Online Appendix for

Parental Investments during Early Childhood and the Gender Gap in Math and Literacy

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Appendix A: Data and Experimental Background

We use data from the Chicago Heights Early Childhood Center (CHECC). CHECC was a field experiment in Chicago Heights, Illinois conducted between 2010 and 2014. The goal of CHECC was to address the academic achievement gap; as such, CHECC was located in a predominately low-income area of Chicago where families had little access to other forms of preschool. Our study tracks the cognitive and non-cognitive skill development of children from age 3 to as old as age 14. We pair this with intensive interventions that focus on preschool, parental investment, or both. Data on children's skills was collected before, during, and after the end of each year of program participation. Administrative data on child test scores were collected once per year in 2014-2019 when children were 8-14 years old.

The parent investment surveys were administered during the skills assessment periods when parents were present. We collected information at baseline before the start of the school year, in the middle of the school year, and at the end of the school year. Parents were given one survey per family, and the respondent answered for the investment behaviors of all members in the family. For families that participated for two years, we used only the survey responses from their first year. The surveys were answered by mothers 61.3% of the time, fathers 12.3% of the time and other caregivers like grandmothers or aunts 3.9% of the time.[1]

Our primary measure of parental investment is the amount of time any family member spent teaching the child on a typical weekday, collected at the end of the school year. Parents selected one out of the following options: "none", "less than 1 hour", "1 to 2 hours", "2 to 3 hours", "3 to 5 hours", or "more than 5 hours". In the results that follow, we merge the "none" and "less than 1 hour" categories together and the "3 to 5 hours" and "more than 5 hours" categories together, which simplifies our exposition but does not appreciably affect our results.

In addition to investment, we collect three measures of parental beliefs in the middle of each school year. Parents were asked about their child's math and reading abilities relative to children of the same age. They were also asked about their child's likelihood of attending college. For math and reading skills, parents chose one out of the following options: "much greater skills than other children", "somewhat greater skills than other children", "about the same as other children", "somewhat lower skills than other children", and "much lower skills than other children". For the likelihood of attending college, parents chose one out of the following options: "very likely", "somewhat likely", "neither likely or unlikely", "somewhat unlikely", and "very unlikely".

Following the CHECC program, children attended an elementary school in the area. Administrative data on test scores were collected directly from the Illinois State Board of

[1] These numbers do not add up to 100% since some respondents did not answer the question regarding who completed the survey. Some surveys were completed by multiple family members, in which case we counted all family members who responded. For example, if the survey was completed by the father and grandmother, we would count them both as respondents.

Education and these schools. The schools conduct tests each year starting in grade 3 (age 9) through grade 8 using the Partnership for Assessment of Readiness for College and Careers (PARCC) test.[2] PARCC is designed to test whether students are on track or ready for college and their future career. It assesses children in two areas: English Language Arts/Literacy (ELA/L) and Mathematics. The ELA assessments contain questions regarding literacy, research stimulation, and narrative writing. The Mathematics assessment includes short and long-answer type questions that require applying mathematical concepts to problem-solving. Each child's raw score on the test is adjusted for slight differences in test difficulty and forms of test-taking across administrations. This final scaled score ranges between 650 and 850 and allows us to accurately compare children within a grade or course. It is this data on English & Language Arts (ELA) and Math that we use to evaluate a potential gender gap in childhood skills. Since PARCC scores are continuous, we standardize them by grade and report the results in standard deviations to facilitate comparisons with estimates from related literature.

Additional data collected during the program are used as control variables. Parents were surveyed about demographic and socio-economic background upon signing up for the program. From this survey, we use variables on child gender, race, age, home language, and year of program participation in our analysis. Children were assessed on their academic skills (receptive vocabulary, reading, writing, and math) and their executive functioning skills (working memory, attention shifting, inhibitory control) three times each year using standard tests (Woodcock et al., 2003; Blair and Willoughby, 2006a, 2006b, 2006c). Our results are robust to controlling for children's cognitive and non-cognitive scores at baseline, before they participated in the program. From these assessments, we find that girls have significantly greater self-regulation scores than boys (PSRA measure, Appendix Table B.1), which could contribute to why parents teach more to girls in the control group.

We possess data on parent's investment and beliefs for the 2,185 children who were enrolled in CHECC during ages 3-5 in 2010-2014. Of these 2,185 children, 1,428 children have corresponding PARCC scores taken at ages 8-15 (grades 3-8) in 2016-2019. Since only 13 children from CHECC were in grade 8 by 2019, we drop grade 8 from our analysis using PARCC scores. Furthermore, there was likely selective attrition from the CHECC program, since parents were more likely to stop sending their children to CHECC if they were less motivated to develop their children's academic skills. We therefore exclude children whose parents did not complete a survey at the end of their first year of program participation. Among the 953 remaining children, we have both PARCC scores and parental survey data for 702 children and only parental survey data for 251 children.

Any potential selective attrition should not influence estimates using only PARCC scores as long as CHECC participation did not influence the elementary schools that children attended afterwards. We can therefore use the full 953 sample of children (490 girls, 463 boys) to estimate gender gaps in math and ELA test scores for grades 3-7. However, selective attrition may bias our measures of parental investment and beliefs, collected during the CHECC program when children were 3-5 years old. We address this concern by using a special group which received extra incentives to complete our investment surveys. Because we did not have the resources to actively recruit the full control group in all years, in some years we randomly assigned a sub-group of the control group to be "special control." This group received greater incentives ($100 rather than $40) to attend assessment and received substantially more phone calls and reminders to attend. This

[2] Partnership for Assessment of Readiness for College and Careers Final Technical Report for 2018 Administration. Available from: New Meridian Corporation; Available at: https://files.eric.ed.gov/fulltext/ED599198.pdf

group had a lower attrition rate than the overall control. The special group comprises of 673 children total (350 girls, 323 boys). Among them, 264 were randomized to control (135 girls, 129 boys), 220 to Preschool (120 girls, 100 boys), and 189 to Parent Academy (95 girls, 94 boys).[3]

[3] 80 children (34 girls, 46 boys) were also randomized to Kinderprep. This was a shorter, 6-8 week half-day preschool conducted during the summer each year. Due to the small sample size of this condition, we have excluded it from our analysis.

Appendix B: Additional Tables and Figures

Table B.1: Why do parents teach more to girls than boys?

	Boys		Girls		Difference		
	Mean	Std Err	Mean	Std Err	Mean	Std Err	**Obs**
	Panel A: Children's discipline and attitudes regarding parental teaching						
Child self-regulation (PSRA)	0.7392	0.0128	0.7712	0.0107	-0.0320*	0.0165	636
Child likes when I teach							
definitely disagree	0		0		0		139
somewhat disagree	0.0132	0.0132	0.0476	0.0270	0.0345	0.0285	139
neither agree nor disagree	0.0921	0.0334	0.0317	0.0223	-0.0604*	0.0419	139
somewhat agree	0.3158	0.0537	0.1587	0.0464	-0.1571**	0.0725	139
definitely agree	0.5789	0.0570	0.7619	0.0541	0.1830**	0.0797	139
	Panel B: Parents' perceptions of own teaching and attitudes						
I like to teach							
definitely disagree	0.0267	0.0187	0.0159	0.0159	-0.0108	0.0251	138
somewhat disagree	0.0133	0.0133	0.0159	0.0159	0.0025	0.0206	138
neither agree nor disagree	0.0000	0.0000	0.0159	0.0159	0.0159	0.0145	138
somewhat agree	0.1867	0.0453	0.1111	0.0399	-0.0756	0.0615	138
definitely agree	0.7733	0.0487	0.8413	0.0464	0.0679	0.0680	138
My child's academic success is important to me							
definitely disagree	0.0132	0.0132	0	0	-0.0132	0.0145	139
somewhat disagree	0		0		0		139
neither agree nor disagree	0		0		0		139
somewhat agree	0.0132	0.0132	0.0159	0.0159	0.0027	0.0204	139
definitely agree	0.9737	0.0185	0.9841	0.0159	0.0104	0.0249	139
I am good at teaching my child to read							
definitely disagree	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	139
somewhat disagree	0.0526	0.0258	0.0476	0.0270	-0.0050	0.0375	139
neither agree nor disagree	0.1184	0.0373	0.0952	0.0373	-0.0232	0.0532	139
somewhat agree	0.4342	0.0572	0.4444	0.0631	0.0102	0.0852	139
definitely agree	0.3947	0.0564	0.4127	0.0625	0.0180	0.0842	139
I am good at teaching my child math							
definitely disagree	0.0133	0.0133	0	0	-0.0133	0.0146	138
somewhat disagree	0.0133	0.0133	0.0317	0.0223	0.0184	0.0251	138
neither agree nor disagree	0.1067	0.0359	0.0635	0.0310	-0.0432	0.0484	138

somewhat agree	0.4133	0.0572	0.4444	0.0631	0.0311	0.0851	138
definitely agree	0.4533	0.0579	0.4603	0.0633	0.0070	0.0857	138

Notes: Panel A summarizes results regarding child's discipline, measured by the self-regulation assessment (PSRA standardized score), and whether child likes it when parent teaches. Panel B summarizes results on parents' perceptions of own teaching abilities and attitudes. All measures except the self-regulation assessment score are collected using parent survey during the middle of the school year. For these measures, results are reported using the control group only. Self-regulation score collected at baseline; results are reported pooling all control and treatment groups. Difference reports average difference (girls – boys). *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table B.2: Estimated treatment effects based on ordered probit regressions

	(1)	(2)
Parental Teaching	**PA**	**PK**
0-1 hours: male	-0.0946*	-0.0641
	(0.0537)	(0.0508)
0-1 hours: female	0.0731	0.114**
	(0.0535)	(0.0486)
1-2 hours: male	-0.0116	-0.00488
	(0.0105)	(0.00582)
1-2 hours: female	0.0129	0.0134
	(0.00999)	(0.00969)
2-3 hours: male	0.0403*	0.0277
	(0.0225)	(0.0218)
2-3 hours: female	-0.0307	-0.0484**
	(0.0229)	(0.0208)
3 or more hours: male	0.0659*	0.0413
	(0.0396)	(0.0331)
3 or more hours: female	-0.0553	-0.0787**
	(0.0395)	(0.0343)
Observations	628	628

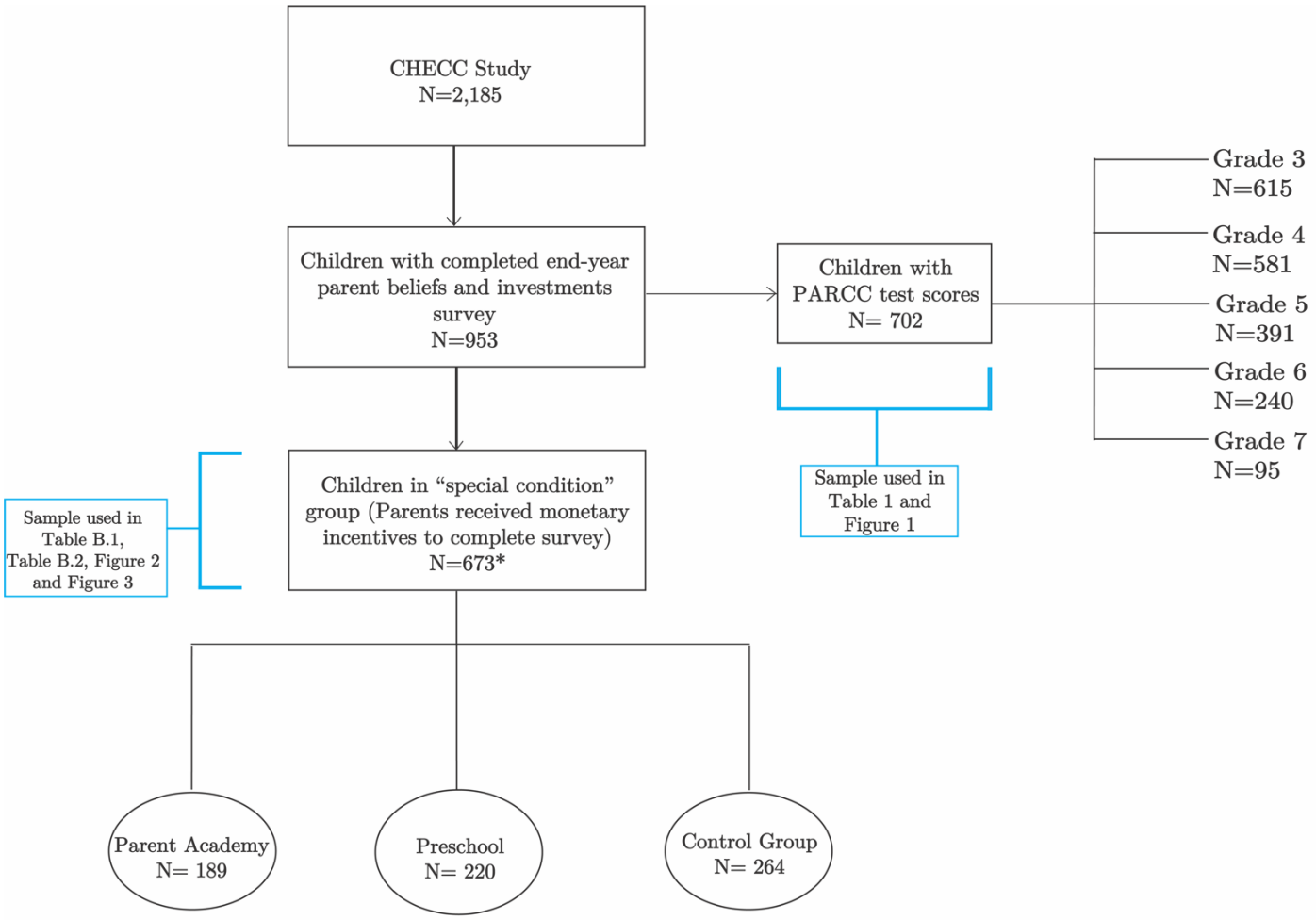
Ordered probit regressions of time spent teaching child on child gender and treatment assignment. Column 2: PK. Column 3: PA. Regressions control for year, race, and home language. Standard errors clustered by family. *** p<0.01, ** p<0.05, * p<0.1

Table B.3: Teaching reading and math by child gender

	Boys		Girls		Difference		
	Mean	Std Err	Mean	Std Err	Mean	Std Err	**Obs**
Amount of time spent teaching reading on typical weekday							
<1 hour	0.8861	0.0360	0.8608	0.0392	0.0253	0.0532	158
1-2 hours	0.0759	0.0300	0.1266	0.0376	-0.0506	0.0481	158
2-3 hours	0.0380	0.0216	0.0127	0.0127	0.0253	0.0251	158
3 or more hours	0	0	0	0	0	0	158
Amount of time spent teaching math on typical weekday							
<1 hour	0.8481	0.0406	0.7848	0.0465	0.0633	0.0618	158
1-2 hours	0.1266	0.0376	0.1519	0.0406	-0.0253	0.0554	158
2-3 hours	0.0253	0.0178	0.0633	0.0276	-0.0380	0.0328	158
3 or more hours	0	0	0	0	0	0	158

Notes: Self-reported parental teaching in reading and math. Survey questions were only asked in 2011, 2022, and 2013. Results are reported using the control group only. Difference reports average difference (girls – boys). *** p<0.01, ** p<0.05, * p<0.1

Figure B.1: Analysis Samples



Notes: This figure shows sample sizes for the analysis samples, as they relate to the full CHECC sample. *80 children were also randomized to Kinderprep. This was a shorter, 6-8 week half-day preschool conducted during the summer each year. Due to the small sample size of this condition, we have excluded it from our analysis.