The Effect of Parental Time Investments: Evidence from Natural Within-Family Variation

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Abstract

First-born children receive more parental time investments and this birth order difference is larger when children are spaced further apart in age. I use this natural within-family variation to estimate the effect of parental time investments on their children's reading test scores. Properly instrumenting for parent child reading is crucial since parents engage in compensatory investments by spending more time with the lower performing child, leading to downward bias of the effects of parental time. I find that an extra day per week of parent-child reading during the first ten years of life raises a child's performance on standardized reading tests by about half of a standard deviation.

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Parents face a number of decisions that involve making a tradeoff between providing their children personal time or material resources. Extra work hours provide more income but less time for one's children. Housing decisions can involve a trade-off between a larger home and a shorter commute to work. The ability to make the decision that is best for the children in these cases requires knowing the relative impact of time and money on child outcomes.

Estimating the impact of parental time on child outcomes is a challenging empirical question. These challenges include knowing the functional form of the production function of child outcomes (Todd and Wolpin 2003), knowing how to combine father and mother inputs in that production function (Pollack 2008), and being able to accurately measure parental time investments in children (Haveman and Wolfe 1995). In addition, unobserved heterogeneity is likely to be a problem since families with more income also provide higher levels of time investments to their children (Gronau and Hamermesh 2006; Guryan, Hurst, and Kearney 2008).

As a result, most of the economic research on the effect of parent-child time has focused on maternal employment. Maternal employment is easier to measure and there are a number of government policies that influence the mother's work decision. However, policies that influence maternal employment affect both the amount of time and money that parents can provide their children such that maternal employment can be positive in some situations but negative in others (Blau and Grossberg 1992).

In this paper, I exploit within family variation in the amount of resources siblings receive. These differences arise from a common pattern in how parents allocate time among their children. Parents spend more time with their first-born child and this birth

order gap is larger when children are spaced further apart (Price 2008). If parental time is an important factor in child outcomes, then birth order differences in child outcomes will be larger when children are spaced further apart and these birth order differences will be larger for the outcomes that are most directly influenced by parental time. I use NLSY data to show that both of these predictions are true. First-born children have higher reading scores, but have no advantage for math scores. In addition, the birth order gap in reading scores is greater when the two children are further apart in age.

I use this natural variation in parental time investments to instrument for how much parents read to their children. Properly instrumenting for the measure of parental reading is important since mother's engage in compensatory investments by spending more time reading to the child who has lower achievement in reading, leading to a downward bias in estimates using family fixed effects. IV estimates indicate that increased mother-child reading time has large positive effects on reading achievement. For example, increasing mother-child reading by an additional day each week during the first ten years of the child's life raises the child's reading performance by more than half of a standard deviation.

I. Related Research

The empirical work in this paper is founded in the household production framework originally developed by Becker (1965; 1991). Parents receive satisfaction from raising happy, healthy, well-behaved, and high-achieving children. Parents allocate time and money to their children so as to maximize child outcomes subject to the constraints of income, time, and technology (Zick, Bryan, and Osterbacka 2001). While

the exact nature of the production function for child outcomes is uncertain, it is likely to depend on a number of family characteristics, parenting styles, and how much parents invest in their children. In this paper, I compare children from the same family, thus controlling for many of the parenting styles or family characteristics that are difficult to measure.

A major challenge in estimating the impact of parental time investments is the lack of exogenous variation in how much time parents spend with their children. As a result, most research on the impacts of parental time has focused on changes in maternal employment. Maternal employment is a situation in which the effects of a decrease parent-child time may offset by the increase in family income (Blau and Grossberg 1992). In addition, eight hours of work does not lead to eight hours less quality time with one's children. Mothers who enter the workforce attempt to minimize the change in the quality time spent with their children by rearranging other aspects of their lives (Bianchi 2000).

Paid maternity leave is one policy that can provide an increase in mother-child time with often no change in family income. Baker and Milligan (forthcoming) examine a Canadian policy in 2000 that extended job-protected, partially compensated maternity leave benefits from six months to one year. Although the program only provided a partial replacement of the mother's lost wages, a simulation exercise by Baker and Milligan indicate that, once taxes and child care costs are accounted for, a mother who took the maternity leave would experience no change in income. They find that the policy increased the amount of maternal care a child received during the first year of life by three months (mostly displacing unlicensed home-based care by non-relatives). However,

they find that this large increase in maternal care has no effect on motor-social development (among infants and toddlers).

The impact of family income is easier to estimate since there are a number of policies that provide changes in family income not influenced by child outcomes. Dahl and Lochner (2005) exploit changes in the EITC and find that an additional $1,000 in family income raises math and reading test scores by about 2–3 percent of a standard deviation, with a larger positive impact for disadvantaged families. Milligan and Stabile (2008) use variation in Canadian child benefits and find that among families with mothers with no more than a high school degree, an additional $1,000 raises math scores by 7.4% and reading scores by 6.8% of a standard deviation[1]. Shea (2006) uses changes in family income that result from plant closings and finds that this drop in income leads to lower child outcomes (but only for families with less educated fathers). Other studies document a strong correlation indicating that children from families with increased income result in higher test scores, fewer behavioral problems, lower chance for teenage pregnancy, increased college attendance, and greater earnings (Brooks-Gunn and Duncan 1997).

II. Data

Most of the analysis in this paper is based on data about the children of the original respondents to the 1979 National Longitudinal Survey of Youth (NLSY). The NLSY is a nationally representative sample of 12,686 young men and women who were 14-22 years old when first surveyed in 1979. These individuals were interviewed

[1] Milligan and Stabile (2008) also find positive effects of income on measures of health and mental health. When they separate the effects of income by gender, they find that the income has a positive impact on educational and health outcomes for boys and a positive effect on mental health outcomes for girls.

annually through 1994 and biennially since then. The NLSY contains extensive information of each respondent's age, education, income, work history, marital status, and fertility. Starting in 1986, information was collected on all children of the female respondents to the NLSY. As measures of child outcomes, I use the Peabody Individual Achievement Tests (PIAT) of reading and math and Peabody Picture Vocabulary Test (PPVT). I standardize all of the outcome measures to have a mean of zero and standard deviation of one for the representative sample in the NLSY (i.e. excluding the oversamples).

The NLSY data also includes a mother-reported measure of how often she reads to each of her children. Possible responses include never, several times a year, several times a month, once a week, about 3 times a week, or daily. In figure 1, I plot the distribution of how often mother's read to their children by age and birth order. For children ages 0-3, about 35% of mothers report reading to the child every day and the difference between a first and second born child is 10 percentage points. The "read aloud" variables are recorded every two years so this birth order difference is based on comparing siblings at the same age rather than at the same point in time. For children ages 4-6, the fraction whose mothers read to them daily drops to 28% and then for children ages 7-8 the daily reading rate drops to about 14%.

I use this mother-child reading question to construct two measures for which the interpretation of the results will be more straightforward. The first measure is whether the mother reports reading daily to the child and the other converts the 1-6 scale into a

measure of days per month that the mother reads to the child.[2] In Figure 2, I compare how two of these measures vary based on the child's age. The frequency of mother-child reading increases during the infant years and peaks at age two (when 40% of mother's report reading daily to their child and the average days per month across the sample is 17). The frequency of reading steadily decreases as the child becomes older such that by age 10, there are no mothers who report reading to their child daily and the average days per month across the sample is six.

There is generally some concern about the reporting bias that occurs with single-item questions about the frequency of reading to your children (Hoffereth 2006). To address this concern, I also use data from the American Time Use Survey (ATUS). This data is based on a time diary completed by one adult from a random sample of households from the outgoing group of the CPS. This person reports all of their activities for one day along with starting and ending times and everyone else present for each activity. I use this information to construct a measure of how much time the parent spends with each of his or her children. I focus specifically on parent-child activities that involve a high degree of interaction and have the greatest impact on child development such as reading, talking, and helping with homework (Bianchi and Robinson 1997).

To provide some additional insight about birth order differences in material inputs, I use data from the 2000 US Census Public Use Microdata Samples which includes detailed information on a 1% sample of the US population. I construct measures of birth order spacing order based on the children currently in the household, specifically ages 4-13, to reduce some of the problems of misclassifying a child's birth order when

[2] While using the 1-6 scale does not provide a natural interpretation of the coefficients. The specific response options provide a measure that is very similar to a logarithmic scale (Gruber and Hungerman 2008).

children have left the home or in cases of incomplete fertility. The measures of material well-being in the Census data include family's income, whether the child lives in a home, the size of the home (in terms of the number of bedrooms). As additional controls, I use information on the child's age and gender, as well as the mother's age, education, marital status, and work status.

In Table 1, I use these three datasets to examine how time and money resources differ across siblings based on their birth order and birth spacing.[3] The first two columns examine differences in the amount of quality time a parent spends with each child using data from the American Time Use Survey. Since there is only one respondent per household, I report the time-use estimates separately for father-child time and mother-child time. The typical second born child receives 22 fewer minutes a day of quality time with her father than the first born child, this difference increases by five minutes for each additional year apart in age between the two children. Similarly for mother-child time, the birth order gap is 25 minutes of quality time a day and increases by seven minutes for each additional year apart in age.

When looking at the frequency that the mother reads to each child, I find a similar pattern. The first-born child is read to 2.9 days per month more often than the second-born child and this difference increases by 0.66 days for each additional year apart in age. When I look whether the mothers reads to the child each day (which is true for 22.3% of children in the sample), first born children are 9.6 percentage points more likely to have mothers who report reading to them daily and this gap increases by 0.2 percentage points for each additional year apart in age.

[3] In each regression, I rescaled the measure of birth spacing down by three years so that the coefficient on the second child is the birth order gap for the typical family in the sample.

The bottom panel in Table 1 indicates that the second-born child experiences higher levels of material well-being. For example, when siblings are three years apart the second born experiences $3,900 more family income each year, is 1.3 percentage points less likely to be below the poverty line, is 9.3 percentage points more likely to live in a house, and lives in a larger home (0.28 more bedrooms). These gaps are larger when the children are spaced further apart.

III. Results

These large differences in parent-child time experienced by siblings provide a potential test of the relative impact of parental time investments. If parental time inputs are an important determinant of child outcomes, then first-born children will have better outcomes and these birth-order differences will be larger when children are spaced further apart. In addition, if parental time is the source of these birth order differences, we should see larger differences for the outcomes that parental time inputs are more likely to directly influence.

In Table 2, I examine differences in three cognitive outcomes. Each of the regressions include mother fixed-effects, controls for the child's gender, and whether the child was born when the mother was a teenager (less than 19 years old). All of the test scores have been normalized to have a mean of zero and a standard deviation of one. All of these regressions are limited to families that have only two children. A major advantage of the data in the NLSY is that it provides multiple observations of the same measures over time for each child. This makes it possible to compare siblings at the same

age rather than just at the same point in time (as would be necessary in cross-sectional data).

The results in panel A of Table 2 are consistent with a positive effect of parental time investments. Among those outcomes for which parental time investments are most likely to have a direct impact (verbal and reading skills), the first-born children have higher outcomes and these birth order differences are larger when the children are spaced further apart in age. For example, the first-born child scores 15.8% of a standard deviation higher on the PPVT than his or her younger sibling (at the same age) and this gap increases by 6.3 percentage points for each additional year of birth spacing. For Piat reading scores, the birth order difference is 15.5% of a standard deviation and increases by 2.6 percentage points for each additional year of birth spacing. However, the birth-spacing interaction terms are not statistically significant for either outcome.

For the outcome measure that is less likely to be influenced directly by parental time investments (math skills), I find only small and statistically insignificant birth-order differences. This does not mean that parents have no influence on their children's math performance. In fact, when I use variation across families, I find that children of mothers with a college degree score 117% of a standard deviation higher than children who mothers didn't graduate from high school and those whose mothers graduated from high school scored 52% of a standard deviation higher. The within family estimates in Table 2 suggest that the impact of parents on their children's math performance result from fixed inputs (genetics, parental education, etc) rather than changes in parental time investments. This is consistent with the fact that much more parent-child time is directed towards reading than towards math.

One concern about these estimates is that birth spacing may be correlated with the endowment of the first-born child. In particular, if parents have a child with a lower initial endowment, they may wait longer to have a second child. This would bias the coefficients of the interaction between birth order and birth spacing downward, since the families with larger birth spacing would have first-born children with lower outcomes (absent any effect of parental time investments). I address this issue by instrumenting for birth spacing using whether or not the mother experienced a miscarriage in between the first and second birth.

Among the mothers in my NLSY sample of two-child families, 6.5% of the mothers experienced a miscarriage in between the birth of the two children (of these, about 10% had more than one miscarriage in this period)[4]. Having a miscarriage increases the average birth-spacing for these mothers by 0.742 years (with a standard error of 0.116). The F-statistic of this instrument is 46.8 and arguments for the validity of this instrument are provided in past research (Miller, forthcoming).[5] This estimate is nearly identical whether or not I control for other characteristics of the mother, such as education, marital status, or labor status, providing additional suggestive evidence that this instrument is exogenous.[6]

[4] The IV results presented in Table 3 are very similar if I use whether the mother had a miscarriage or if I use the number of miscarriages.

[5] Some of the primary concerns about this instrument is miscarriages may be related to smoking or alcohol use during pregnancy or that even in the absence of a miscarriage the baby may have been aborted. This first issue is potentially problematic when using this instrument to examine the impact of age of first birth on female earnings since the unobserved characteristics that lead a woman to engage these behaviors may influence their earning potential directly (Hotz, Mullin, and Sanders 1997). These two issues may be less of a problem when looking at the birth spacing between the first and second birth and using mother fixed effects.

[6] When including these additional controls the estimated coefficient on having a miscarriage is 0.739 with a standard error of 0.115.

Consistent with the expected bias in the non-IV results (based on parents waiting longer after having a first-born child with a lower endowment), I find that the coefficient on the interaction between birth order and birth spacing is much larger when properly instrumenting for birth spacing. For example, the IV results indicate that a first-born child will have a PIAT reading score that is 19.6% of a standard deviation higher and this birth order gap increases by 20 percentage points for each additional year of birth spacing (compared to only 2.6 percentage points in the non-IV results). The interaction term for the PPVT results are not statistically significant in the IV results but the coefficient is consistent with a downward bias in the non-IV results.

The results to this point provide evidence that parental time investments influence children's readings scores. I now turn to a more direct approach using data in the NLSY about how often the mother reads to each child. I start by examining the contemporaneous effect of parent time investments on child's performance on reading tests. First I run a simple regression in which I test whether children who are read to more, have higher reading scores. I include as additional controls in this regression: log household income, the child's gender and age (in months) at the time of the test, the mother's relationship status (married, cohabiting, or single), the mother's work status (full-time, part-time, or not working), the mother's education (college degree, high school graduate, or less than high school), and whether the child was born when the mother was a teenager (<19 years old). The results in Table 3 indicate that for children, ages 3-4, whose mother reads to them daily, score about 48% of a standard deviation higher on the PPVT test (with similar results when using the other two scales of parent-child reading). The OLS coefficient is much smaller when looking at older children (ages 5-9) using the

PIAT reading test scores, where the children who are read to daily score 3.6% of a standard deviation higher.

A major concern with these results is that differences in the frequency of parent-child reading may be due simply to unobserved heterogeneity across households. One solution used in similar settings is to use sibling comparisons or include family fixed effects. When I include the mother fixed effects, the correlation between parent-child reading and reading test scores shrinks considerably, and in some cases becomes negative (and sometimes statistically significant).

The mechanical bias underlying these fixed effect results, relates to the motivations that drives parental investments. The traditional intra-household allocation model of Becker and Tomes (1976) suggests that parents will invest in the child with the highest return (with some indication that this would mean that parents would invest more in the highest endowed child) and later in life the parents will use transfers or bequests to equate utility across children. The results in Table 5 suggest that instead parents engage in compensatory investments by reading more to the child who is doing worse at reading.

As further evidence that these results reflect compensatory investments, I estimated the results in Table 3 separately for children 5-6 and children 7-9. By age seven, nearly all children would be enrolled in first grade and would start to receive formal assessment of their reading ability. For the 5-6 year-old sample (as well as the 3-4 year olds already in Table 3), I find positive within-family correlations between parent-child reading and reading test scores that are not statistically significant.[7] It is only when I look at the children who are older than age 6 that I find the strong negative correlation

[7] For the 5-6 year olds, the coefficient on daily reading is 0.0446 (with a standard deviation of 0.0490).

between parent-child reading and reading test scores (the coefficient for daily reading for this group is -.0466 with a standard error of .017).

These results suggest that as parents receive feedback about the reading performance of each of their children, they adjust the frequency of parent-child reading to provide more time to their children that have lower performance. These results also indicate that in addition to controlling for family-level unobserved heterogeneity using mother fixed effects it is also important to properly instrument for parent time investments to each child to address the problem of reverse causality.

To deal with this second problem, I exploit the natural variation in time investments discussed earlier as an instrument for how often the mother reads to each child. The results in Table 1 indicate that mothers spend more time reading to their first born child at any given age (even for those ages when both children are present) and that this birth order gap is larger when the children are spaced further apart. The F-statistic of the joint test of these two instruments is 156.

When I instrument for how often the mother reads to the child, I find that reading has a consistently positive effect on reading scores (though the precision of these estimates are such that none of them are statistically significant). The coefficients suggest that among children ages 5-9, daily reading increases a child's reading score by 38% of the standard deviation and each day per month of reading increases the child's reading score by 1.1% of a standard deviation. The coefficients are larger when looking at younger children.

These results are based on the contemporaneous effect of mother-child reading. However, it is generally thought that child outcomes are based on a cumulative effect of

parental inputs. In Table 4, I provide results in which reading time refers to the average frequency of the mother reading to that child across the ages 1-10 and the outcome measure is based on the child's performance during the ages of eleven through thirteen[8]. I use the same controls as Table 3, but replace the contemporaneous measures of the mother's relationship and work status and the log family income, with averages of these measures over the same 10 year window as the reading measures.

As before, the fixed effect results without instruments indicate a small or negative relationship between this parental time investment and the child's reading performance. When I instrument for parent-child reading time, I find that these parental time investments have a large and significant positive impact on reading performance. The results indicate that an additional year in which a mother reads to her child each would increase the child's reading tests score by 42% of a standard deviation. Alternatively, if the mother increases the frequency of reading to her child by one day per week during the first 10 years of the child's life, the child's reading test scores would increase by 52% of a standard deviation.

IV. Discussion

The results in this paper provide causal estimates of the effect of parent-child reading on the child's performance in reading. While these results are limited to just one type of parental time investment and one type of child outcome, the specific input is thought to be one of the most important parent-child activities and the outcome is one of the most important predictors of how well students will do in school.

[8] These results based on cumulative parental time investments also help deal with the small window problem that has often been an issue in research on child outcomes (An, Ginther, Haveman, and Wolfe 1996).

The results in this paper provide support for programs designed to increase the fraction of parents who read books to their children each day. The specific estimates in this paper also provide some insight about the marginal rate of technical substitution between time and money in producing child outcomes, or the increase in family income that could compensate a child for an hour less reading time with their mother (thus keeping the child on the original isoquant).

While there have been many studies that have estimated child outcome production functions, very few apply the results of their model to estimate the marginal rate of technical substitution. For example, Hill and O'Neil (1994) use the NLSY data used in this paper to examine some of the factors that influence PPVT scores. The coefficients reported suggest that an extra day each week of reading to your child is equivalent to about $5,000 extra family income.[9] On days that parents read to their children, they read on average for about 30 minutes (Price 2008). Thus taking the Hill and O'Neil estimates at face value, implies a rate of technical substitution of $192 per hour between family income and time spent reading.

The results in this paper indicate that adding an extra day per week of parent-child reading in one year (or about an extra 26 hours of parent-child reading that year) would raise the child's PIAT reading scores by about 4.2% of a standard deviation. Estimates by Dahl and Lochner (2008) who use the EITC as an instrument for family income using NLSY data find that an extra 1,000 dollars in family income in one year leads to an increase in PIAT reading scores of 2-3% of a standard deviation. Combining these

[9] The coefficient on days/week reading is 1.935, the coefficient on family income is 0.3958, and the coefficient on family income squared is -.0034.

estimates suggests that an hour of parent-child reading produces the same change in reading test scores as an additional $54 in family income.[10]

This estimate of the relative value of parent-child time may be a slight under-estimate based on the time horizon of interest. Dahl and Lochner (2008) only found that family income had a contemporaneous effect on child test scores with little evidence that income has a long-run effect on math and reading achievement test scores. The results in this paper suggest the effects of parent-child reading investments during the first years of life carry over into increased performance even after the mother stops reading to the child.

V. Conclusion

Estimating the impact of parental time on child outcomes is a challenge because measures of parental involvement are likely correlated with unobservable parental characteristics that directly influence child outcomes. In addition, parents may adjust their investments to a particular child in response to child behavior or outcomes. Estimates of family income have a similar problem and past researchers have dealt with these issues using variation in family income due to tax policies or plant closings.

This paper documents an important pattern in differences in the type of resources received by children in the same family. The first-born child receives more parental time inputs while the second-born child experiences a higher level of family income at each

[10] This is just a rough estimate of the value of parental-time. An important caveat is that the group of families that provides the identification for the local average treatment effect for these two estimates is quite different. Future research could extend the empirical approach used in this paper to examine the effect of parent-child reading in the Canadian version of the NLSY. These estimates could be compared to the estimated effect of family income of Baker and Milligan (2008), who find large effects of family income on math and reading scores among families with less educated mothers.

age. This birth order difference is even larger when the two children are spaced further apart in age. I find evidence that parental time plays an important role in child outcomes since first-born children have higher reading test scores and birth order differences are larger when the children are further apart in age. In addition, when I use a direct measure of parental time investment (reading aloud to the child) and instrument for this measure using the natural variation due to birth order and birth spacing, I find that reading aloud to a child has very large positive effects on their reading test scores.

While the specific findings of this paper should not surprise most parents or educators, the results highlight that conventional approaches to estimating the effect of parental reading can create potentially misleading results. Cross-sectional estimates of the effects of parent-child reading ignore unobserved heterogeneity across families. The traditional solution to this problem (fixed effects) will also be biased since parents invest more time in children who have lower performance. The empirical strategy in this paper provides a way to deal with both problems, allowing researchers to estimate the causal effect of parental time investments. Another advantage of the strategy used in this paper, is that this pattern of parent-child time appears to be common across all family types leading to estimates that provide a fairly general local average treatment effect.

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Table 1. Differences in Inputs by Birth Order and Birth Spacing (two-child families)

A. Time Resources

	ATUS (2003–2005)		NLSY79 (1986-2004) How often mother reads to child.	
	Father Time	Mother Time	Days/Month	Daily reading
second child	-21.806**	-24.838**	-2.9262**	-0.0963**
	[1.856]	[1.653]	[0.1377]	[0.0055]
second · spacing	-4.847**	-7.101**	-0.6569**	-0.0218**
	[1.332]	[1.313]	[0.0923]	[0.0037]
spacing	0.119	1.122	0.1012	0.0032
	[1.586]	[1.501]	[0.1122]	[0.0043]
R-squared	0.145	0.169	0.178	0.133
Mean	80.9	109.5	12.52	0.223
N	3,254	4,674	16,512	

B. Money Resources

	Census PUMS (2000)		
	Family Income	<Poverty Line	Lives in a House
second child	3,952.2**	-0.0130**	0.1298**
	[172.7]	[0.0008]	[0.0026]
second · spacing	1,403.9**	-0.0053**	0.0495**
	[99.1]	[0.0006]	[0.0018]
spacing	-1,385.2**	0.0027**	-0.0334**
	[92.1]	[0.0006]	[0.0016]
R-squared	0.211	0.245	0.145
Mean	65,455	0.121	0.730
N		146,523	

Notes: Both samples are restricted to children ages 4–13. * and ** indicate statistical significance at 5% and 1% levels respectively. Each regression includes controls for the child's age and gender, and the parent's age, education, marital status, and work status. The ATUS regression includes a control for weekend/weekday.

Table 2. Differences in Child Outcomes by Birth Order and Birth Spacing.

A. Mother-Fixed Effects

	PIAT reading (ages 5-13)		PPVT (ages 3-4)		PIAT math (ages 5-13)	
second child	-0.149***	-0.155***	-0.147**	-0.158**	-0.017	-0.020
	[0.023]	[0.024]	[0.072]	[0.075]	[0.023]	[0.023]
second · spacing		-0.026		-0.063		-0.013
		[0.016]		[0.054]		[0.015]
R^2	0.597	0.597	0.889	0.890	0.547	0.547
N	14,394		2,130		14,436	

B. IV Results

	PIAT reading		PPVT		PIAT math	
second child	-	-0.196***	-	-0.184***	-	-0.040*
		[0.021]		[0.054]		[0.022]
second · spacing		-0.200***		-0.203		-0.095
		[0.071]		[0.199]		[0.073]
N	14,394		2,130		14,436	

Notes: The outcome measures have been normalized to have a mean of zero and a standard deviation of one. Each regression includes mother and year fixed effects and controls for the mother's marital status, work status, and education as well as the child's gender, age, and whether the child was born when the mother was a teenager. In the IV results, the instrument for birth spacing is whether the mother experienced a miscarriage between her first and second birth. The first stage of this instrument has an F-statistic of 46.8. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively.

Table 3. Contemporaneous Effect of Parent-Child Reading and the Child's Reading Scores

A. PIAT reading (ages 5-9, N=8,024)

	OLS		IV
Daily Reading	0.036	-0.007	0.379
	[0.033]	[0.040]	[0.642]
Days per month	0.001	-0.003*	0.011
	[0.001]	[0.002]	[0.017]
1-6 Scale	-0.010	-0.040***	0.095
	[0.010]	[0.012]	[0.125]
Mother fixed effects	no	yes	yes

B. PPVT (ages 3-4, N=2,249)

	OLS		IV
Daily Reading	0.479***	0.144	0.712
	[0.048]	[0.162]	[1.154]
Days per month	0.027***	0.009	0.080
	[0.002]	[0.008]	[0.090]
1-6 Scale	0.243***	0.074	1.233
	[0.018]	[0.076]	[1.098]
Mother fixed effects	no	yes	yes

Notes: The outcome measures have been normalized to have a mean of zero and a standard deviation of one. Each regression includes year fixed effects and controls for the mother's marital status, work status, and education; the household's log income; and the child's gender, age, and whether the child was born when the mother was a teenager. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively.

Table 4. Cumulative Effect of Parent-Child Reading and the Child's Reading Scores

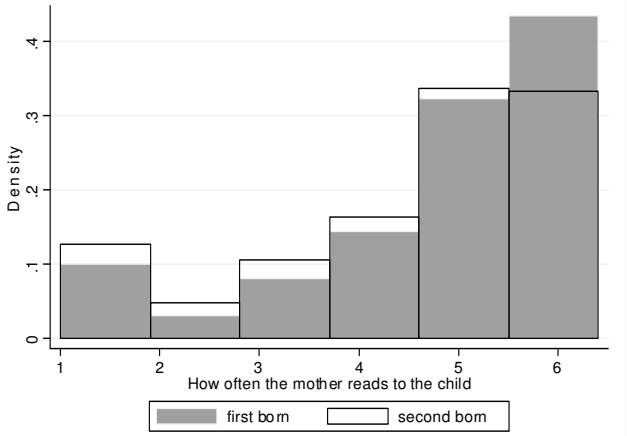
PIAT reading (ages 10-13, N=5,811)

	OLS		IV
Daily Reading	0.268***	-0.004	4.197***
	[0.061]	[0.161]	[1.336]
Days per month	0.010***	-0.006	0.130***
	[0.002]	[0.007]	[0.039]
1-6 Scale	0.048***	-0.088**	0.968***
	[0.017]	[0.044]	[0.305]
Mother fixed effects	no	yes	yes

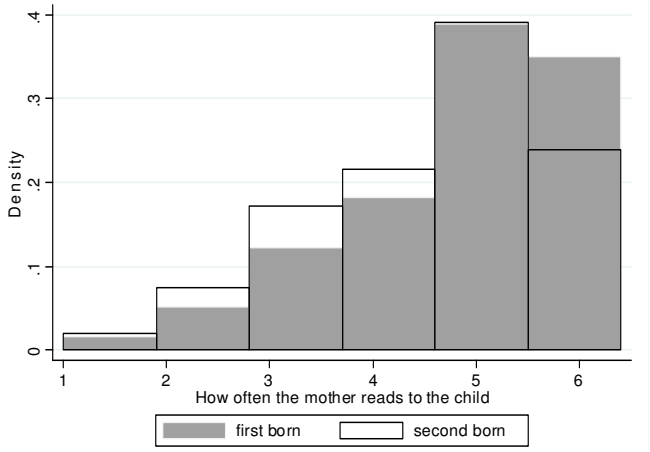
Notes: The outcome measures have been normalized to have a mean of zero and a standard deviation of one. All of the reading measures are the average value of each measure for the child across ages 0-9. Each regression includes year fixed effects and controls for the mother's education, the child's gender and age, and whether the child was born when the mother was a teenager. Each regression also includes the fraction of years the mother was married, cohabiting, working full-time, and working part-time and the average log income during the child's first 10 years of life. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively.

Figure 1. Birth order differences in the distribution of how often the mother reads to the child

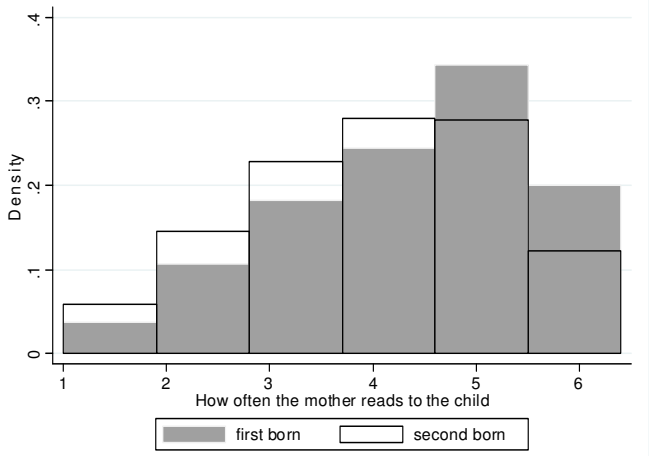
A. Ages 0-3



B. Ages 4-6

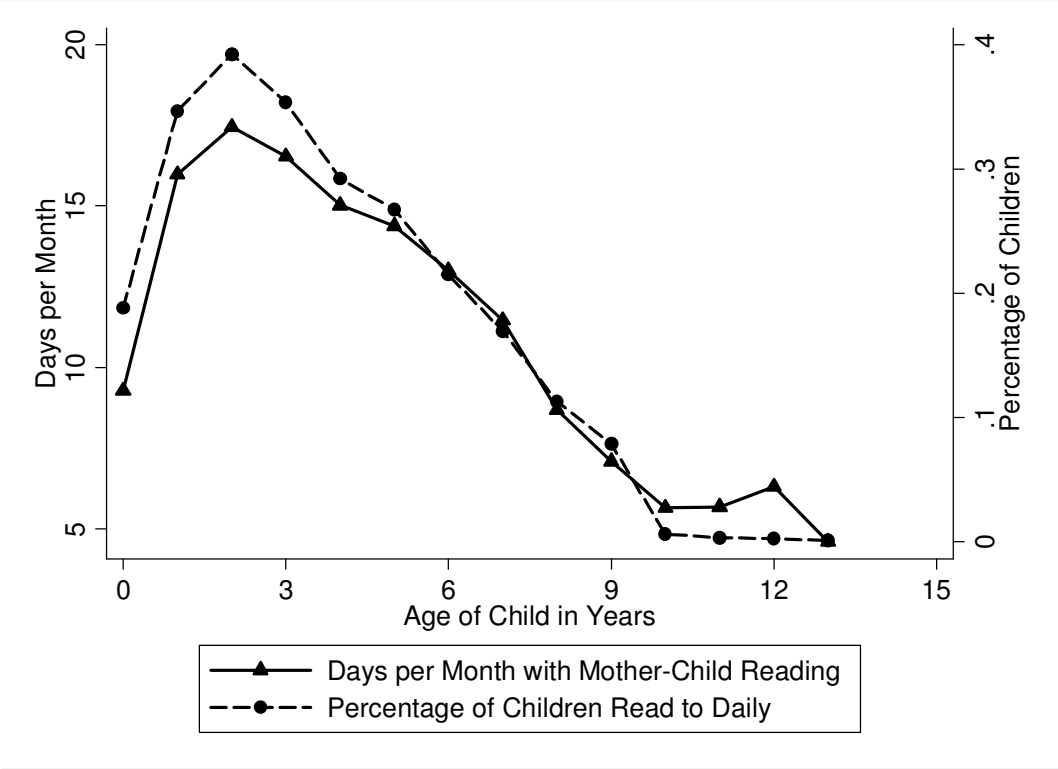


C. Ages 7-8



Notes: Frequency of mother-child reading is reported on a 6 point scale, where 1 indicates never and 6 is daily.

Figure 2. Change in reading time base on the child's age.



Notes: This data is based on the children from two-child families in the NLSY. Both of these measures are based on the 1-6 scale of how often the mother reads to each of her children.