects from OLS models interacting post-September LSAC interview with news type based on forecasted vs actual numeracy scores using Correia's (2018) reghdfe *Stata package. Sample restricted to waves 4 through 6 of LSAC, where lagged NAPLAN scores are available. Each row corresponds to a different outcome. All regressions include fixed effects for survey wave, region and age in months, and controls for weather, child and family characteristics. Child time use observations are weighted by 5/7 if taken on a weekday and by 2/7 if taken on a weekend day. Cluster-robust standard errors at the child level in parentheses. ***, ** and * mark estimates statistically different from zero at the 90, 95 and 99 percent confidence level.*

Table 4 reports the estimated effect of the information content of NAPLAN on time and monetary parental investments, as well as parenting styles and children's time use. We find that on average parents—irrespective of the type of news they get—significantly increase their investments in private tutoring (between 5.5 and 9.3 percentage points) and limit their child's extracurricular activities (between 0.259 and 0.357 activity days per week) following the release of their child's NAPLAN numeracy test scores. It thus seems that while the news types

embedded in NAPLAN reports do not differentially change parents investments, receiving the reports in itself might have a priming effect on them. This is consistent with experimental evidence that giving parents daily updates on their child's in-class engagement has positive effects on homework completion, improved on-task behavior, and class participation (Kraft & Dougherty 2013), while making objective information about children's missed assignments, grades, and attendance attenuates parents' upwardly biased beliefs about their child's effort at school (Bergman 2021; Bergman & Chan 2017). Better information reduces monitoring costs, resulting in more monitoring and, ultimately, improved school performance.

Table 4 also reports the estimated effect of NAPLAN's information content on children's time use. Parents who receive bad news significantly increase their child's time spent on educational activities and decrease their child's time spent on leisure activities; receiving bad news seems to encourage parents to alter their child's time use to redress the poor performance in the NAPLAN. Interestingly, parents who receive good news respond similarly, increasing their child's time spent on educational activities and decreasing their child's time spent on leisure activities, as if to reinforce the academic performance they have just received news about. On the other hand, parents who receive no news do not adjust the time their child spends in these two activities.

In Table 5, we report the estimated effect of NAPLAN's new content on parents' perceptions of their child's school achievement and on their satisfaction with their child's school. We find that it is bad and no news that are driving parents' downgrading of their child's relative school achievement. On average, when parents receive bad news, they downgrade their rating of their child's school achievement by 0.168 points (on a 5-point scale) compared to parents who are interviewed before receiving NAPLAN results. This decrease in the average rating is driven by a significant and sizeable decrease in the chances that parents rate their children as "above average" once they receive bad news and a commensurate increase in the changes of an "average" and "below average" ratings. Parents who receive no news from their child's NAPLAN results nevertheless downgrade their ratings of their child (0.122 points). Some of these parents are much less likely to rate their child as "well above average" and more likely to rate it as "above average". Some are also less likely to rate their child as "average" and more likely to rate "below average" and "well below average". Receiving good news does not lead to any significant change in parents' perceptions of achievement.

Table 5. The Effect of Good, Bad, and No News Based on NAPLAN Numeracy Scores on Parent's Perceptions of Child School Achievement and on Satisfaction with School

	Effect of post-September LSAC interview if based on numeracy scores parents receive:					
	good news	**no news**	**bad news**	Mean	Children	Obs.
Parental perceptions of child school achievement relative to school average:						
Increasing 5-point scale	-0.039	-0.122**	-0.168*	3.77	2,679	5,976
	(0.083)	(0.057)	(0.089)			
Well below average	0.003	0.010*	-0.004	0.01		
	(0.007)	(0.006)	(0.009)			
Below average	0.020	0.024*	0.026	0.05		
	(0.018)	(0.015)	(0.025)			
At average	-0.056	-0.018	0.051	0.34		
	(0.043)	(0.032)	(0.049)			
Above average	0.078	0.042	0.006	0.38		
	(0.050)	(0.034)	(0.048)			
Well above average	-0.046	-0.059**	-0.078*	0.23		
	(0.045)	(0.027)	(0.041)			
Parental satisfaction with child school:						
Increasing 5-point scale	-0.119	-0.054	-0.117	4.45	2,679	5,970
	(0.074)	(0.051)	(0.086)			
Very dissatisfied	0.005	-0.000	0.001	0.01		
	(0.007)	(0.005)	(0.012)			
Dissatisfied	0.003	-0.002	0.015	0.02		
	(0.015)	(0.011)	(0.017)			
Neither	-0.005	-0.004	0.008	0.06		
	(0.023)	(0.015)	(0.024)			
Satisfied	0.103**	0.070**	0.052	0.34		
	(0.048)	(0.033)	(0.050)			
Very satisfied	-0.105**	-0.064*	-0.076	0.57		
	(0.049)	(0.034)	(0.051)			

Average marginal effects from OLS models interacting post-September LSAC interview with news type based on forecasted vs actual numeracy scores using Correia's (2018) reghdfe *Stata package. Sample restricted to waves 4 through 6 of LSAC, where lagged NAPLAN scores are available. Each row corresponds to a different outcome. All regressions include fixed effects for survey wave, region and age in months, and controls for weather, child and family characteristics. Child time use observations are weighted by 5/7 if taken on a weekday and by 2/7 if taken on a weekend day. Cluster-robust standard errors at the child level in parentheses. ***, ** and * mark estimates statistically different from zero at the 90, 95 and 99 percent confidence level.*

On the other hand, when we study parents separately by the type of news they receive, we no longer observe parents becoming less satisfied with their child's school after receiving NAPLAN results. Instead, we observe that parents who receive no news and parents who receive good news are more likely to be satisfied with their child's school after receiving the NAPLAN results. These results are puzzling, yet they can be somewhat explained by the fact that excluding LSAC wave 3 decreases the overall effect of NAPLAN report card release and

makes it insignificant. We are therefore exploring heterogeneity of a weaker effect. It can also be that the NAPLAN reports does have information that drives parents' school satisfaction ratings, yet this information is not related to the (expected) child test scores. The drop could, for example, be related to how the school average performance compares to the national average. We explore this possibility below.[19]

5.2 Information about School vs. Individual Achievement

When they receive their child's NAPLAN report, Are parents learning about and responding to the quality of their children's school or about their children individually? We consider this issue by investigating the heterogeneity in parents' responses in states that do and do not report average NAPLAN scores at the school-level. In Queensland, Western Australia, and South Australia, children's individualized NAPLAN reports also display the school-level mean test score on each child's assessment scale, along with the child's test score. Thus, in those states, parents learn about the NAPLAN performance of their child's school in addition to their child's absolute and relative academic achievement. In other states, parents only find out how well their child's school has performed afterwards, if at all, when school averages are reported on the My School website. Finding stronger effect of receiving NAPLAN results in states that report school averages would suggest that it is school rather than child information that drives those results. One possible reason for this to occur is if parents overestimate the quality of their child's schools—consistent with the very high levels of school satisfaction in our data—and NAPLAN reports provide information that makes them correct their beliefs.

We focus our analyses on the parental investments and beliefs that respond significantly to NAPLAN information: tutoring, number of extracurricular activities, child time spent on educational activities, parents' perceptions of their child's school achievement, and their satisfaction with school. Table 6 shows estimates of the effect of NAPLAN information on this smaller subset of parental investments, separately for parents of the two state types, where 30 percent of children received NAPLAN reports in states that also show their school cohort's average NAPLAN results. We see weak evidence of stringer decreases in school satisfaction

[19] Our focus here has been on the impact of children's numeracy score which the literature suggests may be more responsive to school inputs – specifically principal and teacher quality – than are reading test results (Clark et al. 2009; Rivkin et al. 2005). This raises the possibility that parents may respond differently to literacy than to numeracy scores. We have reanalyzed our data using reading scores instead of numeracy scores to categorize parents into groups that receive "bad news", "no news", and "good news". These analyses yield qualitatively similar results, though we do note slightly stronger reactions to bad news in terms of tutoring, and stronger reactions to good news in terms of children's time use in educational activities. We also see stronger effects on parental beliefs about their child' achievement and their school satisfaction.

for parents who receive NAPLAN reports in states where school averages are also shown. However, parents in both types of states show similar reactions to NAPLAN reports in their use of private tutors, the number of extracurricular activities their child engaged in, and their perceptions of their child's achievement in similar quantities. Moreover, parents in states that do not show school NAPLAN performance show stronger responses to NAPLAN reports by significantly reducing their child's leisure time. This suggests that, while NAPLAN reports might contain information that makes parents update their school satisfaction, this effect on school satisfaction is unlikely to be linked to parental investments.

Table 6. The Heterogeneous Effects of NAPLAN Reports in States and Do and Do Not Show Average School Test Performance on Their Report Cards

	Effect of Post-September LSAC interview if:	
State NAPLAN report cards:	*do not show school avg. [70%]*	*show school avg. [30%]*
Outcomes:		
Has private tutor	0.062**	0.067**
	(0.024)	(0.029)
	0.17	*0.12*
Extracurr. activities per week	-0.306***	-0.350***
	(0.103)	(0.118)
	1.44	*1.41*
Minutes per day on educational activities	24.373*	-11.022
	(13.348)	(16.482)
	264	*264*
Parental perceptions of school achievement	-0.091*	-0.076
	(0.054)	(0.062)
	3.77	*3.75*
Parental satisfaction with child school	-0.093*	-0.142**
	(0.048)	(0.061)
	4.46	*4.40*

Average marginal effects from OLS models interacting post-September LSAC interview with the key heterogeneity variable. OLS model estimated using Correia's (2018) reghdfe *Stata package. Each row corresponds to a different outcome. All regressions include fixed effects for survey wave, region and age in months, and controls for weather, child and family characteristics. Child time use observations are weighted by 5/7 if taken on a weekday and by 2/7 if taken on a weekend day. Cluster-robust standard errors at the child level in parentheses an conditional outcome means in italics. ***, ** and * mark estimates statistically different from zero at the 90, 95 and 99 percent confidence level.*

Our results are consistent with previous evidence that parents may respond differently to information about relative rather than absolute performance. Rogers and Feller (2018), for example, demonstrate that feedback on children's absolute and relative level of absenteeism both matter in correcting parents' downwardly biased beliefs on their child's absences. It is information about attendance levels, however, that leads to an improvement in class

attendance; merely providing parents with information on their child's absences relative to a 'typical' student has no appreciable effect on the level of absenteeism.

5.3 Heterogeneity in Baseline Information

Finally, we conclude our analysis by investigating how parents' responses vary with their likely baseline information. Specifically, we consider whether investment responses to NAPLAN information vary: i) across public- vs. private-school sectors; or ii) across high- vs. low-income families.

There is ample evidence that parents' school interactions vary across sectors. Analyzing school choice survey data, Goldring & Phillips (2008) find that parents who are more likely to consider private schools communicate with their children about school more frequently and report lower parent-school collaboration. These results suggest a 'pull' towards private schools, rather than a 'push' away from public schools—parents consider private schools when they are dissatisfied with the amount of involvement and communication between home and school in the public school system, and seek private schools with these aspects. The literature also suggests that private school parents do get what they pay for. Feuerstein (2000) finds that private school parents are more involved than public school parents even after controlling for socioeconomic status; private school parents participate in parent-teacher organization more frequently, and spend more time volunteering their help at school. We therefore expect private school parents to have more information than public school parents at baseline and so we expect that NAPLAN provides less new information to private school parents. As such, we would expect private school parents to respond less strongly to the release of NAPLAN results.

Table 7 reports the estimated effect of NAPLAN information in subsamples separated by school type, where 81 per cent of children in our estimation sample attend public schools. Overall, we observe no heterogenous effects of NAPLAN information on parental investments across the school types. Although there are no significant differences in the way treated public vs. private school parents respond to NAPLAN information, we do observe that they are acting at different margins and so any observed differences, whilst small in absolute terms, may be proportionately large. For example, while 14 percent of public-school parents enroll their children in private tutoring, 20 percent of private school parents do. This results in a larger proportional increase in private tutoring in response to NAPLAN reports for public school parents compared to private school parents; parents in both school types are 6.5 percent more likely to enroll their children in private tutoring after receiving NAPLAN information. Yet

relative to their unconditional means this same effect represents a 46 percent increase in the likelihood of engaging in private tutor for public school children compared to a smaller 33 percent increase for private school children. Similar differences in the percentage effects occur for the effects on extracurricular activities. That public school parents respond proportionately more strongly to NAPLAN information is suggestive that the information content of NAPLAN is newer to public school parents than it is for private school parents. This interpretation is reinforced by the fact that the entire downgrading of parents' perception of their child's school achievement comes from public school parents; private school parents' perceptions do not change when with NAPLAN reports.

Table 7. The Heterogeneous Effects of NAPLAN Reports in Public and Private Schools

	Effect of Post-September LSAC interview if:	
Child's attends a:	*public school [81%]*	*private school [19%]*
Outcomes:		
Hours per day with parents	-0.228	-0.016
	(0.185)	(0.247)
	3.42	*3.57*
Has private tutor	0.065***	0.064*
	(0.024)	(0.034)
	0.14	*0.20*
Extracurr. activities per week	-0.320***	-0.321***
	(0.100)	(0.123)
	1.33	*1.73*
Minutes per day on educational activities	13.269	13.760
	(12.975)	(18.495)
	258	*287*
Parental perceptions of school achievement	-0.104**	-0.000
	(0.052)	(0.069)
	3.74	*3.87*
Parental satisfaction with child school	-0.106**	-0.096
	(0.047)	(0.062)
	4.39	*4.64*

*Average marginal effects from OLS models interacting post-September LSAC interview with the key heterogeneity variable. OLS model estimated using Correia's (2018) reghdfe Stata package. Each row corresponds to a different outcome. All regressions include fixed effects for survey wave, region and age in months, and controls for weather, child and family characteristics. Child time use observations are weighted by 5/7 if taken on a weekday and by 2/7 if taken on a weekend day. Cluster-robust standard errors at the child level in parentheses an conditional outcome means in italics. ***, ** and * mark estimates statistically different from zero at the 90, 95 and 99 percent confidence level.*

Next, we consider whether investment responses to NAPLAN information vary across high- vs. low-income families. There are well-documented differences in the degrees of parents' school involvement across family socioeconomic status. High-income and highly educated parents are more likely to hold higher educational expectations for their children

(Davis-Kean 2005; Carolan & Wasserman 2015) and are more likely to be involved in their children's education (Stevenson & Baker 1987; Cheadle & Amato 2011). Even after controlling for parental occupation, education, and income, Cheadle and Amato (2011) find that differences in parental involvement persist along racial/ethnic lines. Similarly, Turney and Kao (2009) also find that migrant parents face more barriers to participation in their children's schools and as a result, are less involved than native-born parents. These gaps in parental involvement and expectations lead to differences in children's academic performance, with children from families of higher socioeconomic background outperforming their more disadvantaged peers (see Sirin 2005 for a review). For example, Roksa & Potter (2011) find that social class differences in the academic achievement in children can be attributed to family resources and parental practices (including involvement at home and at school and parent-child communication). We expect that, as a result of their higher involvement in their children's education, high-income parents likely have more information than low-income parents at baseline and so respond less strongly to the information content of NAPLAN. We study this by analyzing the difference in responses to NAPLAN results by households in the bottom and top tertile of the earnings distribution in each LSAC wave.

Table 8 shows that, overall, the effects of NAPLAN information on parental responses to be similar across the bottom and top income tertiles in all outcomes except for time spent in educational activities and parents' satisfaction with their child's school. For these two outcomes, parents in the bottom tertile show stronger reactions to NAPLAN reports than parents in the top tertile. The lack of differences between low- and high-income parents in the other dimensions is an interesting result nonetheless. It suggests that socio-economic disparities in human capital investments do not occur along the income dimension. There is research in Australia that suggests that when focusing on the socioeconomic status of young people, it is particularly important to consider parental occupation and education, more so than household income (Marks et al. 2000; Marks et al. 2006; Lim & Gemici 2011). Parental occupation and education mirror access to cultural capital (Bourdieu 1973), which has been found to strongly affect children's educational outcomes in Australia (Crook 1997). There is also empirical evidence to suggest that parents' education is a stronger predictor of children's test scores than household income (Fejgin 1995; Ganzach 2000). That socioeconomic gaps in Australia are largely accounted for by parental education and occupation helps to explain why we observe little differences in parental responses to NAPLAN information across the income dimension.

Table 8. The Heterogeneous Effects of NAPLAN Reports in Households in the Bottom and Top Tertile of the Income Distribution

	Effect of Post-September LSAC interview if:	
Household income is in the:	*bottom tertile [31%]*	*top tertile [36%]*
Outcomes:		
Hours per day with parents	-0.378	-0.510**
	(0.244)	(0.247)
	3.45	*3.44*
Has private tutor	0.074**	0.064**
	(0.032)	(0.033)
	0.15	*0.18*
Extracurr. activities per week	-0.293**	-0.303**
	(0.136)	(0.134)
	1.23	*1.62*
Minutes per day on educational activities	23.581	8.593
	(17.983)	(18.041)
	248	*281*
Parental perceptions of school achievement	-0.096	-0.049
	(0.070)	(0.068)
	3.66	*3.84*
Parental satisfaction with child school	-0.127*	-0.064
	(0.066)	(0.061)
	4.35	*4.51*

Average marginal effects from OLS models interacting post-September LSAC interview with heterogeneity variable. OLS model estimated using Correia's (2018) reghdfe *Stata package. Each row corresponds to a different outcome. All regressions include fixed effects for survey wave, region and age in months, and controls for weather, child and family characteristics. Child time use observations are weighted by 5/7 if taken on a weekday and by 2/7 if taken on a weekend day. Cluster-robust standard errors at the child level in parentheses an conditional outcome means in italics. ***, ** and * mark estimates statistically different from zero at the 90, 95 and 99 percent confidence level.*

6. Discussion and Conclusions

There is ample evidence that parents often have imperfect information about the way children acquire human capital (see Dizon-Ross 2019 for a review). Our results highlight the many ways in which this information gap gets filled when parents are presented with standardized test score report cards on their child's test performance. To summarize our results, we find evidence that receiving NAPLAN reports:

- increases private tutoring for their children and decrease the number for extracurricular activities they engage in;
- leads to more educational activities and less leisure in their children's time use;
- makes parents downrate their (on average very optimistic) perceptions of their child's achievement relative to others in school;

- makes parents decrease their (on average very high) satisfaction with their children's school.

When isolating the effects of the "good news," "bad news," or "no news" information content in NAPLAN reports and when we explore their heterogeneous effects, we find evidence that:

- changes in parental investments are driven by all types of news (good, bad and no news);
- changes in parents' perceptions of their child's school achievement are mainly driven by no news and bad news, and these effects are stronger for children attending public schools.

Together, these results show that information frictions are also important drivers of parental investments, even in settings with generally high contact between schools and parents and widely available access to information on children's educational achievement and school achievement. And while parents could adjust any one of the multitudes of parental investments in their children in reaction to this information, they do not. Their reactions focus on private tutoring and on restricting the extracurricular and leisure activities of their children. This adds to the evidence that parents make targeted investments at improving academic achievement of their children, where private tutoring plays an important role. Our findings complement recent evidence that changes of private tutoring in response to school investments such as access to better schools or to more qualified teachers (Pop-Eleches & Urquiola 2013; Chang et al. 2020). However, our findings suggest that interventions that keep parents better informed—scalable and likely very cost-effective—can also be effective for increasing parental investments in their children's education. We further find that these interventions will be most effective at raising parental investments in public school children, which are the majority in our setting and are also relatively more disadvantage. Assuming private tutoring leads to better educational outcomes, better information can therefore become a progressive policy to close socioeconomic gaps in academic achievement.

The very inflated parental perceptions of their children's school achievement we find suggests there is a behavioral reason that, at least in part, links information frictions to parental investment. One mechanism at play could be Bénabou and Tirole's (2016) motivated beliefs; parents could be holding unreasonably optimistic beliefs about their children's academic achievement because they *want it to be so*, often regardless of whether these beliefs are accurate. The transparent information in NAPLAN reports helps dispel these beliefs, at least partially. Sharper reactions to report cards in public school children are also consistent with

this interpretation, since one the key differences between Australian private and public schools is the larger degree of parent-school contact in the latter. In these higher feedback environments, it would be harder for parents to hold unreasonably overconfident beliefs.

If motivated beliefs are indeed at the core of our findings, one must also wonder whether providing more and clearer information to parents could backfire as a policy. The concern is not only that correcting beliefs that parents themselves *consume* has a negative immediate effect on their welfare. There is also the possibility that, for sufficiently overconfident parents, more feedback could result in misdirected learning: when faced with feedback some parents could become too pessimistic about their children's ability, lowering outcomes and thus confirming their more pessimistic expectations in a self-defeating circle. This possibility and the conditions under which it could happen is discussed in detail in Heidhues et al. (2018). Unfortunately our data does not allow us to directly test whether this is likely to be the case in our setting.

Another important aspect we sadly cannot address in this paper is a more systematic exploration of which are the binding constraints for increasing parental investment once information barriers are lessened. Private tutoring, in particular, seems to be the tool of choice of parents for improving the academic achievement of their children, but we have little information on how the market for private tutors works. It is easy to imagine that private tutors are heterogeneous in their quality and their price, and that parents themselves might find it difficult to choose their child tutor for their child. Moreover, it could also be that in more disadvantaged schools parents are less informed and affordable access to good tutors is worse. In those cases, simply providing parents with better information will not translate into worthwhile investments. In those cases, better school-parent contact should be paired with information about the best resources parents can invest to improve their children's academic achievement.

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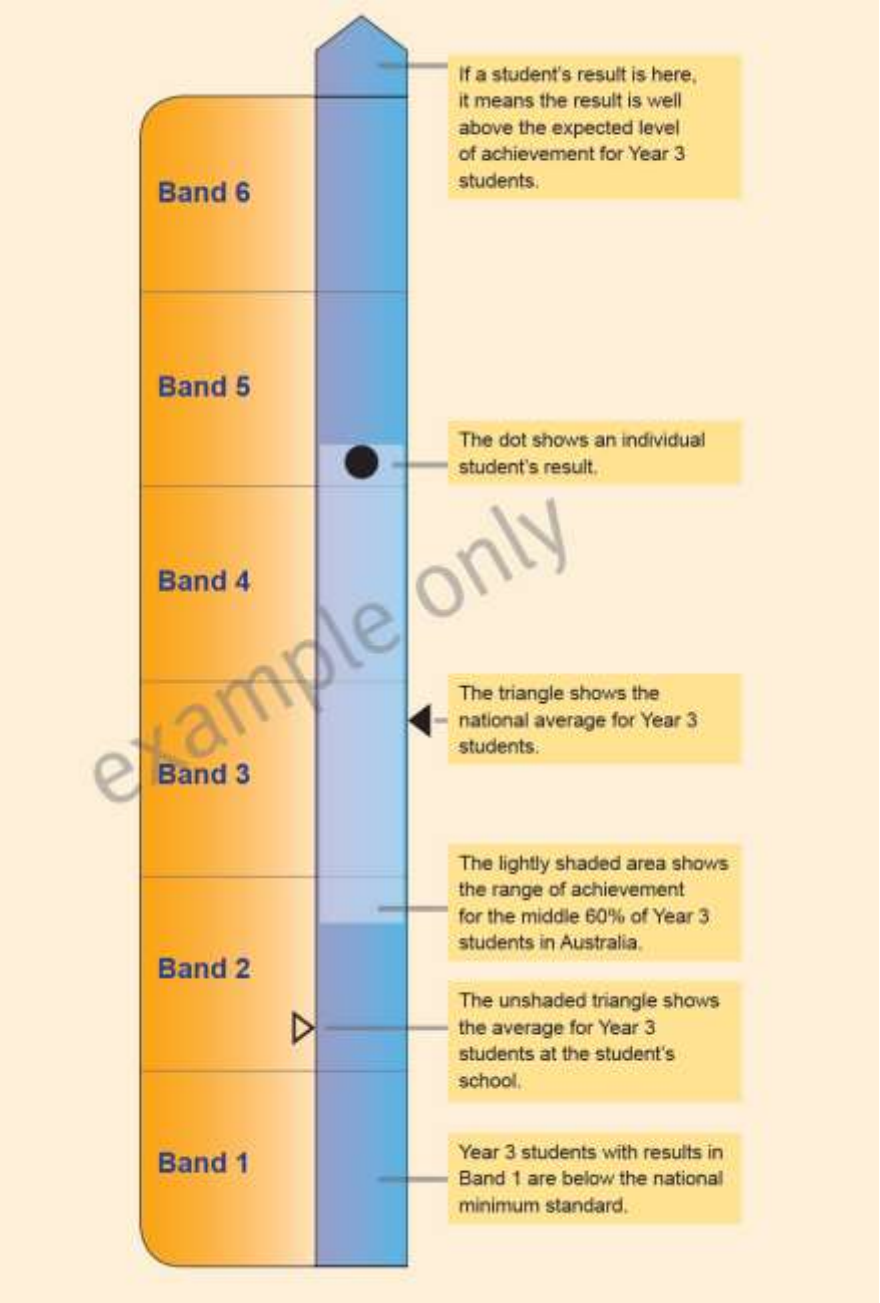
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Appendix A – The Construction of NAPLAN Test Score Scales

An important feature of the NAPLAN, besides its standardized nature, is its common assessment scale. NAPLAN results are reported using five scales, one for each of the skills assessed. These scales have been designed such that they are common across all grade levels from grade 3 to grade 9. By locating all student results on a single scale, the NAPLAN scales can provide significant information about the development of student achievement over time. As each NAPLAN test is different each year, individual student's raw scores can be converted to its equivalent on the NAPLAN scale using equivalence tables that are published annually. The NAPLAN scales are constructed from scores that range from approximately zero to 1000. Each score represents the same level of achievement over time. For example, obtaining a score of 600 in grade 3 reading in 2010 is to be understood as indicating the same level of reading skills as obtaining a score of 600 in grade 5 reading in 2012. The scales, however, cannot be compared across domains, so, a score of 600 in grade 3 reading versus a score of 700 in grade 3 writing does not by itself indicate that the student is more proficient in writing than in reading.

Each scale is divided into ten bands, from 1 to 10, that represent increasing levels of knowledge and understanding of the skills demonstrated in the assessment. These bands are used to determine how each child is performing against established national standards. The national minimum standard describes the level of skills and understanding expected for students in that grade and encompasses one band at each grade level. For example, Band 2 is the minimum standard for students in grade 3. If a child's NAPLAN score places them in a lower band than the minimum standard, this indicates that the child does not demonstrate the learning outcomes expected for their grade level in that domain. For each grade level, NAPLAN results are reported against 6 of the 10 bands from the common scale. For example, the grade 3 student report scale displays bands 1-6 and the grade 4 student report scale displays bands 3-8.

Figure A1. Example of a NAPLAN Report Card Score Figure for Grade 3



Source: http://www.wodonga-ps.vic.edu.au/uploads/9/8/2/6/9826482/naplan_2018_explained.pdf

Appendix B – Additional Tables and Figures

Table B1. Parental Investment Variables and Control Variables

Variable	Waves available	Definition
Time spent with child (days/week of activity)		
Read with child	3 & 4	The number of days in the past week where the parent or an adult in the family has read to the study child from a book.
Told child a story	4 & 5	The number of days in the past week where the parent or an adult in the family has told the study child a story, not from a book.
Drawn picture with child	4 & 5	The number of days in the past week where the parent or an adult in the family has drawn pictures or done other art or craft activities with the study child.
Music with child	4 & 5	The number of days in the past week where the parent or an adult in the family has played music, sung songs, danced or done other musical activities with the study child.
Toys or games with child	4 & 5	The number of days in the past week where the parent or an adult in the family has played with toys or games indoors, like board or card games and excluding electronic games, with the study child.
Everyday activities with child	3, 4 & 5	The number of days in the past week where the parent or an adult in the family has involved the study child in everyday activities at home, such as cooking or caring for pets.
Played outdoors with child	3, 4 & 5	The number of days in the past week where the parent or an adult in the family has played a game outdoors or exercised together (e.g., walking, swimming, cycling) with the study child.
Sum of activity days/week	3, 4 & 5	Sum of days per week spent with the study child being engaged in activities inside the home.
Parent-child activities (last month)		
Gone to playground or pool	3 to 6	Equals 1 if study child has gone to a playground or a swimming pool with their parent or another adult in the family in the past month.
Gone to concert, museum, etc.	3 to 6	Equals 1 if study child has gone to a concert, play museum, art gallery or community or school event with their parent or another adult in the family in the past month.
Attended a religious service	3 to 6	Equals 1 if study child has attended a religious service, church temple, synagogue or mosque with their parent or another adult in the family in the past month.
Visited library	3 to 6	Equals 1 if study child has visited a library with their parent or another adult in the family in the past month.
Sum of activities last month	3 to 6	Sum of parent-child activities outside the home in the last month.
Monetary investments in child		
More than 30 books at home	4 & 5	Equals 1 if study child has more than 30 books at home.
Hired tutor	4 to 6	Equals 1 if study child has received additional help or tutoring from anyone outside the household in the last 12 months.
No pocket money	4 to 6	Equals 1 if study child does not receive weekly pocket money.
Number of extracurricular activities last week	5 & 6	Total number of regular extracurricular activities (at least once a week for three months or more) study child has participated in, in the past week. The list of extracurricular activities are: community group, team sport, individual sport, art, academic classes, new skill classes, and religious activities.

Variable	Waves available	Definition
Warmth parenting		
Display physical affection	3 to 6	How often the parent has expressed affection by hugging, kissing, and holding the study child in the past six months. Answered on a scale of 1 to 5 where 1 is 'Never/Almost Never' and 5 is 'Always/Almost Always'.
Express happiness to child	3 to 6	How often the parent has told the study child how happy he/she makes them in the past six months. Answered on a scale of 1 to 5 where 1 is 'Never/Almost Never' and 5 is 'Always/Almost Always'.
Warm encounters with child	3 to 6	How often the parent has had warm, close times together with the study child in the past six months. Answered on a scale of 1 to 5 where 1 is 'Never/Almost Never' and 5 is 'Always/Almost Always'.
Enjoy doing things with child	3 to 6	How often the parent enjoyed listening to the study child and doing things with him/her in the past six months. Answered on a scale of 1 to 5 where 1 is 'Never/Almost Never' and 5 is 'Always/Almost Always'.
Close when happy or upset	3 to 6	How often the parent has felt close to the study child when he/she was happy and when he/she was upset in the past six months. Answered on a scale of 1 to 5 where 1 is 'Never/Almost Never' and 5 is 'Always/Almost Always'.
High warmth (20+)	3 to 6	We define a parent to have high warmth parenting style if they have rated themselves with a total of 20 or more points from the above 5 warmth parenting items.
Monitoring parenting		
Know child's friends' names and faces	3 to 6	How many of study child's close friends the parent knows by sight and by their first and last names. Answered on a scale of 1 to 5 where 1 is 'None of them' and 5 is 'All of them'.
Know child's friends' parents' names and faces	3 to 6	How many of study child's close friends' parents the parent knows by sight and by their first and last names. Answered on a scale of 1 to 5 where 1 is 'None of them' and 5 is 'All of them'.
Know where child is	3 to 6	How often the parent knows where study child is in the course of a day. Answered on a scale of 1 to 5 where 1 is 'Always' and 5 is 'Never'. We reverse code the scale such that 1 is 'Never' and 5 is 'Always', so that the scale is increasing in monitoring.
Know who child is with	3 to 6	How often the parent knows who the study child is with in the course of a day, when the study child is away from home. Answered on a scale of 1 to 5 where 1 is 'Always' and 5 is 'Never'. We reverse code the scale such that 1 is 'Never' and 5 is 'Always', so that the scale is increasing in monitoring.
Talk with child about their life	3 to 6	How often the parent talks to the study child about what is going on in his/her life. Answered on a scale of 1 to 5 where 1 is 'Always' and 5 is 'Never'. We reverse code the scale such that 1 is 'Never' and 5 is 'Always', so that the scale is increasing in monitoring.
Child goes out without telling	3 to 6	How often the study child goes out without telling the parent where he/she will be. Answered on a scale of 1 to 5 where 1 is 'Always' and 5 is 'Never'.
High monitoring (24+)	3 to 6	We define a parent to have high monitoring parenting style if they have rated themselves with a total of 24 or more points from the above 6 monitoring parenting items.
Parent's assessments		
Child's performance in school	3 to 6	How the parent would describe the study child's overall achievement at school. Answered on a scale of 1 to 5 where 1 is 'Excellent' and 5 is 'Well below average'.
Satisfaction with school	3 to 6	How satisfied the parent is with the school that the study child currently attends. Answered on a scale of 1 to 5 where 1 is 'Very satisfied' and 5 is 'Very dissatisfied'.

Variable	Waves available	Definition
Socioeconomic controls		
Child's age (years)	1 to 6	Study child's age in years.
Female child	1 to 6	Equals 1 if study child is female.
Child birth weight (kilograms)	1	Study child's weight at birth.
Number of siblings	1 to 6	Number of siblings study child has in the household.
2 Biological parents in household	1 to 6	Equals 1 if both study child's biological mother and biological father live at home with study child.
Female responding parent	1 to 6	Equals 1 if the responding parent is female.
Household gross income (AUD/week)	2 to 6	Usual weekly income (gross) earned by adults in the household.
University-educated parent(s)	1 to 6	Equals 1 if one or both parents of the study child has completed at least a bachelor's degree.
Migrant parent(s)	1	Equals 1 if one or both parents of the study child was not born in Australia.
Non-English speaking background parent(s)	1	Equals 1 if one or both parents of the study child comes from a non-English speaking background and speaks a language other than English at home.

Table B2. Categorization of Time Use Diary Activities Across Waves

Category	Wave 4	Wave 5	Wave 6
Educational-Related Activities	[41] Organised team sports and training i.e fooball, basketball, netball etc. [42] Organised individual sport i.e. swimming, dancing, martial arts, etc. [45] Scouts, girl guides, etc. [47] Going out to museums, cultural events, fairs, community events, church etc. [50] Non-Active Activities [52] Listening to music, CDs, playing music for leisure [53] Reading or being read to for leisure [55] Non-Active Club Activities i.e. Chess Club [58] Homework (not on computer) including music practice [61] Computer for homework – internet [62] Computer for homework – not internet [70] School Lessons	[40] Organised team sports and training [41] Organised individual sport and training [44] Active club activities [46] Going out to a concert, play, museum, art gallery, community or school event, an amusement park etc. [51] Listening to music [52] Playing musical instruments or singing for leisure [53] Reading or being read to for leisure [55] Non-active club activities [58] Doing homework (not via electronic devices) [60] Doing homework [70] School Lessons	[401] Archery / Shooting sports [402] Athletics / Gymnastics [403] Fitness / Gym / Exercise [404] Ball Sports [405] Martial arts / Dancing [406] Motor Sports / Roller Sports / Cycling [407] Water/Ice/Snow Sports [408] Organised team sports and training other [411] Archery / Shooting sports (individual) [412] Athletics / Gymnastics (individual) [413] Fitness / Gym / Exercise (individual) [414] Martial arts / Dancing (individual) [415] Motor Sports / Roller Sports / Cycling (individual) [416] Ball Sports (individual) [417] Water/Ice/Snow Sports (individual) [418] Organised individual sport and training other [440] Active club activities [462] Attendance at concert/theatre [463] Attendance at museum / exhibition / art gallery [464] Attendance at zoo / animal park / botanic garden [511] Listening to music

Category	Wave 4	Wave 5	Wave 6
			[521] Playing musical instruments or singing for leisure [531] Reading or being read to for leisure [551] Attend courses (excluding school /university) [552] Clubs [581] Doing homework (not via electronic devices) [601] Doing homework (electronic device) [701] School Lessons
Leisure Activities	[40] Active Activities [43] Ball games, riding a bike, scooter, skateboard, skipping, running, games and other free activities [44] Taking Pet for a walk [46] Shopping [48] Cinema [49] Live Sporting Events [54] Board or card games, puzzles, toys, art and craft, etc. [56] Doing nothing [60] Electronic media, games, computer use [63] Computer games – internet [64] Computer games - not internet [65] Xbox, Playstation, Nintendo, WII etc [66] Internet not covered elsewhere [67] TV/DVD	[42] Unstructured active play [43] Walking pets / playing with pets [45] Shopping [47] Religious activities / ritual ceremonies [48] Attending live sporting events [49] Active activities NEC [54] Unstructured non- active play [56] Doing nothing [59] Non-active activities NEC [61] Playing games [62] Watching TV programs or movies/videos [63] Spending time on social networking sites [64] Downloading/posting media (e.g music, videos, applications) [65] Internet shopping (excluding downloading/posting media)	[421] Archery / Shooting sports (unstructured) [422] Athletics / Gymnastics (unstructured) [423] Fitness / Gym / Exercise (unstructured) [424] Ball Sports (unstructured) [425] Martial arts / Dancing (unstructured) [426] Motor Sports / Roller Sports / Cycling (unstructured) [427] Water/Ice/Snow Sports (unstructured) [428] Unstructured active play Other [430] Walking pets/playing with pets [451] Shopping [452] Purchasing consumer goods [453] Purchasing durable goods [454] Window shopping [455] Purchasing repair services [456] Purchasing administrative services

Category	Wave 4	Wave 5	Wave 6
	[80] Communication [81] Talking face to face [82] Talking on a landline phone [83] Talking on a mobile phone [84] Texting, email, social networking such as Facebook or twitter [85] Skype or Webcam	[66] General Internet browsing (excluding homework) [67] Creating/maintaining websites (excluding social networking profile) [68] General application use (e.g Microsoft Office excluding homework) [69] Electronic device use NEC [80] Talking face-to-face (in person not via electronic devices) [81] Talking on a landline phone (not video chat) [82] Talking on a mobile phone (not video chat) [83] Video chatting (e.g Skype) [84] Texting/emailing [85] Online chatting / Instant messaging [86] Non-verbal interaction (e.g cuddles) [87] Negative face-to-face communication [88] Communication NEC	[457] Purchasing personal care services [458] Purchasing other services [461] Attendance at movies / cinema [465] Attendance at other mass events [466] Going out NEC [471] Religious practice [472] Weddings, funerals, rites of passage [473] Religious activities / ritual ceremonies NEC [481] Attending live sporting events [491] Active activities NEC [541] Chess, card, paper and board games / crosswords [542] Games of chance / gambling [543] Hobbies, collections [544] Handwork crafts (excl. clothes making) [545] Arts [548] Unstructured non-active play NEC [555] Religious groups [561] Doing nothing [591] Non-active activities NEC [611] Playing games (electronic device) [612] Playing games (Electronic device) nfd [621] Watching TV programs or movies/videos [631] Spending time on social networking sites [641] Downloading/posting media

Category	Wave 4	Wave 5	Wave 6
			[651] Internet shopping [661] General Internet browsing [671] Creating/maintaining websites [681] General application use [691] Electronic device use NEC [802] Talking face-to-face [811] Talking on a landline phone [821] Talking on a mobile phone [831] Video chatting [841] Texting/emailing [851] Online chatting / Instant messaging [861] Non-verbal interaction [871] Negative face-to-face communication [881] Communication NEC
Personal Care Activities & Sleep	[10] Eating/drinking [20] Personal care/hygiene [21] Bathing, dressing, toileting, teeth brushing, hair care etc. [22] Dentist, Doctor, Chiropractor, Physio etc. [57] Sleeping/napping	[10] Eating/drinking [20] Cleaning teeth [21] Showering/bathing [22] Getting dressed/getting ready [23] Personal care not elsewhere classified (NEC) [24] Doctor [25] Dentist [26] Physiotherapist / Chiropractor [27] Medical/Health care NEC [57] Sleeping/napping	[101] Eating/drinking [201] Cleaning teeth [211] Showering/bathing [221] Getting dressed / getting ready [231] Personal care NEC [241] Doctor [251] Dentist/Orthodontist [261] Physiotherapist / Chiropractor [271] Medical/Health care [281] Personal care/Medical/Health Care NEC. [571] Sleeping/napping (not end of day bed-time
Other Activities	[30] Chores	[0] Retailing (including fast food)	[1] Retailing

Category	Wave 4	Wave 5	Wave 6
	[31] Making own bed, tidying own room [32] Making, preparing own food [33] Getting self ready, packing own school or sports bag [34] Cleaning, tidying other rooms [35] Cooking, meal preparation, making lunch, setting table for others [36] Washing dishes, stacking and emptying dishwasher [37] Gardening, putting out the bin [38] Taking care of siblings, other children [39] Taking care of pets [90] Travel [91] By foot [92] By bike, scooter, skateboard etc. [93] By private car [94] Travel by public transport such as bus, taxi or aeroplane [99] Other	[1] Pamphlet delivering [2] Umpiring/refereeing [3] Car washing [4] Gardening / lawn mowing [5] Babysitting [6] Animal care [7] Working in a family business or farm [8] Work not elsewhere classified (NEC) [9] Volunteering [30] Cleaning/tidying [31] Laundry/clothes care [32] Food/drink preparation [33] Food/drink clean up [34] Gardening / lawn mowing [35] Animal care (excluding active play) [36] Home maintenance [37] Taking care of siblings [38] Chores NEC [90] By foot [91] By bike, scooter, skateboard etc [92] By private motor vehicle/bike [93] By public/chartered transport such as bus, taxi or aeroplane [94] Travel NEC [99] Other	[11] Hospitality (including fast food) [21] Clerical/office [31] Labourers and related workers [41] Gardening / lawn mowing [51] Babysitting [61] Apprenticeships/trades persons [71] Working in a family business or farm [81] Work Other [82] Umpiring (work) [83] Car washing (work) [84] Animal care (work) [91] Volunteering (work) [301] Cleaning/tidying [311] Laundry/clothes care [312] Clothes making [321] Food/drink preparation [331] Food/drink clean up [341] Gardening (maintenance chores) [342] Cleaning grounds/garage/shed/outside of house (chores) [344] Pool care (chores) [351] Animal care [361] Home maintenance [362] Design/Home Improvement [363] Heat/water/power upkeep [364] Car/boat/bike care [365] Selling/disposing of household assets [366] Rubbish/Recycling [367] Packing

Category	Wave 4	Wave 5	Wave 6
			[368] Household management Other
			[371] Taking care of siblings (chores)
			[381] Chores NEC
			[901] By foot
			[911] By bike, scooter, skateboard etc
			[921] By private motor vehicle/bike
			[931] By public/chartered transport
			[941] Travel NEC
			[981] Filling out the diary
			[971] Illegal activities
			[998] Uncodeable activity
			[991] Other

Table B3. Summary Statistics in the Estimation Sample

	Estimation sample		All test-takers		Diff.	
	Obs.	Mean	Obs.	Mean		
Everyday activities (times per week)						
Read with child	7,743	1.04	9,934	1.00	0.04	
Told child a story	5,050	1.17	7,072	1.16	0.01	
Drawn picture with child	5,050	0.53	7,072	0.52	0.01	
Music with child	5,050	1.42	7,072	1.44	-0.02	
Toys/games with child	5,050	0.83	7,072	0.82	0.01	
Everyday activities with child	7,746	2.73	9,940	2.74	-0.01	
Played outdoors with child	7,746	1.79	9,940	1.75	0.04	
Sum of activity days/week	5,047	9.11	7,066	9.08	0.03	
Parent-child outings (times last month)						
Gone to a playground/pool	9,808	0.59	12,820	0.58	0.01	**
Gone to concert, museum	9,808	0.46	12,820	0.46	0.00	
Attended a religious service	9,808	0.30	12,820	0.30	0.00	
Visited library	9,808	0.28	12,820	0.27	0.01	
Sum of activities last month	9,808	1.64	12,820	1.60	0.04	**
Material investments						
>30 books at home	5,050	0.74	7,072	0.73	0.01	*
Hired a tutor for child	7,022	0.15	9,807	0.16	-0.01	
No pocket money given to child	7,111	0.37	9,949	0.38	-0.01	
Extracurricular activities (times last week)						
Community group	4,484	0.10	6,276	0.10	0.00	
Team sport	4,484	0.48	6,276	0.47	0.01	
Individual sport	4,484	0.26	6,276	0.25	0.01	
Art etc.	4,484	0.32	6,276	0.31	0.01	
Academic classes	4,484	0.08	6,276	0.08	0.00	
New skill classes	4,484	0.03	6,276	0.03	0.00	
Religious activities	4,484	0.15	6,276	0.15	0.00	
Sum of extracurr. activities last week	4,484	1.42	6,276	1.40	0.02	
Warmth parenting (5-point scales)						
Display physical affection	9,327	4.30	12,274	4.28	0.02	**
Express happiness to child	9,335	4.01	12,282	3.99	0.02	*
Warm encounters with child	9,329	4.11	12,277	4.09	0.02	**
Enjoy doing things with child	9,337	4.27	12,285	4.26	0.01	
Close when happy or upset	9,333	4.36	12,280	4.34	0.02	
High warmth (20+)	9,318	0.72	12,264	0.71	0.01	**
Monitoring parenting (5-point scales)						
Know child's friends names/faces	9,675	3.68	12,662	3.65	0.03	*
Know child's friends' parents names/faces	9,675	3.29	12,662	3.25	0.04	***
Know where child is	9,692	4.65	12,680	4.64	0.01	
Know who child is with	9,692	4.57	12,680	4.55	0.02	**
Talk with child about their life	9,639	4.45	12,620	4.44	0.01	
Child goes out without telling	9,692	4.82	12,680	4.81	0.01	
High monitoring (24+)	9,622	0.75	12,600	0.73	0.02	**
Children's time use (daily minutes)						
Total time spent with either parent	6,490	210	9,066	211	-1.66	
Educational activities	6,490	259	9,066	260	-1.06	
Leisure activities	6,490	321	9,066	321	-0.30	
Sleeping & personal care	6,490	642	9,066	640	2.19	

	Estimation sample		All test-takers		Diff.	
	Obs.	**Mean**	**Obs.**	**Mean**		
Other activities	6,490	219	9,066	220	-0.79	
Children's NAPLAN-related variables						
Post-September LSAC interview	8,648	0.18	11,683	0.33	-0.15	***
Numeracy score	9,866	520	12,901	524	-4.63	***
Reading score	9,866	522	12,901	527	-4.31	***
Parent's assessments					0.00	
Child achievement in school	9,806	3.77	12,800	3.75	0.02	
Satisfaction with school	9,816	4.44	12,816	4.43	0.01	
Socio-demographic characteristics						
Child's age (years)	9,861	11.06	12,894	11.33	-0.27	***
Female child	9,866	0.49	12,901	0.49	0.00	
Child birth weight (kilograms)	9,765	3.42	12,766	3.42	0.00	
Number of siblings	9,857	1.59	12,890	1.58	0.01	
2 Biological parents in household	9,861	0.78	12,894	0.78	0.00	
Female responding parent	9,857	0.96	12,890	0.96	0.00	
Household gross income (AUD/week)	9,271	2,310	12,098	2,300	9.88	
University-educated parent(s)	9,866	0.46	12,901	0.45	0.01	
Non-English speaking parent(s) at birth	9,866	0.14	12,901	0.14	0.00	
Migrant parent(s)	9,866	0.33	12,901	0.33	0.00	

Table B4. The Groups of Parents Identified by Equation (4)

		The type of news parents (will) get when they receive NAPLAN score cards ($Bad\ News_{iw}$ and $Good\ News_{iw}$)		
		bad news	***no news***	***good news***
Parents are interviewed before receiving NAPLAN score cards ($Post_{iw}$)	***no***	$\widehat{\beta_2}$	Comparison group	$\widehat{\beta_1}$
	yes	$\widehat{\gamma_2}$	$\widehat{\beta_0}$	$\widehat{\gamma_1}$

Subgroups identified by Equation (4) estimates of $Investment_{iw} = \beta_0 Post_{iw} + \beta_1 Good\ News_{iw} + \beta_2 Bad\ News_{iw} + \gamma_1[Post_{iw} \times Good\ News_{iw}] + \gamma_2[Post_{iw} \times Bad\ News_{iw}] + \tilde{\gamma}' Weather_{iw} + \tilde{\delta}_w + \tilde{\delta}_{Region} + \tilde{\delta}_{Age} + \tilde{\varepsilon}_{iw}$ *after adding weather controls, and after accounting for wave, region and age fixed effects. All effects are interpreted relative to the comparison group.*