Good News, Bad News: Parents' Responses to their Children's Achievement Test Scores*

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We estimate the causal impact of informing parents about their children's academic achievement on various parental investments using quasi-experimental variation in the timing of the release of national standardized test score report cards. The release of report cards leads to a 44 percent increase in private tutoring and a 22 percent reduction in extracurricular activities, and has no effect on other parental investments, including parenting style. The release of report cards also leads parents to have more modest beliefs about their child's academic achievement. Using forecasted vs actual score comparisons, we show that most effects are primarily driven by receiving unexpectedly "bad" child performance news. The effects are also stronger among children attending public schools. Our findings suggest better information could help close socioeconomic gaps in student achievement.

Keywords: Parental investments; test score information; beliefs; 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 and what affects it to help explain socio-economic disparities in human capital investments (Boneva & Rauh 2018; Dizon-Ross 2019). A natural way to realign parental beliefs and child achievement is to provide information to parents through the school system, yet we know little of how this information affects parental investments across the socioeconomic gradient.

Our objective is to estimate the causal impact of objective information receive through the school system 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 which 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

[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.

objective information about their child's individual test results in several domains (e.g., literacy, numeracy, writing). Interviews occur in the same years 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 identifying the 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 participated 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 on children's time use, which is overall affected by parents' receipt of their child's NAPLAN leading to 21 minutes less leisure time for children each week.

These changes in parental investments can be understood in part through the way that NAPLAN reports alters parents' perceptions of their child's academic achievement. When asked directly, Australian parents are generally optimistic about their child's school performance; only 5.1 percent of LSAC parents report that their child is either below or well below average, while fully 60.3 percent believe that their child is above or well above average. The receipt of NAPLAN results, however, leads parents to be significantly more modest in their views of child's relative achievement. Some parents appear to initially holding inaccurate beliefs about their child's performance, but then update those beliefs in the face of new information (see Dizon-Ross 2019). It could also be that NAPLAN reports also affect parents' perceptions of their children's school quality (see Greaves et al. 2019). We show that parents are overwhelmingly positive about their child's school and receiving NAPLAN reports lowers their school satisfaction.

The way that parents respond to their child's NAPLAN reports will likely depend on whether parents received good news, bad news, or no real news regarding their children's school performance. To explore this, we start 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 regardless of whether the news is good or bad. Parents also adjust the time their children spend in educational and leisure activities in response to either bad or good news. Bad news alone, however, drive the reduction in extracurricular activities, and they are also at the heart of parents' increased pessimism about their child's achievement level and their reduced school satisfaction. Together, these results are best explained by a model where parents compensate for bad news about their children's test scores, yet also reinforce good news—and where these are potentially not the same parents.

Finally, we estimate a series of heterogeneous effect models to shed light on two key issues: the relative importance of parental beliefs about child achievement and parental school satisfaction as response mechanisms, and the socioeconomic gradient in parental responses to NAPLAN reports. For 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 NAPLAN performance of their child's school. Interestingly, the reduction in children's leisure time and perceived school quality following the release of NAPLAN reports occurs only in jurisdictions where school information is *not* shown. This suggests that the information content of NAPLAN that parents respond to is information on their child, and that showing additional school information can muddle the signal. We discuss why that could be the case below. For the second exercise we estimate heterogeneous effects of NAPLAN reports high- vs. low-income families and across public vs. private school sectors. We find that low-income and public-school parents respond much more strongly than other parents to the information that NAPLAN reports provide, suggesting that they may have less informed about their children's achievement than high-income and private-school parents. Parental responses to "news" also differs in public- and private-school families; good news may be new information for many public-school parents, while it is poor performance that seems to be new information for private-school parents.

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 show the impact of providing easily understandable report cards on parental investments in well-developed economies, extending results in developing economies by Andrabi et al. (2017) and Dizon-Ross (2019). The fact that report card information still shifts parental investments 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. We additionally produce evidence of the asymetric effect of "bad news," "good news" and "no news" on investments, beliefs on child achievement and school satisfaction, on average and across the socioeconomic spectrum. Our results suggest heterogenous responses to information across parents consistent with different motives—or different parents—driving behavioral reactions to information about child achievment. 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 on both child and school performance, and that we are able to link these information shocks to parental beliefs and school satisfaction reports. The lack of response to report card infromation when school performance is also provided is further consistent with the local distortions discussed in Kinsler and Pavan (2020). These local distortions should be considered when designing contact systems between parents and schools that maximize parental engagement and responsiveness.

Our findings are particularly timely and useful in 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 investment decisions.

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 a rich source of biennial information on 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]

Our data are extremely rich; it combines detailed longitudinal interview data from the children's parents, teachers, and later on the children themselves, 24-hour time use diaries with extremely granular information on how children spend their time, and linked information on the National Assessment Program - Literacy and Numeracy (NAPLAN) of the children and of 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 day.

NAPLAN test scores are designed to track student level and progress over time and across cohorts in 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

[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.

[4] For an in-depth description of the way NAPLAN assessment scales are constructed see Appendix A.

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, and State and Commonwealth education departments, teachers, and parents use NAPLAN results to ensure academic standards are being met. We show the distribution of NAPLAN numeracy scores across different grade levels in Figure 1. The within-grade variation and the natural grade progression in scores can be clearly seen in the figure.

[Figure 1 here]

All students in relevant grades in Australia take the NAPLAN test on the same three days in May each year. Once graded, individual NAPLAN report cards 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 report card to take home to their parents.[5]

NAPLAN report cards present test score information in an intuitive way and include additional guidance and instructions on how to interpret this information.[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 20 – 80 percentile score range. In the states of Queensland, Western Australia and South Australia, the report cards also show the average for 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]

[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. 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, and combine the rich information on the interactions that parents have with their children in LSAC to produce several measures for 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 out of 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 sum of the time each child spends with either parent in a day, as well as summary measures of the time spent at-home and out-of-home activities as the sum of activity-days in each category 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.

We also use time use diary data to construct measures of how children allocate their time across activities since these measures can also be directly affected by parents. The LSAC contains 24-hour time use diaries that are filled out by each study child, describing how they spent their time in weekdays and weekends. Each child as asked to record their daily activities as well as the start times and end times of each activity, from the moment they wake up to the moment they go to bed at night. In each wave there is a list of activities children can choose from, including eating, doing chores, doing homework, listening to music, playing sports, etc. We aggregate these activities into four distinct types: i) educational-related, ii) leisure, iii) sleep & personal care, and iv) other.[9] For each type we sum up the total daily time spent in all activities. 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 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; and iii) providing a weekly allowance, and iv) the number of extracurricular activities, such as team sports or art classes, the child participates in (most likely financed by parents). We analyze the first three indicators separately, and sum of all weekly days if extracurricular activities. In our sample 74 percent of children 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.

Regarding parenting style, we consider two key dimensions: i) warmth and ii) control.[10] Parenting warmth combines five items measuring whether parents display acceptance and affection towards their children. Each is answered on a 5-point scale (from "never" to "almost always"). Parenting control combines six items (also ranked on a 5-point scale) measuring 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.

At various points in our analyses we also control for 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), as well as controls for weather (monthly averages of daily maximum temperature and the number of rainy days at the state level).

[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 restrictions. First, we exclude children who do not take their NAPLAN test in the same year the LSAC interviews are conducted—mostly 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 the differences between the two groups. We see 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 report cards 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 the NAPLAN results to parents (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 schools, we do know 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 staff for school administration, and a process for giving students their

individual reports to take home is established.[11] Consequently, we assume that schools do not work quickly enough to provide results to parents by August and that parents responding to LSAC in January through August have not 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 here]

There is also 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-experiment should result in causal estimates so long as two key identifying assumptions are met. 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, as it did not include in its considerations anything related to NAPLAN. In fact, the sampling design was implemented years before NAPLAN even 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, beginning 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]

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

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 report card information. 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 around September which means some parental time investments can 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, one can think of parents—within the same calendar year and geographical region, and exposed to the same weather—interviewed in January through August as our control group and parents interviewed in October through December as our treatment group.

We investigate the empirical validity of our identifying assumptions by running a series of balancing regressions to assess whether our treatment and control groups are similar in other 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 $Post_{iw}$. $Weather_{iw}$ are weather controls, whereas δ_w and δ_{Region} represent unobserved heterogeneity fixed at the wave and region levels, which we account for via two-way fixed effects. We vary the inclusion of these controls 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 pre-determined characteristics of

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).

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 initial 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 imbalanced 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. However, this is purely mechanical: 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.

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 find no such differences once we add wave and region fixed effects.

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 string evidence that our treatment assignment is as good as random, supporting our quasi-experimental design.

[Table 1 here]

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 specification:

$$Investment_{iw} = \theta Post_{iw} + \tilde{\gamma}' Weather_{iw} + \tilde{\delta}_w + \tilde{\delta}_{Region} + \tilde{\delta}_{Age} + \tilde{\varepsilon}_{iw} \qquad (2)$$

where $Investment_{iw}$ are the investments made by parent i in wave w and, in addition to our balancing controls discussed above, we account for child age differences $\tilde{\delta}_{Age}$ with an additional

set of fixed effects for child age in months. These controls are helpful in ensuring that our results are not confounded by differences in the age at which children are tested.[14] We further consider specifications that control for lagged values of our outcome variables as well as family-level socioeconomic characteristics as controls (see Appendix Table B1 for full details). While not crucial for our identification strategy, these additional controls increase the precision of our estimates in some cases.

4. Parental Responses to Children's Achievement Test Scores

4.1 Parental Investments

We find that parents respond to information about their child's academic achievement by modifying their investment choices. Specifically, the release of NAPLAN test scores significantly increases the use of private tutoring and decreases the number of extracurricular activities that children engage in each week (see Table 2). Both responses are economically important. Tutoring increases almost 50 percent relative to the mean; 21.6 percent of parents interviewed post-September enroll their child in tutoring, compared to 15 percent of parents in the estimation sample. Similarly, the fall in extracurricular activities is a little over 20 percent; children interviewed post-September undertake 1.1 extracurricular activities per week in comparison to an average of 1.4 weekly activities across the entire sample. Thus, when better informed about their child's actual performance, parents increase their investments in private tutoring and reduce their child's extracurricular activities.

One interpretation of our results is that parents are altering their investment choices in the hopes of motivating children to put more time and effort into their studies. 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). In particular, our results are consistent with Weinberg (2001) who models parents' use of financial investments to

[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.

solve the agency problems associated with children's provision of effort. Interestingly, we find that the release of NAPLAN reports does not affect the time that parents spend with their children; nor does it influence the extent to which they adopt a parenting style that is characterized by high warmth or strict monitoring.[15] Parents' responses appear to be largely financial.

[Table 2 here]

At the same time, it is reasonable to expect that parents may also react to the release of NAPLN results by restricting the way that children spend their own time (Becker 1965). Children generally have only limited agency in the decisions affecting them, putting their time use squarely in the hands of their parents. Adolescents, on the other hand, can be characterized as separate economic agents with the power to affect family outcomes (Lundberg et al. 2009); influencing their time use requires more complex incentive structures.[16] Parents shape their young and adolescent children's time use through numerous mechanisms including set bed times, restrictions on internet access or screen use, curfews, and mandated study time. Cosconati (2011) provides evidence that parental rather than child control of curfews, for example, increases the study time of children with low levels of effort; but decreases the study time of high-effort children. This makes the degree of monitoring and control that parents adopt very important since the way that children's time is allocated affects their cognitive and non-cognitive development (Fiorini & Keane 2014). Parental control – and the gradual sharing of decision making – can be seen as a form of investment in children's development (Lundberg et al. 2009).

We consider this issue using measures of children's time use constructed through 24-hour time use diaries. This is a major strength of the LSAC data we analyze; very few studies provide shed light on the way that children spend their time (Fiorini & Keane 2014). In particular, these measures allow us to observe how the time children spend in key activities changes once NAPLAN test scores become available. Specifically, we follow the same estimation strategy as outlined in Section 3.4 using weights to account for weekday vs. weekend diaries and considering four

[15] It is important to note that the lack of evidence for parental responses in these investments is not due to a lack of statistical power. Our null effects are estimated precisely. Based on ex-post Minimum Detectable Effect (MDE) calculations, for example, we are able to rule out effects of NAPLAN information as small as 31 minutes a day spent with their child; 9 percentage points in the probability of having more than 30 books at home; and 7 percentage points in the probability of being a high-warmth parent. In our MDE calculations, we find the smallest effect that could be detected with 95% confidence and 80% power.

[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.

mutually-exclusive types of activities (educational, leisure, personal care and sleep, other).[17] Results are presented in Table 3.

The average time use in the four activity types sum to 1440 minutes per day. Positive coefficients on the post-September interview indicator can be interpreted as a substitution towards spending time in that activity; negative coefficients imply a substitution away from an activity. We find that the release of NAPLAN reports leads children to significantly reduce the time they spend in leisure activities by 21.3 minutes each day. Children re-allocate that time across all three other types leading them to spend more time on educational and other activities as well as in sleeping and personal care. These effects are not statistically significant; however, this lack of statistical significance is not due to lack of power.[18] Interestingly, the significant impact of NAPLAN information on the number of extracurricular activities children participate in (Table 2) is not accompanied by a significant increase in the time children devote to extracurricular activities (Table 3). Parents may be responding to their child's NAPLAN reports by encouraging children to focus their time and energy on fewer activities, while at the same time increasing the intensity of their engagement with each activity.

[Table 3 here]

4.2 Parental Beliefs

Parents' views about their child's academic achievement and the quality of the schools their children attend are an important determinant 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 further encouraging high achievement. At the same time, a parent who believes that their child under-performing relative to their peers may seek to ameliorate this disparity by investing in additional educational resources in compensation; these additional resources may come at the cost of a

[17] Specifically, the children in our sample are asked to fill out a time use diary for a specific day of the week – this could either be a weekday or a weekend day. Thus, in our regressions we use a frequency weight of 5 if the child completed a weekday diary; the frequency weight is 2 if the child completed a weekend diary (Mohal et al. 2020).
[18] We find relatively precise null effects and can rule out effects as small as 34.6 minutes in extracurricular activities, 16.1 minutes in sleep and personal care, and 20.4 minutes in other activities.

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.

Parents' beliefs about their child's relative academic achievement generally align with children's actual NAPLAN performance. Specifically, Figure 3 depicts the proportion of children with NAPLAN numeracy scores above the national average for their grade level by parents' perceptions of their relative school performance. The proportion of parents believing that their child is "well below average", "below average", "average", etc. is reported in square brackets along the x-axis. The proportion of children with above-national-average NAPLAN numeracy results (and 95 percent confidence intervals) are given in the vertical bars. There is clearly a positive relationship between the beliefs that parents hold and the results their children actually achieve. At the same time, it also seems that parents are overly optimistic about their child's performance in school. Approximately 94 percent of parents believe their child is performing at or above their school average, which is highly unlikely given the bell-shaped distribution of NAPLAN scores (see Figure 1) and the representativeness of the LSAC data. In fact, at least one fifth of children whose parents believe they are performing well above the school average actually have below-national-average NAPLAN numeracy scores.[19]

[Figure 3 here]

This raises the question: Do parents update their beliefs about their child's relative school performance and the quality of their child's school when they are provided with accurate information about their child's skill levels? We address this question by estimating the impact of NAPLAN reports on parental beliefs. Results are reported in Table 4. We find 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 4). On average, parents interviewed after the release of NAPLAN reports rate their child's relative performance as 0.08 points (on a 5-point scale) lower than parents interviewed earlier, a difference that is statistically significant at the 10% level. The significant increase (2.7 percentage points) in the likelihood of rating children as "below average" suggests that some parents who might have rated their children as "average" in the absence of NAPLAN information instead rate their children as "below average" once NAPLAN results are

[19] Previous research suggests that parents also over-estimate children's effort in school (Bergman 2021).

available. Given the descriptive evidence that parents are likely overly optimistic about their child's relative performance (see Figure 3), our results are consistent with NAPLAN reports partially correcting parents' informational bias.

[Table 4 here]

Parents also revise their perceptions of schools after receiving objective information on their child's academic achievement. Specifically, the release of NAPLAN reports leads parents to reduce their overall satisfaction with their child's school by 0.09 points (on a 5-point scale) (bottom panel Table 4). This drop in satisfaction is statistically significant at the 5% level and is likely driven by parents moving from being "very satisfied" to being merely "satisfied". 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 fundamentally depend on the nature of the information they receive. Well-informed parents may learn very little that they already did not know, giving them little incentive to adjust their existing 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 quite nuanced 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 conducting a series of analyses that allow us to isolate 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 academic performance. Each child's current NAPLAN numeracy score is forecasted using information about their previous test scores and parents' prior assessments of their academic performance. We then estimate the impact of the release of NAPLAN numeracy scores on three separate groups of parents – those who received "good news", those who received "bad news", and those who received "no news". Specifically, we use the following linear model to generate an estimate of parents' expectation for their child's NAPLAN scores:

$$NAPLAN_{i,w} = f(NAPLAN_{i,w-1}, Child\ Assessment_{i,w-1}, \gamma_{Region}, \gamma_w) + \varepsilon_{iw} \qquad (3)$$

where $NAPLAN_{iw}$ is the NAPLAN numeracy score of child i in wave w and $Child\ Assessment_{i,w-1}$ is their parent's assessment of their performance one wave prior. The model is estimated using our sample of non-treated parents with pre-September interviews so that our estimates are not affected by recently released NAPLAN results. Using the regression coefficients obtained from the pre-September sample, we construct individual-specific forecasted scores $\widehat{NAPLAN}_{i,w}$ (and standard errors of the forecast) for the entire estimation sample. We then create three new mutually exclusive categorical variables, $Good\ News_{i,w}$, $Bad\ News_{i,w}$, and $No\ News_{i,w}$. Specifically, $Good\ News_{i,w}$ 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. Our model results in 74 percent of parents getting "no news" and the rest of parents getting either "good news" (13 percent) or "bad news" (13 percent).

The relationship between predicted and realized NAPLAN numeracy scores is depicted in Figure 4. Precited scores are shown along the x-axis in ten 50-point intervals across the score distribution. The grey bars present the 2-standard-forecast-error band for each score. They largely straddle the 45-degree line suggesting that our model is forecast-unbiased across the score distribution – generally, the realized NAPLAN numeracy scores (y-axis) lie close to the forecasted scores. The blue dots illustrate "good news" – realized NAPLAN scores above the forecasted bands; the green and red dots illustrate "no news" and "bad news" respectively.

[Figure 4 here]

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:

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

The model given in equation (4) allows us to isolate the effect of both i) the timing (before vs. after the LSAC interview) and ii) the news content (positive, negative, and none) of the information that parents receive once their child's NAPLAN report arrives. Specifically, $\widehat{\beta_0}$ identifies the difference in the investments of parents who have received a NAPLAN report with no news (i.e., actual scores are within the 2-standard-error band of the forecasted score) by the time of their LSAC interview relative to those of parents who *will* receive no news but have not yet done so because they were interviewed before NAPLAN reports are released. Similarly, the difference in the investments of parents who have received good news and who *will* receive good news is identified by the difference $\widehat{\gamma_1} - \widehat{\beta_1}$, while $\widehat{\gamma_2} - \widehat{\beta_2}$ captures the difference in investments of parents who have received bad news and parents who *will* receive bad news. These estimated differences are reported in Tables 5 and 6.[20]

[20] 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 positive rather than no news ($\widehat{\beta_1}$) or between parents who will eventually receive

Table 5 reports the estimated effect of the information content of NAPLAN on time and monetary parental investments, as well as parenting styles. We find that all parents – irrespective of the type of news they get – significantly increase their investments in private tutoring following the release of their child's NAPLAN numeracy test scores. Parents receiving either good news or bad news increase their hiring of private tutors by almost identical proportions (approximately 8.5 percent), while those receiving no news also increase their use of private tutors though to a lesser extent (5.6 percent) (see column 5). Taken together, our results indicate that the receipt of objective information about children's educational achievement may focus parents' attention on their child's education prompting them to increase their financial investments, regardless of the news content of that information. 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.

Interestingly, it is parents receiving either bad or no news who respond to NAPLAN information by reducing their child's weekly extracurricular activities (column 7), while parents who receive bad news also spend significantly less time with their children (column 1) and are less likely to provide allowance to their children (column 6). Parents often use the withdrawal of allowance as an incentive mechanism in molding their child's behavior (see Weinberg 2001), making it likely that parents react to bad news by disciplining their child. At the same time, we find no evidence that the way that parents generally parent their children is affected by the receipt of NAPLAN information (columns 8 and 9).

[Table 5 here]

Table 6 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

bad news rather than no news ($\widehat{\beta_2}$). Appendix Table B4 maps the coefficients in equation (4) to the parental groups they isolate in the data.

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.

[Table 6 here]

In Table 7, we report the estimated effect of NAPLAN's new content on parents' beliefs about their child's performance and on their satisfaction with their child's school. We find that it is bad news that is driving parents' pessimism about their child's relative performance (top panel Table 7). On average, when parents receive bad news, they downgrade their rating of their child's relative numeracy performance by 0.186 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. We also observe that parents who are unsurprised by their child's NAPLAN results nevertheless downgrade their ratings of their child and are more likely to rate their child as "below average". Receiving good news, however, does not lead to any significant change in parents' beliefs about their child's performance at school.

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 (bottom panel Table 7). 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.[21]

[Table 7 here]

[21] 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. Consequently, we replicate Figure 3 as well as Tables 5 and 6 by using reading scores instead of numeracy scores to categorize parents into groups that receive "bad news", "no news", and "good news". We report these direct comparisons in Figure A1, Table A1, and Table A2 respectively. Whilst little differences arise from using reading scores to characterize the information content of children's NAPLAN reports, we note that the results in Tables A1 and A2 are somewhat weaker compared to that of Tables 5 and 6.

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' investment responses in states that do and do not report average NAPLAN scores at the school-level. Specifically, 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. 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 within their age cohort. In other states, parents only find out how well their child's school has performed afterwards, when school averages are reported on the My School website. If we notice a stronger effect of receiving NAPLAN results in states that report school averages, this could be suggestive that parents are, on average, overestimating the quality of their child's schools and that NAPLAN is providing information to allow them to update their beliefs to become more accurate. Our focus is on the parental investments and beliefs that respond significantly to NAPLAN information – i.e. tutoring, number of extracurricular activities, rating of child's performance, and satisfaction with school. Regression estimates of the effect of NAPLAN information on a smaller subset of parental investments are reported in Table 8, separately for parents of the two state types.

Fully 30 percent of children received NAPLAN reports that showed their performance relative to their school cohort. Parents receiving this information altered their use of private tutors (columns 1 and 2), the number of extracurricular activities their child engaged in (columns 3 and 4), their perceptions of their child's performance (columns 7 and 8), and their satisfaction with their child's school (columns 9 and 10) in the same way as parents who did not. School-level NAPLAN information is, however, linked to the decisions parents make regarding their children's leisure time (columns 5 and 6). Parents who do not know how well their child has performed relative to their school cohort respond to NAPLAN information by significantly reducing their child's leisure time. On the other hand, parents who understand how their child has performed relative to the school average do not alter their child's time use. This suggests that parents are responding to new information about the quality of their child, and not their child's school. It also explains why we do not see any differences across the state types in parents' satisfaction with their

child's school (columns 9 and 10). Heterogenous effects on this investment are also observed when we separate parents by news types. Regardless of whether parents received bad news, no news, or good news, parents who do not see their child's performance relative to their school respond more strongly by reducing their child's time in leisure activities. 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.

[Table 8 here]

5.3 Heterogeneity in Baseline Information

Finally, we conclude our analysis by investigating how parents' behavioral 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 parental involvement and parent-school collaboration are important indicators of private school choice – parents who are more likely to consider private schools both 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 who consider private schools are somewhat dissatisfied with the amount of involvement and communication they perceive to exist between home and school in the public school system and are attracted to private schools for more opportunities of involvement and communication. The literature also suggests that private school parents do get what they pay for – Feuerstein (2000) finds evidence 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 expect that private school parents likely have more information than public school parents at baseline and so we expect that

NAPLAN provides less new information to private school parents and as such, they would respond less strongly to the release of NAPLAN results.

Table 9 reports the estimated effect of NAPLAN information in subsamples separated by school type. Fully 22 per cent of children in our estimation sample attend private schools. Overall, we observe no heterogenous effects of NAPLAN information on parental responses 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, we observe a larger proportional increase in private tutoring by treated public school parents compared to private school parents. Fully, 14 percent of public-school parents enroll their children in private tutoring whilst 20 percent of private school parents do. After receiving NAPLAN information, public school parents are 6.6 percent more likely to enroll their children in private tutoring, compared to non-treated public-school parents who have not received their child's NAPLAN results (column 1). This is a 47 percent increase in the likelihood of private tutoring relative to the mean, compared to a 35 percent increase in the likelihood, relative to the mean, of treated private school parents enrolling their children in private tutoring. Similarly, as a result of receiving NAPLAN information, treated public school parents reduce their children's leisure activity time by 8.6 percent compared to the mean whereas treated private school do so by only 4.4 percent. 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.

Public- and private-school parents also respond different to the news content of their children's NAPLAN scores. Private school parents who receive bad news significantly decrease the amount of time their children spend on leisure activities by 136 minutes a day (column 6) whereas public school parents who receive bad news do not significantly alter their child's time in leisure activities. On the other hand, public school parents who receive good news significantly decrease their children's time spent on leisure activities by 73 minutes a day (column 5), whilst private school parents who receive good news do not respond to the new information significantly. These results are interesting, as they can help inform what is considered new information to the two types of parents. The results suggest that receiving bad news is news for private school parents,

whereas receiving good news is news for public school parents. Private school parents may be expecting good results from their children, and so when they get bad news from NAPLAN, they alter their investments to compensate for this poor performance. When they receive the good news, they do not change their investments as their children are performing as expected. Public school parents on the other hand, may expect bad news from their children, and so bad news from NAPLAN comes as no shock, leading them to not change their investment strategies. However, when they receive good news, public school parents may want to reinforce the good performance they observe by altering their investments.

Public-school parents who receive bad news also respond by significantly downgrading their rating of their child's performance, compared to public school parents who do not receive NAPLAN results by the time of their interview. Private-school parents on the other hand, do not change their rating of their child's performance in response to bad news. This heterogeneity between parent types could be explained by higher involvement of private school parents in their children's education (Feuerstein 2000). As a result of this involvement, private school parents may have a clearer idea of their child's academic performance compared to public school parents, and as such, do not let a piece of bad news affect their beliefs on their child's quality. Public school parents may hold beliefs on their children that are more susceptible to bad news since they less involved in their children's education and as such do not formulate robust beliefs on their child's quality.

[Table 9 here]

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 performance 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 lowest quartile of earnings with households in the quartiles above. We define low-income parents as parents with a household income in the lowest quartile in our estimation sample, and high-income parents as parents in the second, third, or highest quartile in our estimation sample.

Table 10 reports the estimated effect of NAPLAN information in subsamples separated by the first quartile income line. Overall, we find the effects of NAPLAN information on parental responses to be similar across income levels in all outcomes except for time spent in leisure activities – parents who earn above and below the first quartile income level do not react to NAPLAN information significantly differently from each other, except that low-income parents do respond more strongly to NAPLAN information by sharply reducing their child's time spent in leisure activities compared to high income parents. 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.

Low-income parents who have received their child's NAPLAN report by the time of their interview reduce their child's time spent in leisure activities by 44 minutes a day (a reduction of 13 percent relative to the mean), compared to low-income parents who have yet to receive the NAPLAN results at the time of interview. On the other hand, high income parents reduce their child's daily time spent in leisure activities by 17 minutes a day as a result of receiving NAPLAN results (a reduction of 5 percent relative to the mean). It could be that the leisure activities that parents are restricting in response to the NAPLAN involve some monetary investments as well, such as going shopping and going to the cinema (see Table B2 for the categorization of our variables from children's time use diaries) and hence, low-income parents, with a tighter budget constraint, respond more strongly by reducing the time their children spend in these activities.

Further separating parents by the type of news they receive, we again observe differences between how low- and high-income parents respond to news by altering their children's time spent in leisure activities. Low-income parents who receive no news through the NAPLAN reduce their children's time spent in leisure activities by 37 minutes a day, whereas high income parents who are not surprised by their child's NAPLAN results reduce their time spent in leisure activities by only 7 minutes a day. The heterogeneity in the responses of low- and high-income parents to no news are in line with our hypothesis that high income parents respond less strongly to NAPLAN results compared to low-income parents as a result of high-income parents having more information at baseline compared to low-income parents. The results we observe suggest that the NAPLAN informational content seems to be newer to low-income parents even when their child has performed as expected and the results provide no news as such.

[Table 10 here]

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 children's performance. To summarize our results, we find that receiving these report cards:

- 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) beliefs about their children's academic 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 those report cards, and when we explore heterogeneity across the socioeconomic gradient, we find evidence that:

- the increases in private tutoring, children's educational activities, and on parents beliefs about their children's achievement are driven by all types of news (good, bad and no news);
- the decrease in extracurricular activities are mainly driven by bad news;
- most 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 performance. 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 beliefs about their children's academic 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 performance because they *want it to be so*, often regardless of whether these beliefs are accurate. The transparent information in NAPLAN report cards 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.

References

ACARA. (2021). *National Protocols for Test Administration.* Australian Curriculum Assessment and Reporting Authority.

Andrabi, T., Das, J., & Khwaja, A. I. (2017). Report cards: The impact of providing school and child test scores on educational markets. *American Economic Review, 107*(6), 1535–1563.

Attanasio, O., Boneva, T., & Rauh, C. (2019). *Parental beliefs about returns to different types of investments in school children* (NBER Working Paper Series No. w25513).

Attanasio, O., Cunha, F., & Jervis, P. (2019). *Subjective Parental Beliefs. Their Measurement and Role* (NBER Working Paper Series No. w26516).

Australian Bureau of Statistics. (2016). *Australian Statistical Geography Standard (ASGS): Volume 1 - Main Structure and Greater Capital City Statistical Areas* (ABS Catalogue No. 1270.0.55.001).

Baumrind, D. (1966). Effects of Authoritative Parental Control on Child Behavior. *Child Development, 37*(4), 887-907.

Becker, G. S. (1965). A Theory of the Allocation of Time. *The Economic Journal, 75*(299), 493-517.

Becker, G. S., & Tomes, N. (1976). Child Endowments and the Quantity and Quality of Children. *Journal of Political Economy, 84*(4, Part 2), S143–S162.

Bergman, P. (2021). Parent-child information frictions and human capital investment: Evidence from a field experiment. *Journal of Political Economy, 129*(1), 286-322.

Bergman, P., & Chan, E. (2017). *Leveraging technology to engage parents at scale: Evidence from a randomized controlled trial* (CESifo Working Paper Series No. 6493).

Black, S. E. (1999). Do better schools matter? Parental valuation of elementary education. *The Quarterly Journal of Economics, 114*(2), 577-599.

Bonesrønning, H. (2004). The determinants of parental effort in education production: Do parents respond to changes in class size? *Economics of Education Review, 23*(1), 1–9.

Boneva, T., & Rauh, C. (2018). Parental Beliefs about Returns to Educational Investments—The Later the Better? *Journal of the European Economic Association, 16*(6), 1669–1711.

Bono, E. D., Francesconi, M., Kelly, Y., & Sacker, A. (2016). Early maternal time investment and early child outcomes. *The Economic Journal, 126*(596), F96-F135.

Bourdieu, P. (1977). Cultural reproduction and social reproduction. In J. Karabel & A. H. Halsey (Eds.), *Power and ideology in education* (pp 487-511). New York: Oxford University Press.

Carneiro, P., Galasso, E., Lopez Garcia, I., Bedregal, P., & Cordero, M. (2019). *Parental Beliefs, Investments, and Child Development: Evidence from a Large-Scale Experiment* (IZA Discussion Paper Series No. 12506).

Carolan, B. V., & Wasserman, S. J. (2015). Does parenting style matter? Concerted cultivation, educational expectations, and the transmission of educational advantage. *Sociological Perspectives, 58*(2), 168-186.

Chang, S., Cobb-Clark, D. A., & Salamanca, N. (2020). Parents' Responses to Teacher Qualifications. *IZA Discussion Paper Series*, No. 13065. Institute for the Study of Labor (IZA).

Cheadle, J. E., & Amato, P. R. (2011). A quantitative assessment of Lareau's qualitative conclusions about class, race, and parenting. *Journal of Family Issues, 32*(5), 679-706.

Clark, D., Martorell, P., & Rockoff, J. (2009). *School Principals and School Performance.* (National Center for Analysis of Longitudinal Data in Education Research Working Paper No. 38).

Cobb-Clark, D. A., Salamanca, N., & Zhu, A. (2019). Parenting style as an investment in human development. *Journal of Population Economics, 32*(4), 1315–1352.

Cosconati, M. (2011). *Parenting Style and the Development of Human Capital in Children* (Society for Economic Dynamics Meeting Papers No. 854).

Crook, C. J. (1997). *Cultural practices and socioeconomic attainment: The Australian experience*. Connecticut: Greenwood Publishing Group.

Cunha, F. (2015). Subjective Rationality, Parenting Styles, and Investments in Children. In P. R. Amato, A. Booth, S. M. McHale, & J. Van Hook (Eds.), *Families in an Era of Increasing Inequality* (pp. 83–94). Cham: Springer.

Cunha, F., & Heckman, J. (2007). The technology of skill formation. *American Economic Review, 97*(2), 31-47.

Darling, N., & Steinberg, L. (1993). Parenting Style as Context: An Integrative Model. *Psychological Bulletin, 113*(3), 487–496.

Das, J., Dercon, S., Habyarimana, J., Krishnan, P., Muralidharan, K., & Sundararaman, V. (2013). School Inputs, Household Substitution, and Test Score. *American Economic Journal: Applied Economics, 5*(2), 29–57.

Davis-Kean, P. E. (2005). The influence of parent education and family income on child achievement: the indirect role of parental expectations and the home environment. *Journal of Family Psychology, 19*(2), 294.

Delaney, L., & Doyle, O. (2012). Socioeconomic differences in early childhood time preferences. *Journal of Economic Psychology, 33*(1), 237-247.

Dizon-Ross, R. (2019). Parents' Beliefs about Their Children's Academic Ability: Implications for Educational Investments. *American Economic Review, 109*(8), 2728–2765.

Doepke, M., & Zilibotti, F. (2017). Parenting With Style: Altruism and Paternalism in Intergenerational Preference Transmission. *Econometrica, 85*(5), 1331–1371.

Doepke, M., Sorrenti, G., & Zilibotti, F. (2019). The economics of parenting. *Annual Review of Economics, 11*, 55–84.

Feinstein, L. (2003). Inequality in the early cognitive development of British children in the 1970 cohort. *Economica, 70*(277), 73-97.

Fejgin, N. (1995). Factors contributing to the academic excellence of American Jewish and Asian students. *Sociology of Education.*, *68*(1), 18–30.

Feuerstein, A. (2000). School characteristics and parent involvement: Influences on participation in children's schools. *The Journal of Educational Research, 94*(1), 29-40.

Fiorini, M., & Keane, M. P. (2014). How the allocation of children's time affects cognitive and noncognitive development. *Journal of Labor Economics, 32*(4), 787-836.

Fredriksson, P., Öckert, B., & Oosterbeek, H. (2016). Parental responses to public investments in children: Evidence from a maximum class size rule. *Journal of Human Resources, 51*(4), 832–868.

Friedman, B. A., Bobrowski, P. E., & Markow, D. (2007). Predictors of parents' satisfaction with their children's school. *Journal of Educational Administration, 45*(3), 278-288.

Ganzach, Y. (2000). Parent's education, cognitive ability, educational expectations and educational attainment. *British Journal of Educational Psychology.*, *70*, 419–441.

Gelber, A., & Isen, A. (2013). Children's schooling and parents' behavior: Evidence from the Head Start Impact Study. *Journal of Public Economics, 101*(1), 25–38.

Goldring, E. B., & Phillips, K. J. (2008). Parent preferences and parent choices: The public–private decision about school choice. *Journal of Education Policy, 23*(3), 209-230.

Greaves, E., Hussain, I., Rabe, B., & Rasul, I. (2019). *Parental responses to information about school quality: Evidence from linked survey and administrative data.* (ISER Working Paper Series, No. 2019-03).

Haisken-DeNew, J., Hasan, S., Jha, N., & Sinning, M. (2018). Unawareness and selective disclosure: The effect of school quality information on property prices. *Journal of Economic Behavior & Organization, 145*, 449-464.

Hampden-Thompson, G., & Galindo, C. (2017). School–family relationships, school satisfaction and the academic achievement of young people. *Educational Review*, *69*(2), 248-265.

Hao, L., Hotz, V. J., & Jin, G. Z. (2008). Games parents and adolescents play: Risky behaviour, parental reputation and strategic transfers. *The Economic Journal, 118*(528), 515-555.

Hastings, J. S., & Weinstein, J. M. (2008). Information, school choice, and academic achievement: Evidence from two experiments. *Quarterly Journal of Economics, 123*, 1373–1414.

Heckman, J., & Cunha, F. (2010). *Investing in Our Young People.* (NBER Working Paper Series No. w16201).

Heidhues, P., Kőszegi, B., & Strack, P. (2018). Unrealistic expectations and misguided learning. *Econometrica*, 86(4), 1159-1214.

Kinsler, J., & Pavan, R. (2016). *Parental Beliefs and Investment in Children: The Distortionary Impact of Schools* (HCEO Working Paper Series No. 2016-029).

Kooreman, P. (2007). Time, money, peers, and parents; some data and theories on teenage behavior. *Journal of Population Economics, 20*(1), 9-33.

Laferrère, A., & Wolff, F. C. (2006). Microeconomic models of family transfers. Handbook of the Economics of Giving, *Altruism and Reciprocity, 2*, 889-969.

Lim, P., & Gemici, S. (2011). *Measuring the socioeconomic status of Australian youth*. National Centre for Vocational Education Research.

Louden, W. (2019). *NAPLAN Reporting Review Prepared for COAG Education Council*. Education Services Australia.

Lundberg, S., Romich, J. L., & Tsang, K. P. (2009). Decision-making by children. Review of *Economics of the Household, 7*(1), 1-30.

Marks, G. N., Cresswell, J., & Ainley, J. (2006). Explaining socioeconomic inequalities in student achievement: The role of home and school factors. *Educational research and Evaluation*, *12*(02), 105-128.

Marks, G. N., McMillan, J., Jones, F. L., & Ainley, J. (2000). *The measurement of socioeconomic status for the reporting of nationally comparable outcomes of schooling: Draft report of the National Education Performance Monitoring Taskforce.* Australian Council for Educational Research and Sociology Program.

Mohal, J., Lansangan, C., Howell, L., Renda, J., Jessup, K., & Daraganova, G. (2020). *Growing Up in Australia: The Longitudinal Study of Australian Children – Data User Guide Release 8.0.* Australian Institute of Family Studies.

Park, S., & Holloway, S. D. (2013). No parent left behind: Predicting parental involvement in adolescents' education within a sociodemographically diverse population. *The Journal of Educational Research*, *106*(2), 105-119.

Patrikakou, E. N., & Weissberg, R. P. (2000). Parents' perceptions of teacher outreach and parent involvement in children's education. *Journal of Prevention & intervention in the community*, *20*(1-2), 103-119.

Pop-Eleches, C., & Urquiola, M. (2013). Going to a better school: Effects and behavioral responses. *American Economic Review, 103*(4), 1289-1324.

Quadlin, N. Y. (2015). When children affect parents: Children's academic performance and parental investment. *Social Science Research, 52*, 671-685.

Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica*, *73*(2), 417-458.

Rogers, T., & Feller, A. (2018). Reducing student absences at scale by targeting parents' misbeliefs. *Nature Human Behaviour, 2*(5), 335-342.

Roksa, J., & Potter, D. (2011). Parenting and academic achievement: Intergenerational transmission of educational advantage. *Sociology of Education, 84*(4), 299-321.

Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of educational research, 75*(3), 417-453.

Soloff, C., Lawrence, D., & Johnstone, R. (2005). *LSAC Technical Paper No. 1: Sample Design.* Australian Institute of Family Studies.

Spera, C. (2005). A Review of the Relationship Among Parenting Practices, Parenting Styles, and Adolescent School Achievement. *Educational Psychology Review, 17*(2), 125-146.

Stevenson, D. L., & Baker, D. P. (1987). The family-school relation and the child's school performance. *Child Development*, 1348-1357.

Turney, K., & Kao, G. (2009). Barriers to school involvement: Are immigrant parents disadvantaged?. *The Journal of Educational Research, 102*(4), 257-271.

Weinberg, B. A. (2001) An incentive model of the effect of parental income on children. *Journal of Political Economy, 109*(2), 266-280.

Yi, J., Heckman, J. J., Zhang, J., & Conti, G. (2015). Early Health Shocks, Intra-Household Resource Allocation and Child Outcomes. *The Economic Journal, 125*(588), F347–F371.

Tables and Figures

Figure 1. Distribution of NAPLAN numeracy scores across years

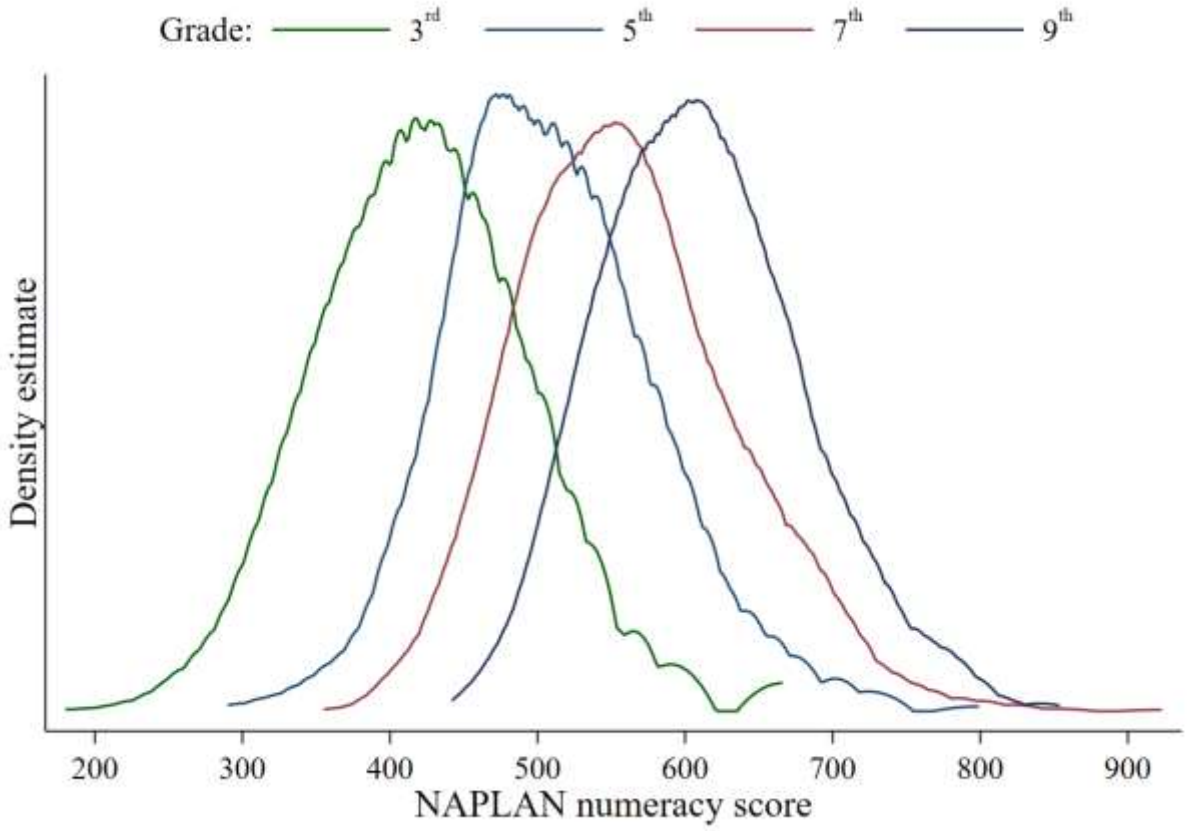


Figure 2. LSAC interview month relative to dates of NAPLAN results release

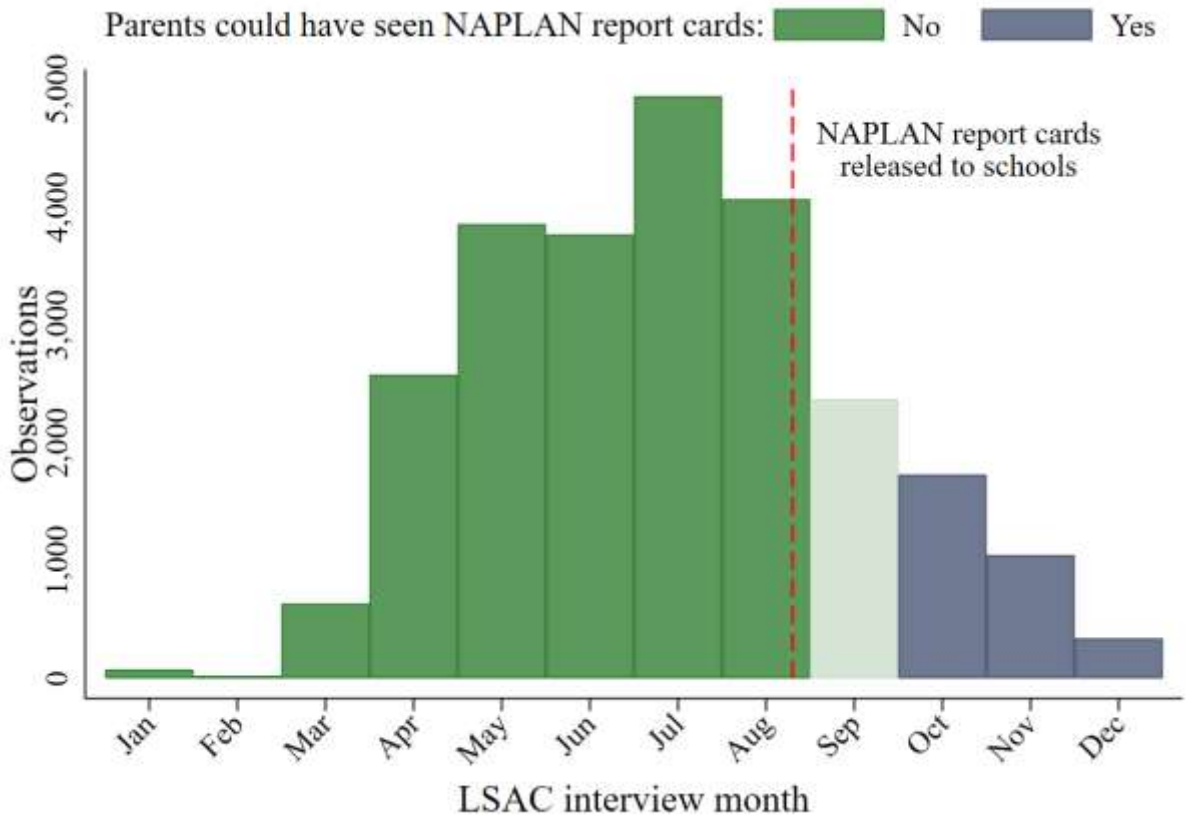


Table 1. Balancing test using pre-determined characteristics and parental investments

	Mean	Effect of having a post-September interview			
Pre-determined outcomes:					
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)
Pre-determined investments:					
Waves 1-2					
Sum of activity days/week	15.97	-1.817***	-0.477	-2.139***	-0.154
		(0.319)	(0.315)	(0.363)	(0.361)
Sum of activities last 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)
Assessed child performance in school	3.86	0.084	0.084	-0.058	-0.058
		(0.062)	(0.062)	(0.099)	(0.099)
Satisfaction with school	4.54	-0.026	0.010	-0.046	0.005
		(0.043)	(0.044)	(0.051)	(0.052)
Weather controls		✓	✓	✓	✓
Wave FE			✓		✓
Region FE				✓	✓

*OLS coefficients with 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 2. The effect of NAPLAN test score release on parental investments

Outcomes:	**Parental investments:**								
	Time			**Monetary**				**Parenting style**	
	Hrs/day with parents	**Everyday activities / week**	**Parent-child outings / month**	**30+ books at home**	**Has private tutor**	**Has allowance**	**Extracurr. Activities / week**	**High warmth**	**Strict monitoring**
Post-September LSAC interview	-0.200 (0.186)	-0.360 (0.342)	0.032 (0.059)	-0.014 (0.032)	0.066*** (0.023)	-0.038 (0.030)	-0.319*** (0.097)	0.009 (0.025)	-0.023 (0.024)
Outcome mean	3.45	9.20	1.64	0.74	0.15	0.37	1.43	0.72	0.75
Wave, region & age FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Weather, lagged outcome & SES	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	5,459	4,240	8,449	4,243	5,901	5,980	3,738	8,028	8,303
Children	2,596	2,592	2,853	2,592	2,667	2,679	2,350	2,800	2,836

OLS coefficients estimated using Correia's (2018) reghdfe *Stata package. 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 3. The effect of NAPLAN test score release on children's time use

Outcomes:	**Child time (minutes per day) spent on:**			
	Educational activities	**Leisure activities**	**Sleeping & personal care**	**Other activities**
Post-September LSAC interview	13.106	-21.280*	6.869	3.202
	(12.371)	(12.266)	(5.762)	(7.304)
Outcome mean	283	304	638	216
Wave, region & age FE	✓	✓	✓	✓
Weather, lagged outcome & SES	✓	✓	✓	✓
Child-day observations	24,176	24,176	24,176	24,176
Children	2,602	2,602	2,602	2,602

OLS coefficients estimated using Correia's (2018) reghdfe *Stata package. Cluster-robust standard errors at the child level in parentheses. Each observation is frequency weighted by 5 if it was taken on a weekday and by 2 if it was taken on a weekend day. ***, ** and * mark estimates statistically different from zero at the 90, 95 and 99 percent confidence level.*

Figure 3. Children with above-average NAPLAN numeracy scores, by parental beliefs about child school performance

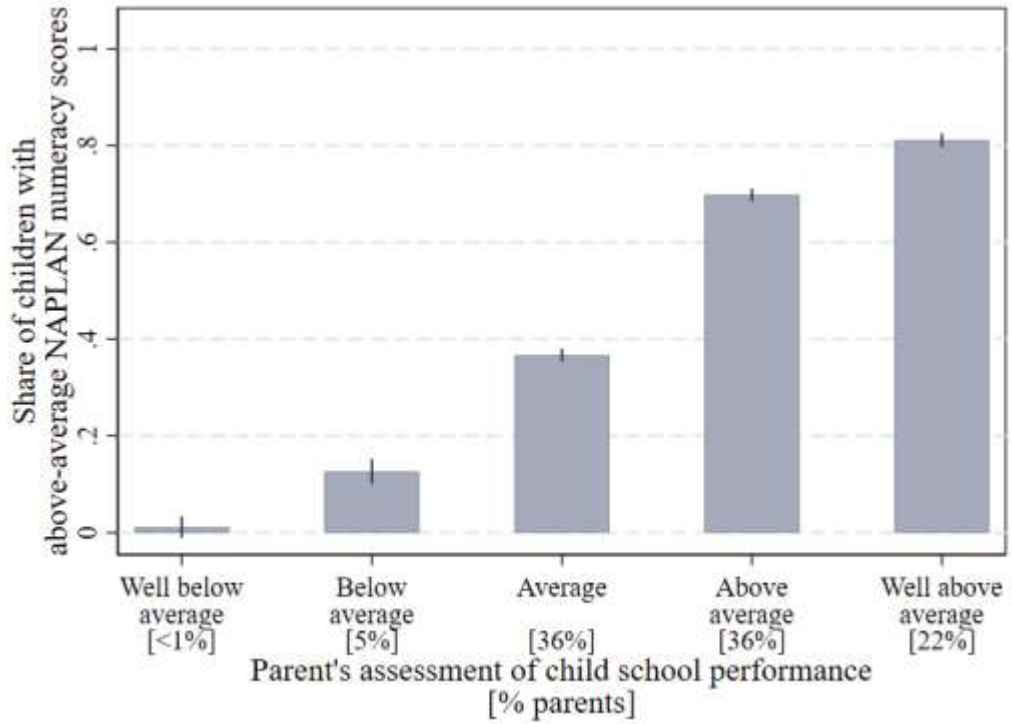


Table 4. The effect of NAPLAN test score release on parental beliefs about child school achievement and on parental satisfaction with school

Outcomes:	**Parents' rating of child overall school performance relative to school average**			
	5-point scale	**Below**	**At**	**Above**
Post-September LSAC interview	-0.080*	0.027**	-0.023	-0.003
	(0.042)	(0.012)	(0.025)	(0.025)
Outcome mean	3.76	0.05	0.35	0.60
Observations	8,444	8,444	8,444	8,444
Children	2,852	2,852	2,852	2,852
Outcomes:	**Parents' satisfaction with school**			
	5-point scale	**Not satisfied**	**Satisfied**	**Very satisfied**
Post-September LSAC interview	-0.089**	0.011	0.052*	-0.059**
	(0.045)	(0.017)	(0.029)	(0.029)
Outcome mean	4.44	0.09	0.35	0.57
Observations	8,456	8,456	8,456	8,456
Children	2,853	2,853	2,853	2,853
Wave, region & age FE	✓	✓	✓	✓
Weather, lagged outcome & SES	✓	✓	✓	✓

OLS coefficients estimated using Correia's (2018) reghdfe *Stata package. 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.*

Figure 4. Illustrating expectation predictions and surprises with numeracy scores

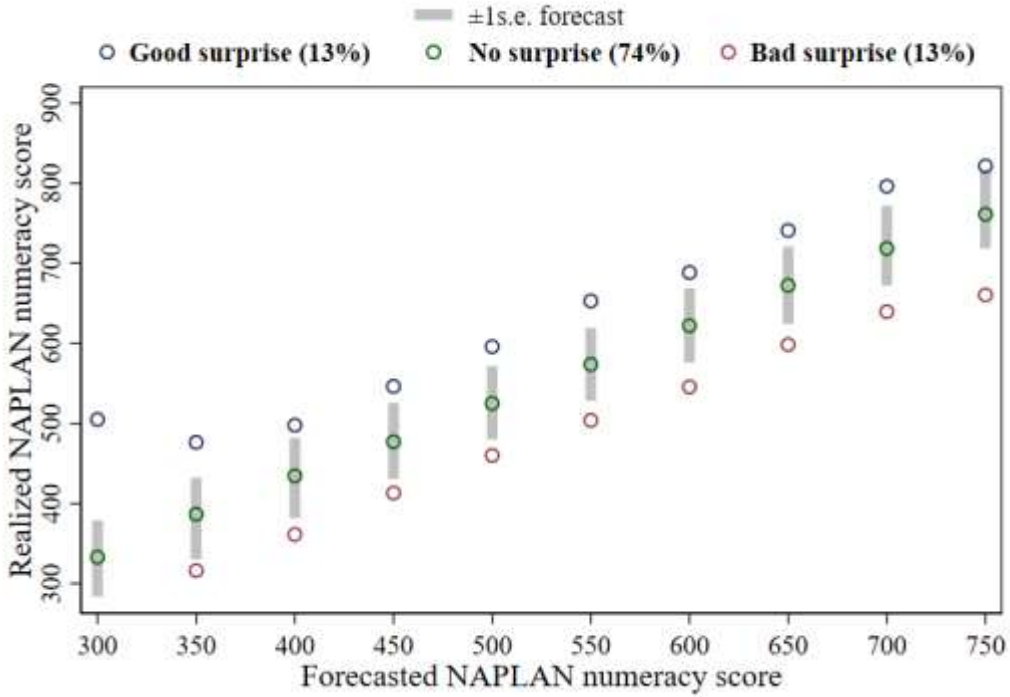


Table 5. The effect of NAPLAN test score release on parental investments, by news type based on numeracy scores

Outcomes:	**Parental investments in:**								
	Time			**Monetary**				**Parenting Style**	
	Hrs/day with parents	**Everyday activities / week**	**Parent-child outings / month**	**30+ books at home**	**Has private tutor**	**Has allowance**	**Extracurr. Activities / week**	**High warmth**	**Strict monitoring**
Effect of post-September LSAC interview when numeracy scores provide:									
Bad news	-0.451*	-0.425	0.058	-0.062	0.087**	-0.085*	-0.281*	0.018	-0.027
	(0.273)	(0.567)	(0.105)	(0.050)	(0.038)	(0.045)	(0.144)	(0.040)	(0.041)
No news	-0.184	-0.332	0.027	0.002	0.056**	-0.023	-0.371***	0.007	-0.031
	(0.198)	(0.363)	(0.067)	(0.035)	(0.024)	(0.032)	(0.099)	(0.029)	(0.028)
Good news	-0.038	-0.321	-0.072	-0.029	0.085**	-0.047	-0.202	0.022	-0.020
	(0.290)	(0.514)	(0.095)	(0.049)	(0.036)	(0.045)	(0.145)	(0.043)	(0.041)
F-test difference [p-value]	[0.421]	[0.983]	[0.443]	[0.383]	[0.514]	[0.312]	[0.329]	[0.902]	[0.958]
Outcome mean	3.45	9.21	1.55	0.74	0.15	0.37	1.43	0.70	0.71
Wave, region & age FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Weather, lagged outcome & SES	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	5,451	4,232	5,972	4,235	5,896	5,972	3,737	5,846	5,881
Children	2,594	2,588	2,677	2,588	2,667	2,677	2,350	2,648	2,660

Average marginal effects from OLS models interacting post-September LSAC interview with surprise type based on numeracy scores and score forecasts using Correia's (2018) reghdfe *Stata package. 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 6. The effect of NAPLAN test score release on children's time use, by news type based on numeracy scores

Outcomes:	**Child time (minutes per day) spent on:**			
	Educational activities	**Leisure activities**	**Sleeping & personal care**	**Other activities**
Effect of post-September LSAC interview when numeracy scores are:				
Surprisingly bad	50.663***	-37.296*	-1.318	-8.023
	(19.077)	(19.263)	(9.117)	(11.129)
Unsurprising	0.637	-12.342	9.950	3.138
	(13.106)	(12.849)	(6.132)	(7.836)
Surprisingly good	32.663*	-44.421**	0.264	13.330
	(19.363)	(20.145)	(9.098)	(10.934)
F-test difference [p-value]	[0.007]	[0.114]	[0.289]	[0.251]
Outcome mean	283	304	638	216
Wave, region & age FE	✓	✓	✓	✓
Weather, lagged outcome & SES	✓	✓	✓	✓
Observations	24,147	24,147	24,147	24,147
Children	2,601	2,601	2,601	2,601

Average marginal effects from OLS models interacting post-September LSAC interview with surprise type based on numeracy scores and score forecasts using Correia's (2018) reghdfe *Stata package. Each observation is frequency weighted by 5 if it was taken on a weekday and by 2 if it was 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 7. The effect of NAPLAN test score release on parental beliefs about child school achievement and on parental satisfaction with school, by surprise type based on numeracy scores

Outcomes:	**Parents' rating of child overall school performance relative to school average**			
	5-point scale	**Below**	**At**	**Above**
Effect of post-September LSAC interview when numeracy scores provide:				
Bad news	-0.186**	0.019	0.060	-0.077*
	(0.074)	(0.024)	(0.045)	(0.043)
No news	-0.121**	0.030**	-0.012	-0.019
	(0.048)	(0.014)	(0.029)	(0.028)
Good news	-0.036	0.006	-0.040	0.032
	(0.067)	(0.017)	(0.040)	(0.039)
F-test difference (p-value)	[0.185]	[0.351]	[0.133]	[0.088]
Outcome mean	3.77	0.05	0.34	0.60
Observations	5,976	5,976	5,976	5,976
Children	2,679	2,679	2,679	2,679
Outcomes:	**Parents' satisfaction with school**			
	5-point scale	**Not satisfied**	**Satisfied**	**Very satisfied**
Effect of post-September LSAC interview when numeracy scores provide:				
Bad news	-0.102	0.021	0.048	-0.070
	(0.082)	(0.031)	(0.050)	(0.050)
No news	-0.040	-0.012	0.069**	-0.053
	(0.050)	(0.019)	(0.032)	(0.033)
Good news	-0.068	-0.011	0.084*	-0.068
	(0.070)	(0.027)	(0.047)	(0.047)
F-test difference (p-value)	[0.682]	[0.516]	[0.829]	[0.896]
Outcome mean	4.45	0.09	0.34	0.57
Observations	5,984	5,984	5,984	5,984
Children	2,680	2,680	2,680	2,680
Wave, region & age FE	✓	✓	✓	✓
Weather, lagged outcome & SES	✓	✓	✓	✓

Average marginal effects from OLS models interacting post-September LSAC interview with surprise type based on numeracy scores and score forecasts using Correia's (2018) reghdfe *Stata package. 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 8. Heterogeneous effects of NAPLAN test score release and surprises by states that show school average vs. states that do not

Outcomes:	**Has private tutor**		**Extracurr. activities / week**		**Leisure activities (miutes per day)**		**Rating of performance**		**Satisfaction with school**	
State cards show school average [30%]:	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*
Post-September LSAC interview	0.065***	0.067**	-0.320***	-0.317***	-35.403***	-0.361	-0.124**	-0.098	-0.051	-0.060
	(0.024)	(0.029)	(0.102)	(0.117)	(12.868)	(15.918)	(0.048)	(0.060)	(0.050)	(0.064)
Effect of post-September LSAC interview when numeracy scores provide:										
Bad news	0.084*	0.099	-0.203	-0.489**	-52.860**	-9.448	-0.190**	-0.162	-0.091	-0.142
	(0.044)	(0.061)	(0.164)	(0.213)	(21.220)	(34.775)	(0.085)	(0.119)	(0.086)	(0.181)
No news	0.057**	0.054*	-0.391***	-0.333***	-25.584*	7.094	-0.133***	-0.089	-0.026	-0.071
	(0.026)	(0.031)	(0.104)	(0.123)	(13.836)	(17.104)	(0.051)	(0.064)	(0.053)	(0.068)
Good news	0.076*	0.112*	-0.196	-0.222	-61.303***	-25.033	-0.017	-0.091	-0.118	0.068
	(0.041)	(0.061)	(0.164)	(0.227)	(22.285)	(35.086)	(0.073)	(0.123)	(0.077)	(0.113)
Outcome mean	0.17	0.12	1.44	1.41	316	316	3.77	3.77	4.47	4.40
Wave, region & age FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Weather, lagged outcome & SES	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	4,113	1,783	2,583	1,154	3,795	1,656	4,169	1,807	4,170	1,814
Children	1,902	786	1,652	707	1,846	766	1,909	792	1,909	793

OLS coefficients and average marginal effects from OLS models interacting post-September LSAC interview with surprise type and the heterogeneity dummy using Correia's (2018) reghdfe *Stata package. 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 9. Heterogeneous effects of NAPLAN test score release and surprises by private vs public school

Outcomes:	**Has private tutor**		**Extracurr. activities / week**		**Leisure activities (miutes per day)**		**Rating of performance**		**Satisfaction with school**	
Private school [22%]:	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*
Post-September LSAC interview	0.066***	0.070**	-0.319***	-0.319***	-27.624**	-13.196	-0.128***	-0.067	-0.050	-0.049
	(0.023)	(0.033)	(0.099)	(0.121)	(12.566)	(17.197)	(0.048)	(0.060)	(0.049)	(0.062)
Effect of post-September LSAC interview when numeracy scores provide:										
Bad news	0.105**	0.033	-0.293*	-0.220	-15.370	-136.147***	-0.229***	-0.029	-0.072	-0.198
	(0.042)	(0.073)	(0.156)	(0.254)	(21.753)	(31.169)	(0.082)	(0.127)	(0.087)	(0.176)
No news	0.051**	0.077**	-0.367***	-0.385***	-21.855*	4.328	-0.133***	-0.066	-0.042	-0.017
	(0.025)	(0.038)	(0.101)	(0.128)	(13.263)	(19.131)	(0.050)	(0.067)	(0.051)	(0.067)
Good news	0.095**	0.065	-0.216	-0.169	-73.126***	7.058	-0.029	-0.051	-0.073	-0.023
	(0.041)	(0.059)	(0.162)	(0.216)	(22.048)	(35.028)	(0.077)	(0.106)	(0.081)	(0.095)
Outcome mean	0.14	0.20	1.33	1.73	321	297	3.74	3.87	4.40	4.64
Wave, region & age FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Weather, lagged outcome & SES	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	4,612	1,284	2,783	951	4,271	1,176	4,686	1,290	4,694	1,290
Children	2,297	720	1,827	643	2,239	675	2,316	722	2,317	722

OLS coefficients and average marginal effects from OLS models interacting post-September LSAC interview with surprise type and the heterogeneity dummy using Correia's (2018) reghdfe *Stata package. 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 10. Heterogeneous effects of NAPLAN test score release and surprises by income above vs. below the first quartile

Outcomes:	**Has private**		**Extracurr.**		**Leisure activities**		**Rating of**		**Satisfaction with**	
Household income above first quartile [75%]:	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*
Post-September LSAC interview	0.062**	0.066***	-0.287**	-0.333***	-43.765***	-16.575	-0.142**	-0.106**	0.011	-0.082*
	(0.029)	(0.024)	(0.114)	(0.101)	(15.147)	(13.104)	(0.061)	(0.048)	(0.061)	(0.050)
Effect of post-September LSAC interview when numeracy scores provide:										
Bad news	0.074	0.093**	-0.441*	-0.223	-52.586*	-34.778	-0.155	-0.200**	0.067	-0.187*
	(0.061)	(0.044)	(0.246)	(0.158)	(31.600)	(22.208)	(0.130)	(0.082)	(0.122)	(0.098)
No news	0.033	0.064**	-0.325***	-0.391***	-37.469**	-6.551	-0.176***	-0.099**	0.004	-0.058
	(0.030)	(0.026)	(0.121)	(0.103)	(16.787)	(13.810)	(0.066)	(0.050)	(0.068)	(0.053)
Good news	0.210***	0.043	-0.091	-0.242	-57.998*	-46.525**	-0.020	-0.045	-0.035	-0.089
	(0.068)	(0.038)	(0.238)	(0.159)	(34.686)	(25.064)	(0.127)	(0.073)	(0.122)	(0.075)
Outcome mean	0.15	0.16	1.29	1.49	332	311	3.66	3.81	4.36	4.47
Wave, region & age FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Weather, lagged outcome & SES	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1448	4448	870	2867	1310	4141	1472	4504	1477	4507
Children	991	2193	705	1907	923	2127	1000	2204	1001	2205

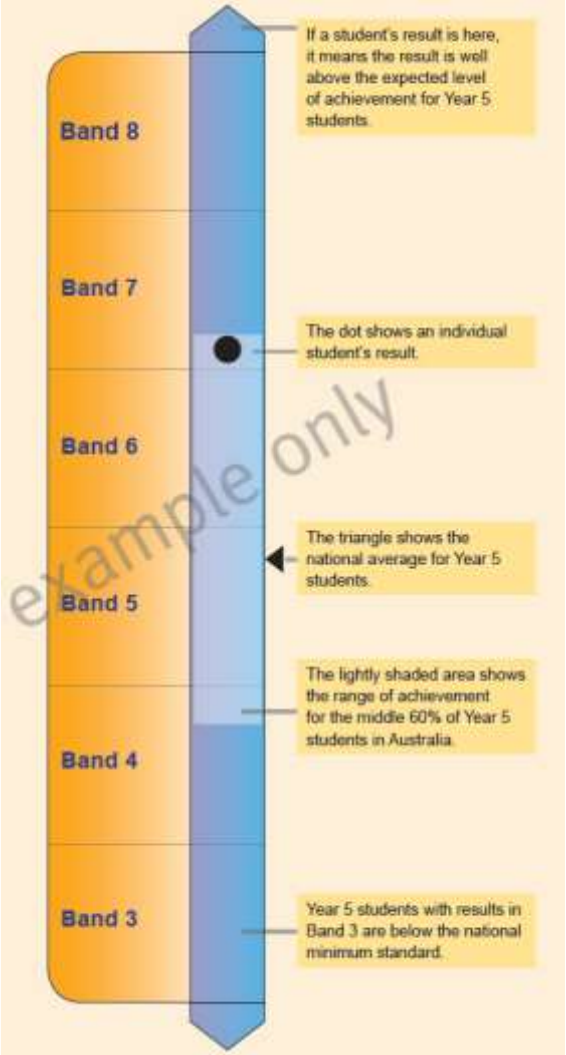
OLS coefficients and average marginal effects from OLS models interacting post-September LSAC interview with surprise type and the heterogeneity dummy using Correia's (2018) reghdfe *Stata package. Cluster-robust standard errors at the child level in parentheses. ***, ** and * mark estimates statistically different from zero at the 90, 95 and 99 percent*

Appendix A – The Construction of NAPLAN 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. Sample Grade 3 NAPLAN Achievement Scale



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

Table A1. The effect of NAPLAN test score release on parental investments, by news type based on reading scores

Outcomes:	**Parental investments in:**								
	Time			**Monetary**				**Parenting Style**	
	Hrs/day with parents	**Everyday activities / week**	**Parent-child outings / month**	**30+ books at home**	**Has private tutor**	**Has allowance**	**Extracurr. Activities / week**	**High warmth**	**Strict monitoring**
Effect of post-September LSAC interview when reading scores provide:									
Bad news	-0.077	-0.635	-0.015	-0.038	0.059	-0.050	-0.301**	-0.011	-0.011
	(0.284)	(0.576)	(0.099)	(0.053)	(0.039)	(0.048)	(0.141)	(0.041)	(0.043)
No news	-0.283	-0.293	0.034	-0.008	0.064***	-0.026	-0.333***	0.013	-0.032
	(0.195)	(0.358)	(0.068)	(0.034)	(0.024)	(0.031)	(0.100)	(0.028)	(0.028)
Good news	0.189	-0.365	-0.005	0.005	0.067*	-0.081*	-0.226	0.007	-0.025
	(0.287)	(0.592)	(0.101)	(0.049)	(0.035)	(0.047)	(0.148)	(0.047)	(0.043)
F-test difference [p-value]	[0.159]	[0.824]	[0.813]	[0.778]	[0.986]	[0.388]	[0.689]	[0.802]	[0.870]
Outcome mean	3.45	9.21	1.55	0.74	0.15	0.38	1.43	0.7	0.71
Wave, region & age FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Weather, lagged outcome & SES	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	5,455	4,236	5,976	4,239	5,900	5,976	3,738	5,850	5,885
Children	2,594	2,590	2,677	2,590	2,667	2,677	2,350	2,648	2,660

*Average marginal effects from OLS models interacting post-September LSAC interview with surprise type based on reading scores and score forecasts. 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 A2. The effect of NAPLAN test score release on children's time use, by news type based on numeracy scores

Outcomes:	**Parents' rating of child overall school performance relative to school average**			
	5-point scale	**Below**	**At**	**Above**
Effect of post-September LSAC interview when reading scores provide:				
Bad news	-0.190***	0.014	0.024	-0.035
	(0.073)	(0.024)	(0.044)	(0.043)
No news	-0.108**	0.028**	-0.013	-0.017
	(0.047)	(0.013)	(0.029)	(0.028)
Good news	-0.090	0.014	-0.007	-0.014
	(0.072)	(0.017)	(0.043)	(0.042)
F-test difference (p-value)	[0.418]	[0.600]	[0.663]	[0.884]
Outcome mean	3.77	0.05	0.34	0.60
Observations	5,980	5,980	5,980	5,980
Children	2,679	2,679	2,679	2,679
Outcomes:	**Parents' satisfaction with school**			
	5-point scale	**Not satisfied**	**Satisfied**	**Very satisfied**
Effect of post-September LSAC interview when reading scores provide:				
Bad news	-0.081	-0.003	0.053	-0.051
	(0.081)	(0.030)	(0.050)	(0.050)
No news	-0.049	-0.005	0.063**	-0.054*
	(0.050)	(0.019)	(0.032)	(0.032)
Good news	-0.049	-0.020	0.094*	-0.076
	(0.071)	(0.026)	(0.050)	(0.050)
F-test difference (p-value)	[0.902]	[0.798]	[0.757]	[0.880]
Outcome mean	4.45	0.09	0.34	0.57
Observations	5,988	5,988	5,988	5,988
Children	2,680	2,680	2,680	2,680
Wave, region & age FE	✓	✓	✓	✓
Weather, lagged outcome & SES	✓	✓	✓	✓

*Average marginal effects from OLS models interacting post-September LSAC interview with surprise type based on numeracy scores and score forecasts. 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.*

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.
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'.

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 [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 [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	[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) [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)	[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 [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

	[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	[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 [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 [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	[0] Retailing (including fast food) [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	[1] Retailing [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

	[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	[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	[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 [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	**
Children's time use (daily minutes)						
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	
Other activities	6,490	219	9,066	220	-0.79	
Monetary 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 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's performance 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	

The estimation sample is the sample of children that took the NAPLAN test in the same year as the LSAC interview and excludes September interviews. All test-takers include, in addition to the estimation sample of students, students taking NAPLAN tests ahead or behind their cohort school year and September interviews.

- We see virtually no differences between the samples, which suggests that the sample restrictions that make our design clean and valid don't make our sample look much different than the overall LSAC sample base.
- Note: standard *, **, and *** symbols for differences significant at the 10%, 5% and 1% levels. These are based on two-sample unpaired t-tests with unequal variances (The best I

Table B4. The Parental Groups Isolated 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.