Time vs. Money: Which Resources Matter for Children?*

Joseph Price

Department of Economics
Brigham Young University

Abstract

Parents face a number of decisions that involve a trade-off between the amount of time and money they can provide their children. This paper estimates the relative impact of parental time and family income on child outcomes. I exploit the fact that first-born child gets more parental time while the second child experiences a higher level of family income at each age and that these differences are larger when children are spaced further apart. Using this within-family variation in resources received by each child, I find that for the average family an hour of quality parent-child quality interaction produces the same amount of reading achievement as over $100 of additional family income. Parental time inputs also decrease measures of behavior problems but neither time nor family income appear to influence math achievement.

* Author contact: joseph_price@byu.edu. This paper has benefited from helpful comments from Jessica Bean, Fran Blau, David Card, Julio Caceres, Thomas DeLeire, Lisa Dragoset, Ron Ehrenberg, Gary Fields, Baran Han, George Jakubson, Lars Lefgren, Liz Peters, Robert Pollack, Dan Rees and participants at the SOLE conference. Any comments are extremely welcome.

Parents face a number of decisions that involve making a tradeoff between providing their children more time or more material resources. Every extra hour worked means more money for the family but potentially less time with the children. When choosing where to live parents often have to weigh the benefits of having a larger home or 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 very challenging empirical question. Past research has generally focused on relationship between child outcomes particular types of parent-child activities (reading, eating dinner together, etc) or self reports (by the parent or child) about how much time they spend together. One concern with such estimates is that the unobserved factors about parents that influence the amount of time that they spend with their children is likely to have a direct impact on child outcomes.

As a result, most of the economic research on parent-child time has focused on maternal employment. The reason for this focus is that maternal employment is easier to measure and there are a number of government policies that influence the mother's work decision (the ability of policy makers to induce parents to spend quality time with their children is much more limited). The research on maternal employment is essentially a debate about whether the additional income can compensate for the decrease in time the mother has available for her children.

In this paper, I exploit a common pattern in the way parents allocate time among their children to test for the impact of parental time inputs on child outcomes. Price

(2008) finds that parents spend more time with their first-born child and that this birth order gap is larger when children are spaced further apart. If parental time is an important factor in child outcomes then we would expect that the birth order gaps documented in past studies should be larger when children are spaced further apart and that the birth order gaps should be larger for those outcomes over which parental time inputs are likely to have a larger influence.

Using data on siblings from the National Longitudinal Survey of Youth (NLSY), I find that first-born children do better on reading and lower levels of behavioral problems (two measures over which parental time is likely to have the largest inputs) but no difference in math scores. I also find that these birth order gaps are larger when the children are spaced further apart, providing suggestive evidence that differences in parental time potentially contribute to improved child outcomes.

Using 2000 US Census data, I show that while first-born children get more time with their parents, second-born children material resources (i.e. experience a higher level of family income, live in a bigger home, and are more likely attend a private school). These differences in material resources are larger when the children are spaced further apart.

I use these birth order patterns to estimate both the impact of family income and parental time inputs on child outcomes in a single estimation. This provides a measure of the impact of parental time inputs in terms of the amount of additional income that would be needed to create the same change in child outcomes (the rate of technical substitution). These type of results extend beyond the debate about the consequences of a mother's working and focuses more broadly on the degree to which additional income can compensate for fewer hours of parent-child interaction for both fathers and mothers.

These estimates could provide guidance to parents as they chose the ideal mix of time and money resources to provide their children much in the same way that firms make decisions about the optimal mix of labor and capital. These estimates could also provide insight into the possible consequences of public policies (such as welfare reform, subsidized child care, or other tax credits) which encourage parents to exchange their time for additional income. They also provide some insight into the possible benefits of institutional changes that make it easier for workers to chose hours that deviate from the traditional 40-hour week in the U.S.

I. Child Outcomes Production Function

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. This paper looks at differences in outcomes between children in the same family, thus controlling for many of the parenting styles or family characteristics that are difficult to measure (at least in large national data). I focus instead on the relative impact on two of the major types of parental investments: time and money.

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 of the economic research on the impact of parental time has focused on changes in maternal employment. These estimates of the effects of maternal employment confound the effect of time and money investments. For example, Blau and Grossberg (1992) comment that the positive impact of maternal employment that they find for children after the first year of life may reflect the increase in family income that accompanies the additional hours of work. In addition, 8 hours of work clearly does not lead to 8 hours less quality time with one's children. Bianchi (2000) notes that 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.

The impact of family income is easier to estimate since there are a number of policies that provide changes for in family income that are 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 impact on more disadvantaged families. Shea (2006) uses changes in family income that result from plant closings and finds that this drop in income leads to lower child outcomes. Other studies document a strong correlation showing that children from families with more income have higher test scores, fewer behavioral problems, are less likely to have a teenage pregnancy, are more likely to go to college, and end up with higher earnings themselves.

The contribution of this paper is to examine jointly the impact of parental time and money investments in their children. Combining both effects into a single estimation provides information on the relative impact of both types of resources. This relative impact is the relevant measure for important decisions that involve a tradeoff between providing the type of resources that are allocated to children.

II. Data

The analysis in this paper draws on data from the National Longitudinal Survey of Youth (NLSY), the American Time Use Survey (ATUS) and the US Census Public Use Micro Sample (PUMS).

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 annually through 1994 and biennially since then. The NLSY contains extensive information on 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. The three child outcomes that I use in this study are the raw scores of Peabody Individual Achievement Tests (PIAT) of reading and math and the Behavior Problems Index (BPI). The PIAT test instruments are the same for all children and so the test score increases as children age.

The ATUS 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 the start and end time and who else was present for the 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 are thought to have the greatest impact on child development such as reading, talking, and helping with homework.

Many time-use researchers lament the fact that the ATUS does not contain any measures of child outcomes. Even if the ATUS included measures of child outcomes, the measurement error involved in inferring someone's typical time use from one day would not provide any meaningful analysis. The power of the time use data comes when aggregating the information over many individuals with similar characteristics.

Since the ATUS respondents are drawn from the outgoing rotation group of the CPS, there is a large set of characteristics about the respondent and other household characteristics including the age, gender, birth order, and birth spacing of the children and the age, education, work status, and marital status of the parents. Later in the analysis, I use these measures to impute information about parent-child time from the ATUS onto the NLSY.

The Census PUMS data is a 1% sample of the US population. I construct measures of birth order and spacing based on the children currently in the household and focus on children ages 4-13 to reduce some of the problems of misclassifying these variables due to children having left the home or incomplete fertility. The measures of material well-being that I use are the family's combined income, whether the child is enrolled in a private school, the number of bedrooms in the residence, and whether the child lives in a home. As additional controls, I use information on the child's age and gender, and the mother's age, education, marital status, and work status.

The first two columns in Table 1 provide regression estimates of differences in time and money inputs based on a child's birth order and spacing. Since there is only one respondent per household, I report the time-use estimates separately for father-child time and mother-child time. The results in the table show that the gaps favoring the first born in terms of time inputs get larger as the children are spaced further apart 5.6 minutes for each additional year for father time and 8.9 minutes for each year for mother time. The difference in parental time inputs between two siblings who are four years apart is 29 minutes each day of father-child time (a difference of 36%) and 39 minutes each day of mother-child time (35%).

The last four columns indicate that the second-born child experiences higher levels of material well-being and that these gaps are larger when the children are spaced further apart. For example, when siblings are four years apart the second born will experience $7,000 more family income each year (10% more), will be 17% more likely to attend a private school, will live in a house with 3% more bedrooms, and be 5% more likely to live in a house.

III. Relative Impact of Time and Money

These large differences in the time and money resources experienced by children in the same family provide an intriguing test of the relative impact of time and money. If parental time inputs are important, then first-born children will have better outcomes, especially when children are spaced further apart. In addition, if parental time is important, then we will expect to see larger differences for those outcomes which parental time inputs are the most likely to influence.

If family income is important to child outcomes, then when the family's income is increasing at a sufficient rate each year, the additional income experienced by the second child may offset the effect of the additional time the first child receives. To control for the slope of the family's income, I estimate a time trend for each family using measures of family income after the first child is born. The average slope of income in the sample is $1,066 per year (the median is $686). However, there is a great deal of variation, with families at the 25th percentile experiencing an average drop in real income of $464 and families at the 75th percentile experiencing an average growth of $3,892 per year. One caveat is that this approach hinges on the assumption that families do not smooth their income over long periods of time.

To test the impact of time and money, I use the following empirical model:

$$Y_{ij} = \beta_0 + \beta_1 \cdot second + \beta_2 \cdot second \cdot spacing + \beta_3 \cdot second \cdot slope \\ + \beta_4 \cdot second \cdot spacing \cdot slope + \mu_j + \varepsilon_{ij}$$

If parental time matters, then β_2 will be positive and if family income matters, then some of the birth order difference will offset in families with a steeper income slope, such that β_4 is negative. The inclusion of mother fixed effects makes it unnecessary to include the main effects for the family income slope or birth spacing.

A major advantage of the data in the NLSY is that it provides multiple observations for the same outcome measures over time for the same child and for multiple children within the same family. 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 table 2 are based on a model with mother fixed effects and controls for the child's gender and age in months. Since I use multiple observations for each child, I cluster the standard errors at the level of the individual child.

The first column for each outcome shows the average difference between the first and second-born child. Second-born children have PIAT reading scores that are 1.214 points lower (relative to a mean of 40.1 and a standard deviation of 18.6) and BPI scores that are 14.459 points higher (relative to a mean of 59.3 and a standard deviation of 59.3). The differences for PIAT math scores are statistically insignificant and quantitatively very small.

The second column for each outcome includes an interaction between birth order and spacing. For both reading scores and BPI, the birth order gap is larger when the children are spaced further apart providing supportive evidence that parental time is an important influence on child outcomes.

The third column under each outcome includes the interactions with the family income slope. For reading and math the relative impact of family income is insignificant and for BPI it has a different sign than would be expected, indicating that children that experience higher levels of family income have more behavioral problems. While the negative impact of income on BPI seems unexpected, Blau (1999) finds a very small and insignificant negative impact of income on BPI in his mother-fixed effect models.

IV. Estimating the Rate of Technical Substitution

The results in previous section indicate that parental time inputs matter more than additional income in terms of creating higher reading achievement and lower behavior problems. This section estimates the rate of technical substitution between time and money or the amount of additional family income needed to produce the same change in child outcomes as an additional hour of parental time.

I adopt a simple production framework in which child outcomes depend on time and money resources (T and M) as well as a set of factors that are common to all children in the family (v):

$$Y_{ij} = \alpha \cdot T + \beta \cdot M + \nu_j + \varepsilon_{ij}$$

Time inputs (T) are measured as sum of quality time hours received from the child's father and mother. Money inputs (M) are measured as the sum of the family income experienced by the child during the first ten years of life. A major advantage of this approach is that it provides a single measure of the rate of technical substitution between time and money inputs making it possible to easily report the results over different outcomes and a wider set of specifications.

The assumptions underlying this production function are that father and mother time inputs are both additive and perfect substitutes.[1] This linear model also assumes that time and money inputs are perfect substitutes (though I relax this assumption by using a Cobb-Douglas specification) and also that the impact of time and money are the same across the ages of 0-10 (which I address through additional specifications that differentiate the impact of inputs into different time periods).

One of the more difficult decisions is aggregating mother and father time. I combine the amount of time the child spends with both her mother and father regardless of whether one or both are present (so that an hour with both parents present is counted double). Folbre et al. (2005) discuss some of the issues involved in measuring parental overlap time and note that children may benefit from having two adults present because

[1] Pollak (2007) discusses issues of combining parental inputs into a single production functions and notes that Becker's (1991) work on household production often makes the assumption of perfect substitutes. Pollak suggests a number of ways in which these assumptions may be unreasonable and some directions that might be used to provide a more realistic picture of household production.

the adults will experience less stress and the children are able to observe the adults interacting. Price (2008) finds that about 58% of parent-child quality interaction in the ATUS involves both parents. If instead the appropriate metric of parent time inputs is the amount of time that one parent is present then the coefficients on parental time in the empirical work that follows should be divided by .58. Though even this rescaling would need to be refined if the fraction of time that was spent with both parents at the same time differed by birth order and spacing.

Even with a properly specified production function and appropriate way of aggregating father and mother time, estimating the rate of technical substitution between requires a dataset that has information on child outcomes, family income, and the amount of parent-child interaction. The NLSY contains accurate measures of both child outcomes and family income but not parent-child time.

Haveman and Wolfe (1995) point out that a major deficiency of current datasets is an accurate measure of parental time inputs. The PSID addresses part of this deficiency with the child development supplements that contain a time diary component in 1996 and 2002. However, the two days of observation of an individual child's time use is likely a noisy proxy for the actual level of parent-child interaction.[2] The real strength of time diary data comes from aggregating the information over groups with similar characteristics.

To incorporate parent time inputs into the analysis, I estimate a model using ATUS data predicting the amount of quality time a child receives with her parents based on the child's age, gender, birth order, birth spacing; and mother's education, race,

[2] This is similar to the small window problem discussed by An, Ginther, Haveman, and Wolfe (1996) to illustrate that single year measures of family income or family structure may be a poor proxy for the types of inputs that a child has received.

marital status, and work status. I use the coefficients from this model to impute a predicted value of parent-child quality time for each person-year observation in the NLSY using the same set of covariates.[3]

Since the ATUS does not collect time diaries for both parents, I estimate parent time inputs separately for fathers and mothers but use the mother's information about age, education, and employment in both cases. In families where a father is present (married or cohabiting), I sum the predicted values of mother and father time. Otherwise, I just use the predicted value of mother time, thus assuming that children only receive father time inputs when there is a residential father. Argys et al. (2006) discuss many of the challenges involved in accurately measuring the amount of contact between children and their non-residential fathers. Using data from the 1998 wave of the NLSY data, they find that most children (60-90% depending on the subgroup) report contact with their non-residential father with the typical amount of contact being 2-5 times a week.

I use the imputed parental time measures (*T*) from the ATUS, and the outcomes (*Y*) and measures of family income (*M*) from the NLSY to estimate the following regression:

$$Y_{ij} = \alpha \cdot T + \beta \cdot M + \gamma \cdot X_{ij} + \nu_j + \varepsilon_{ij}$$

The measures of parent time and family income are averaged over the first ten years of life and outcomes are measured for when the child is between ages 11 and 13. The rate of technical substitution comes by dividing α by β and adjusting by the

[3] This is similar to the approach of Carroll (1994) who uses information from the PSID to calculate predicted values of income for individuals in the consumer expenditure survey. Also, Gruber and Mullainathan (2005) use information on individual characteristics to estimate the degree to which someone is likely to be a current or former smoker and Björklund and Jäntti (1997) obtain predicted values of an income of the individual's father.

appropriate units (since parental time is measured in hours per day and family income is measured in $1,000's per year).

The results in Panel A of Table 3 show that parent-child time has a positive impact on reading scores, especially among families in the lower quartile of the income distribution. While the effect of income does not have an aggregate positive impact on reading scores, it does have a positive and significant impact when using log income, a spline function of income (for the bottom quartile) or when restricting the sample to the bottom quartile of income. For the families in the bottom quartile of income, the implied rate of technical substitution is $9.25 per hour.[4] This estimate of $9.25 matches very closely to research by Moore and Driscoll (1997) on the impacts of maternal employment among single mothers receiving welfare differs based on their wage level. They find that for mother's earning $7.50 per hour (or $9.45 in year 2000 dollars), that maternal employment is associated with higher reading scores.

Neither parental time nor family income appears to have any major effect on math scores. For BPI, parental time has a positive impact while additional family income has a negative impact (i.e. a higher BPI). Both of these results are consistent with the earlier results based on birth order and spacing.

Of the parents who report positive wages among the families in the bottom quartile of family income, 15% of the mothers and 17.5% of the fathers report wages greater than $9.25. This indicates that even for the sample of families for which the additional income matters the most, only a small fraction of these families could improve

[4] The RTS comes from: $\frac{1.661}{356} \Big/ \frac{.504}{1000}$.

child outcomes by trading one hour of parent-child quality time for one more hour of work.

These results are based on a linear production function of child outcomes (thus assuming constant returns to scale in both inputs and perfect substitution between them). An alternative specification would be to adopt a Cobb-Douglas production function:

$$Y = A \cdot T^{\alpha} \cdot M^{\beta} \qquad \text{with } A = e^{\gamma \cdot X + \mu + \nu + \varepsilon}$$

This approach allows for decreasing returns to scale in both inputs and recognizes the fact that even large amounts of additional income can not compensate for a complete lack of parental time inputs (or vice versa). Taking logs of both sides leads to the following estimation equation:

$$\ln(Y_{ij}) = \alpha \cdot \ln(T) + \beta \cdot \ln(M) + \gamma \cdot X_{ij} + \mu_{ij} + \nu_j + \varepsilon_{ij}$$

The results in panel A of table 4 show that a 10% increase in the amount of parent-child time leads to a 1.23% increase in reading scores, while a 10% increase in family income leads to only .38% increase in reading scores. The last row of the first column shows that these two coefficients are significantly different from each other at the 1% level (F-stat of 11.61), suggesting that if a parent could obtain a 10% increase in parent-child time in exchange for 10% less income, their children's reading scores would increase by about 1%.

For families in the bottom quartile the impact of parental time inputs are slightly smaller in magnitude while the impacts of family income are slightly larger. The difference in the coefficients on time and money inputs is no longer significant, suggesting that the ability of lower income families to improve child outcomes by exchanging time for money is less certain. For both the full sample and the low income sample, a 10% increase in parent-child interaction leads to a 3.8% decrease in the behavior problem index, while additional income actually leads to an increase.

The average income for the full sample is $46,000 compared to the $10,000 per year for the families in the bottom quartile, while quality time inputs are 866 hours per year for the full sample and 824 hours for the low income group. Thus the implied marginal rate of technical substitution at the sample means ($46,000 p/year for the full sample and $10,000 for the low income sample) is $172 per hour of quality parent time for the full sample and $24 for the low income sample.

To put this estimate into the context of past studies, Hill and O'Neil (1994) find that an extra day each week of reading to your child is equivalent to about $5,000 extra family income. On days that parents read to their children, they read on average for about 30 minutes (Price 2008). Thus the Hill and O'Neil estimates imply a rate of technical substitution of $192 per hour between family income and time spent reading.

A second issue is that the previous results were based on the view of family income as a purely public good, subject to no resource dilution. I adjust family income in each year by the equivalence factor of Cutler and Katz (1992) using the number of parents and children present in the home at the time: $(A + cK)^e$, where A is the number of adults, K the number of children, and c is the relative consumption of children compared to adults. They adopt a value of c of .4 based on work by Deaton and Muellabauer (1986) and Lazear and Michael (1988) and pick an intermediate value of .5 for e based on the range of estimates from Buhmann et al. (1988).

The results using this alternative measure of material well-being are presented in panel B of table 4. Comparing these results with the first columns of each panel in table 3 shows that adjusting family income for household size has almost no effect on the size of the coefficients. However, for the low-income family sample, the household size adjustment shifts the coefficients in the direction of more positive outcomes (reading and math score coefficients increase and BPI coefficient decreases). Part of this shift comes from the fact that the income measures of have all been rescaled downward (since the adjustment factors is always greater than 1). Adjusting the income coefficients by the average rescaling (1.64) leads to a coefficient on income of .422 and an implied RTS for reading scores of $9.61 per hour.

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 influence child outcomes directly. In addition, parents may adjust their parent inputs to a particular child is response to child behavior or outcomes. Estimates of family income have a similar problem and past researchers have dealt with this using variation in family income coming from tax policies, union status, or layoffs due to plant closings.

In this paper, I exploit a pattern in how parents allocate time to their children that provides a source of variation in the amount of time received by siblings that is unrelated to unobserved parental characteristics or observed past outcomes of the specific child. This variation arises because parents provide more parental-time at each age to the first-born child and this birth order gap is larger when the children are spaced further apart.

Using parental-time patterns based on birth order and birth spacing, I impute data on parent-child interaction from the American Time Use Survey onto a sample of siblings in the NLSY. I use the inputted parental time measures along with measures of family income from the NLSY to estimate the rate of technical substitution between parental time and family income in the production of child outcomes. The results show that the rate of technical substitution in terms of reading scores for the full sample is about $172 per hour of parent-child quality time and about $9-24 per hour for the families in the bottom quartile of the income distribution in the NLSY sample.

Given the most of the families in the sample have a wage much lower than the estimated rate of technical substitution; most families could improve child outcomes by substituting some of their current work hours to allow more time to interact with their children. Of course, parents derive utility from many things besides their children's well-being and so may provide less time than this analysis might suggest is optimal because of the other ways that they can use their additional income. In addition, the results provide some insight into the consequences of programs that shift the division of time between work and family and support research

References

An, Chong-Bum; Donna Ginther, Robert Haveman, Barbara Wolfe. "The "Window Problem" in Studies of Children's Attainments: A Methodological Exploration" *Journal of the American Statistical Association*, 91, 435, 970–982, 1996.

Argys, Laura; H. Elizabeth Peters; Steven Cook; Steven Garasky; Lenna Nepomnyaschy; and Elaine Sorensen. "Measuring Contact between Children and Nonresident Fathers" in *Handbook of Measurement Issues in Family Research* edited by Sandra Hofferth, and Lynne Casper, Mahwah, N.J.: Lawrence Erlbaum & Associates, 2006.

Becker, Gary. *A Treatise on the Family*, Cambridge, MA: Harvard University Press, 1991.

Becker, Gary. "A Theory of the Allocation of Time." *The Economic Journal*, 75, 493–517, 1965.

Bianchi, Suzanne. "Maternal Employment and Time with Children: Dramatic Change or Surprising Continuity?" *Demography* , vol. 37, no. 4, 139–154, 2000.

Björklund, Anders; Markus Jäntti. "Intergenerational Income Mobility in Sweden Compared to the United States." *The American Economic Review,* 87, 5, 1009–1018, 1997.

Blau, David. "The Effect of Income on Child Development." *The Review of Economics and Statistics*, 81, 2, 261–276, 1999

Blau, Francine and Adam Grossberg. "Maternal Labor Supply and Children's Cognitive Development," *The Review of Economics and Statistics*, vol. 74, no. 3, 474–81, 1992

Buhmann Brigitte; Lee Rainwater, Guenther Schmaus, and Timothy Smeeding. "Equivalence Scales, Well-being, Inequality, and Poverty: Sensitivity Estimates Across Ten Countries Using the Luxembourg Income Study." *Review of Income and Wealth*, 34, 2, 115-142, 1988.

Carroll, Christopher. "How Does Future Income Affect Current Consumption?" *The Quarterly Journal of Economics*, 109, 1, 111–147, 1994.

Cutler, David and Lawrence Katz. "Rising Inequality? Changes in the Distribution of Income and Consumption in the 1980's." *The American Economic Review*, 82, 2, 546-551, 1992.

Dahl, Gordon and Lance Lochner. "The Impact of Family Income on Child Achievement." *IRP Discussion Paper No. 1305–05*, 2005.

Deaton, Angus and John Muellbauer. "On Measuring Child Costs: With Applications to Poor Countries." *Journal of Political Economy*, 94, 720-44, 1986.

Folbre, Nancy; Jayoung Yoon, Kade Finnoff, and Allison Sidle Fuligni. "By What Measures? Family Time Devoted to Children in the United States. *Demography*, 42, 373-390, 2005.

Gruber, Jonathan and Sendhil Mullainathan. "Do Cigarette Taxes Make Smokers Happier?" *Advances in Economic Analysis & Policy*, 5, 1, 2005.

Haveman, Robet and Barbara Wolfe. "The Determinants of Children's Attainments: A Review of Methods and Findings" *Journal of Economic Literature*, 33, 1829–1878, 1995.

Hill, Anne and June O'Neill. "Family Endowments and the Achievement of Young Children with Special Reference to the Underclass." *The Journal of Human Resources*, 29, 4, 1064–1100, 1994.

Lazear, Edward and Robert Michael. *Allocation of Income Within the Household*, Chicago: University of Chicago Press, 1988.

Moore, Kristin and Anne Driscoll. "Low-Wage Maternal Employment and Outcomes for Children." The Future of Children, 7, 122-127, 1997.

Pollak, Robert. "Allocating Time: Individuals' Technologies and Household Technology." Paper presented at Society of Labor Economics, May 2007.

Shea, John. "Does Parents' Money Matter?" *Journal of Public Economics*, 77, 155–184, 2000.

Zick, Cathleen D., W. Keith Bryant, and Eva Osterbacka. "Mother's Employment, Parental Involvement, and the Implications for Children's Behavior." *Social Science Research,* vol. 30, 25–49, 2001.

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

	ATUS (2003–2005)		Census PUMS (2000)			
	Father Time	Mother Time	Family Income	# Bedrooms	Private School	House
second · spacing	-5.55**	-8.88**	1,711.524**	0.023**	0.008**	0.010**
	[1.40]	[1.38]	[154.367]	[0.003]	[0.001]	[0.001]
second child	-6.99	-3.24	171.348	-0.014*	-0.007**	-0.007**
	[3.95]	[3.74]	[321.535]	[0.005]	[0.003]	[0.003]
spacing	0.58	2.21	-516.399**	-0.022**	0.001	-0.007**
	[1.61]	[1.54]	[91.611]	[0.002]	[0.001]	[0.001]
Observations	3,254	4,674	146523	146523	146523	146523
R-squared	0.15	0.17	0.23	0.18	0.07	0.16
Mean	80.9	109.5	64,709	2.99	0.143	0.727
N	3,254	4,674	146,523			

Notes: Both samples are restricted to children ages 4–13. * significant at 5%; ** significant at 1%. 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 and the Census regression includes parental measures on just the mother. Both regressions exclude single father families.

Table 2. Differences in Child Outcomes by Birth Order, Spacing, and Income Slope Using Family-Fixed Effects

A. PIAT (Ages 5–13)

	Reading [mean=40.1]			Math [mean=36.9]		
	(1)	(2)	(3)	(1)	(2)	(3)
second	-1.214***	-0.678**	-0.681**	-0.021	0.183	0.203
	[0.143]	[0.316]	[0.322]	[0.128]	[0.282]	[0.287]
second·space		-0.194*	-0.186*		-0.074	-0.068
		[0.102]	[0.104]		[0.091]	[0.093]
second·slope			-0.018			-0.004
			[0.050]			[0.045]
second·slope·space			-0.002			-0.010
			[0.019]			[0.017]
Observations	16,450	16,450	16,252	16,529	16,529	16,330
# families	2,694	2,694	2,634	2,698	2,698	2,637
R-squared	0.78	0.78	0.78	0.79	0.79	0.79

B. BPI (Ages 4–13) [mean=59.3]

	(1)	(2)	(3)
second	14.459***	4.793***	5.333***
	[0.721]	[1.609]	[1.639]
second·space		3.458***	3.267***
		[0.514]	[0.527]
second·slope			-0.404*
			[0.244]
second·slope·space			0.177*
			[0.091]
Observations	18,717	18,717	18,457
# families	2,840	2,840	2,764
R-squared	0.12	0.12	0.13

Notes: All models include mother-fixed ages and variables indicating the child's age in months. * significant at 5%; ** significant at 1%. The standard deviation of each of the measures is 18.6 for reading, 16.7 for math and 59.3 for BPI.

Table 3. Difference in child outcomes based on average family income and parent-child time across the ages of 0-10.

A. PIAT-Reading (ages 11-13)

		Full Sample		Family Income in bottom quartile
Parent-child time	1.474***	1.621***	1.624***	1.661*
hrs/day	[0.310]	[0.317]	[0.317]	[0.875]
Income	-0.005			0.504**
$1,000/year	[0.006]			[0.216]
Ln(Income)		1.696**		
		[0.820]		
Spline1			0.350**	
			[0.161]	
Spline2			0.070	
			[0.092]	
Spline3			0.044	
			[0.063]	
Spline4			-0.009	
			[0.006]	
Observations	6,630	6,612	6,630	1,660
R-squared	0.74	0.74	0.74	0.72

B. PIAT-Math (ages 11-13)

		Full Sample		Family Income in bottom quartile
Parent-child time	0.099	0.163	0.168	-0.069
hrs/day	[0.242]	[0.245]	[0.244]	[0.594]
Income	-0.001			0.311*
$1,000/year	[0.006]			[0.169]
Ln(Income)		0.681		
		[0.565]		
Spline1			0.210*	
			[0.112]	
Spline2			-0.005	
			[0.061]	
Spline3			0.026	
			[0.053]	
Spline4			-0.002	
			[0.007]	
Observations	6,662	6,644	6,662	1,634
R-squared	0.70	0.70	0.70	0.63

C. BPI (ages 11-13)

		Full Sample		Family Income in bottom quartile
Parent-child time	-3.323**	-2.830*	-2.837*	-2.273
hrs/day	[1.480]	[1.495]	[1.482]	[3.795]
Income	0.055*			2.311**
$1,000/year	[0.028]			[0.986]
Ln(Income)		8.011**		
		[3.243]		
Spline1			0.985	
			[0.763]	
Spline2			-0.198	
			[0.443]	
Spline3			0.645**	
			[0.319]	
Spline4			0.039	
			[0.030]	
Observations	6,820	6,802	6,820	1,662
R-squared	0.61	0.61	0.61	0.64

Notes: All income is based on year 2000 dollars. Income refers to the average income across all years which family income was available for the child between ages 0-10.

Table 4. Alternative Specifications

A. Cobb-Douglas Model

	Full-sample			Family Income in Bottom Quartile		
	ln(read)	ln(math)	ln(bpi)	ln(read)	ln(math)	ln(bpi)
ln(parental time)	0.123***	0.031	-0.384***	0.113*	0.031	-0.381*
	[0.023]	[0.021]	[0.085]	[0.067]	[0.056]	[0.205]
ln(income)	0.038**	0.017	0.123**	0.056*	0.020	0.103
	[0.017]	[0.013]	[0.054]	[0.032]	[0.023]	[0.068]
Observations	6,611	6,611	6,802	1,642	1,638	1,644
R-squared	0.73	0.66	0.61	0.71	0.58	0.65
Test: ln(T)= ln(M)	11.61***	0.45	29.25***	0.71	0.04	5.15**

B. Adjust income by number of parents and children in the household

	Full-sample			Family Income in Bottom Quartile		
	read	math	bpi	read	math	bpi
parental time	1.478***	0.090	-3.358**	1.445*	-0.192	-3.262
	[0.309]	[0.241]	[1.477]	[0.858]	[0.586]	[3.787]
income	-0.008	-0.005	0.099**	0.693**	0.476*	3.289**
	[0.011]	[0.011]	[0.050]	[0.323]	[0.248]	[1.506]
Observations	6630	6634	6820	1660	1658	1662
R-squared	0.74	0.70	0.61	0.72	0.63	0.64

Notes: Panel B is the same as the first and last columns of table 5 except that family income is divided by the family equivalence scale used by Cutler and Katz (1992): $(\text{adults} + .4\cdot\text{kids})^{.5}$.