Do Investments in Human Capital Explain the Relationship Between Parental Education and Child Learning?

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2005. *China Labor Economics.* 2(2): 60-74.

Abstract

Numerous empirical studies have noted that parental education has a robust and positive influence on child learning, a result that is often attributed to more educated parents making greater investments in their children's human capital. However, neither the form of this investment nor the extent to which it explains the relationship between parental education and child learning is well understood. Using household data from Gansu province, this paper analyzes the extent to which investments in education-related goods and time help to explain the relationship between parental education and child learning. It is then shown that parental education has a strong, positive effect on children's test scores, and that point estimates of the effect of parental education on children's test scores are smaller in households that undertake investments in human capital. Although endogeneity concerns remain, this evidence suggests that investments in goods and time are important mechanisms by which parental education affects children's learning.

Keywords: Parental Education, Human Capital, Learning, Time Allocation, China

JEL classification: D13, I29, J22, O12

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Acknowledgements: I am grateful to the Spencer Foundation, the Mellon Foundation, and the University of Michigan Center for Chinese Studies for supporting the fieldwork and writing of this research. Albert Park, David Lam, Jan Svejnar, and Bob Willis provided many helpful suggestions. Axel Anderson gave his time generously to assist with big questions and small details alike. This paper also benefited tremendously from discussions with Eric Edmonds, Emily Hannum, Sandy Hofferth, and Chris Ryan.

1 Introduction

The landmark study of race and education in the United States known as the "Coleman Report" (**?**) concluded that family characteristics are more important determinants of educational achievement than school quality or teacher experience, particularly in the early stages of schooling. Subsequent analyses undertaken in other countries have provided further evidence, even while controlling for various household and community characteristics. For example, **?** find that rural Pakistani children whose fathers completed junior secondary school score 31 percent higher on reading tests and 29 percent higher on mathematics tests than children whose fathers did not. **?**, **?**, **?**, and **?** reach similar conclusions about the importance of parental education on children's schooling for Ghana, Malaysia, Brazil, and South Africa.

However, the reasons that parental education have such a robust effect on child learning are not very well understood. One possibility noted by **?** and others is that more educated parents may make greater investments in their children's education by providing higher levels of education-related goods and services and/or by spending more time interacting with their children. While each of these investments may be desirable, poor parents in areas with incomplete credit markets may face a trade-off between providing more goods and allocating more time to interacting with their children. Unfortunately, few studies have analyzed either the form of these human capital investments or whether they help to explain the relationship between parental education and children's test scores. **?** use survey data from the Philippines to find that urban mothers who attended school spend 50 to 75 percent more on children's education than urban mothers who never attended. **?** use household data from India to conclude that that literate mothers allocate more time to caring for children than illiterate mothers, even controlling for labor force participation. Neither article addresses whether the beneficiaries of such investments outperform thier peers in school.

This is the second in a series of two papers that explores the relationship between parental education and investments in children's schooling. Brown (2005)[1] analyzes how parental education affects the provision of goods and time used in the production of children's human capital in Gansu province. That paper concludes that more educated parents make greater investments in both goods *and* time despite prevailing poverty in many of the surveyed

[1] Zhang Dandan, please add the first China Labor Economics article to the bibliography!

households. Survey evidence suggests that more educated parents anticipate higher returns to education for their children, offering one explanation for this result. This paper then analyzes the extent to which investments in goods and time help to explain the relationship between parental education and children's scores on standardized tests. It is shown that

Building from these results, this paper analyzes the extent to which such investments help to explain the relationship between parental education and child learning by comparing the estimated effect of parental education on children's test scores in high- and low-investment households. Reductions in the estimated effects are interpreted as evidence that investments are one means by which parental education affects child learning. It is found that parental education has a strong, positive effect on children's test scores in surveyed households, but that the point estimates for parental education are smaller in households that undertake investments in human capital. Although serious endogeneity bias concerns remain, these findings strongly suggest that investments in goods and time are important mechanisms by which parental education affects children's learning.

The data for both papers come from the Gansu Survey of Children and Families, a survey of 1970 children in 100 rural villages in 20 counties located across Gansu province. These data allow for several innovations. First, the data are unusually rich, offering multiple measures of human capital investment: goods investments are measured by education-related expenditures on the sampled child, by the availablity of children's reading materials, and by the availability of a designated area for children's studying; time investments are measured by parental time allocated to helping children with homework, by whether parents read to the sampled child, and by whether parents discuss the sampled child's schooling with his or her teachers. Second, detailed household, teacher, school, and village data – all linked to the sampled child – help to control for unobserved heterogeneity to better isolate the effects of parental education.

The remainder of this paper is organized as follows: section 2 describes the empirical strategy and discusses some important endogeneity concerns; section 3 describes the data and variables; section 4 explores the extent to which these investements in goods and time help to explain the relationship between parental education and children's test scores, and section 5 concludes. Those interested in learning more about the relationship between parental education and specific investments in children's human capital production are referred to

Brown (2005).

2 Empirical Strategy and Specification

This paper seeks to investigate whether education-related investments help to explain the relationship between parental education and child learning as measured by standardized test scores. This is accomplished by following the procedure suggested by **?** and **?**. The "baseline" determinants of children's learning in household h are estimated by:

$$Z_h = \alpha + b_1 H_h^f + b_2 H_h^m + \mathbf{F} b_3 + \mathbf{K} b_4 + b_5 (H_h^f \times S_h) + b_6 (H_h^m \times S_h) + u_h \quad (1)$$

where Z is a child's test score, H^j is the number of grades completed by parent j, $j \in \{m, f\}$, and u is an error term. $\mathbf{F}$ is a vector of family characteristics including parent age,[2] the number of other enrolled children, and the number of non-enrolled children in the household; $\mathbf{K}$ is a vector of child-specific characteristics such as sex (S), age, and grade level. Because father's and mother's education may affect investments in sons and daughters differently, the sex of the child is interacted separately with mother's and father's education. The equation is then re-estimated with education-related investments included as additional regressors:

$$\begin{aligned} Z = \alpha &+ b_1 H^f + b_2 H^m + \mathbf{F} b_3 + \mathbf{K} b_4 + b_5 (H^f \times S) + b_6 (H^m \times S) \quad (2) \\ &+ b_7 \eta + b_8 (H^f \times \eta) + b_9 (H^m \times \eta) + u \end{aligned}$$

where η is an investment in either education-related goods (x) or time (θ), $\eta \in \{x, \theta\}$. Interactions are included to capture complementarity between parental education and investments in children's human capital production. Reductions in the point estimates are interpreted as evidence that part of the empirical relationship between parental education and child learning is attributable to education-related investments.

Measurement error in education-related investments may bias the estimated effect of investments on children's test scores, and thus changes in the estimated coefficients on parental

[2]The timing of parental education may have implications for interpreting estimates because the quality and content of education have likely evolved over time. Controlling for measures such as parental age may help to mitigate this variation.

education. For example, ? and ? find that more educated mothers are more likely to overstate time engaged in socially-desirable activities such as reading to children. Measurement error in time investments may be mitigated in this study, however, because two of the three investments are dichotomous and because the third – time spent helping children with homework – is undertaken regularly and with limited variation (?). Measurement error in goods investment is similarly mitigated because two of the investments were directly observable by the enumerator and because the third – education-related expenditures – was constructed from detailed consumption records.

Simultaneity may bias the estimated effects of investments on learning if low test scores prompt greater investment. Omitted variable bias may also be a concern if, for example, parents make greater investments in more diligent students. Household wealth (alternatively, income or expenditures) is a likely candidate for an instrument for education-related investment at first blush, yet it is unlikely to be orthogonal to the error term in equation 2 because wealthier households may consume more goods that complement learning, e.g. more nutritious food and electric lighting. Instruments for income such as the household's allocation of high quality land and exogenous shocks to harvest income are reasonably strong predictors of investment in the first stage, yet they do not explain sufficient variation in investments to produce precise estimates in the second stage.

Lacking adequate instruments, a second-best strategy is to include additional regressors to control for known omitted variables. More educated parents may face less severe resource constraints, thus controlling for household wealth (Y) may be important.[3] Similarly, more educated parents may invest in children to compensate for low teacher quality (Q). A child's cognitive ability (A) may also affect the optimal household allocation because more educated parents may invest more in very gifted children or may help less gifted children by providing greater investments in their schooling. Additionally, community norms and school quality may influence investment patterns. Thus, the determinants of children's test scores are estimated by:

[3] One would ideally instrument for household wealth using proxies such as land allocation and harvest quality. Such measures perform well in the first stage of two-stage estimation, but not the second. Nevertheless, instrumenting for wealth did not appreciably change the magnitude or sign of any coefficient.

$$Z_{hv} = \alpha + b_1 H^f_{hv} + b_2 H^m_{hv} + \mathbf{F}_{hv} b_3 + \mathbf{K}_{hv} b_4 + b_5 (H^f_{hv} \times S_{hv}) + b_6 (H^m_{hv} \times S_{hv}) \quad (3)$$
$$+ b_7 Y_{hv} + b_8 Q_{hv} + b_9 A_{hv} + \gamma_v + u_{hv}$$

where γ_v is a village fixed effect that controls for unobserved heterogeneity and any endogenous sorting. Following the procedure outlined above, investments in good and time are added to the regression equation:

$$Z_{hv} = \alpha + b_1 H^f_{hv} + b_2 H^m_{hv} + \mathbf{F}_{hv} b_3 + \mathbf{K}_{hv} b_4 + b_5 (H^f_{hv} \times S_{hv}) + b_6 (H^m_{hv} \times S_{hv}) \quad (4)$$
$$+ b_7 Y_{hv} + b_8 Q_{hv} + b_9 A_{hv} + b_{10} \eta_{hv} + b_{11} (H^f_{hv} \times \eta_{hv}) + b_{12} (H^m_{hv} \times \eta_{hv}) + \gamma_v + u_{hv}$$

to see how investments change the point estimates.

3 Data and Variables

The data come from the Gansu Survey of Children and Families (GSCF),[4] a survey of 1,970 children between the ages of 9 and 12 and their families in Gansu province. Separate instruments were administered to children, mothers, heads of household, and community leaders, as well as to teachers and principals for children who were enrolled in school at the time of the survey. A cognitive development test that was designed to be independent of achievement was also administered to each child. Brown (2005) describes the sampling strategy.

Child learning is measured by scores on Chinese language tests that are given at the end of the school year and are used to determine whether children are eligible to proceed to the next grade. Teachers did not report test scores for 29 students. Test scores were converted into Z-scores (defined as the number of standard deviations from the cohort mean) for the empirical analysis; in this case, the cohort is comprised of all children in the same grade and

[4] The GSCF was administered in 2000. It was a colloborative effort between researchers in China, Canada, and the U.S., including the author.

county. Where sampled children are either very advanced or are falling substantially behind, Z-scores cannot be calculated because there are too few tests scores in the cohort.[5]

Table 1 presents descriptive statistics. Fathers have completed one grade in junior secondary school on average, while mothers have completed 4.2 primary grades. The average household spends 46.5 RMB per year on non-required education-related goods and services for the sampled child. Only 6.2 percent of households allocate less than 10 RMB to this spending, while 1.8 percent of households spend at least 200 RMB. Some 54.4 percent of households have children's books and 58.8 percent have designated study areas for children, e.g. a child's desk or work table. On average, mothers and fathers spend 4.1 hours in total helping children with homework each week, although parents do not help their children with homework in 32.5 percent of the sampled households. At the other extreme, 5.7 percent of households spend at least 14 hours per week helping children with homework.[6] Time spent helping children with homework is inclusive of all children (not just the sampled child) and the average household has 0.9 other enrolled children and 0.4 non-enrolled children. Parents read to the sampled child in almost two-thirds of the sampled households and discuss the sampled child's school performance with teachers in 76.2 percent of the sampled households. Boys comprise 53.9 percent of the sample. Primary school enrollees account for 96.0 percent of the sample, an artifact not only of the ages of the sampled children, but also of the delayed age of enrollment prevalent in many areas. The median child is in fourth grade, having enrolled at age 7. Total household wealth (measured as the present value of housing and durable goods) averages 14,773.8 RMB, but there is considerable variation with 3 percent of households having over 50,000 RMB in wealth.

A few issues are worth noting. First, this survey does not distinguish between birth parents, adoptive parents, and step-parents. Nevertheless, **?** find that biology is less important than marital responsibility in fathers' investments in children. Second, teacher quality is measured by the official system used by school administrators across Gansu; this ranking incorporate teacher education, experience, attendance, publications, student performance, and student- and peer evaluations. Teacher quality is likely to capture past quality as

[5] Specifically, there are too few observations to calculate Z-scores for 9-12 year-old children in the third year of junior secondary school. In some counties, there are too few observations to calculate Z-scores for children in the first year of primary school or in the second year of junior secondary school as well.

[6] This statistic is averaged across the entire year and thus properly accounts for parents who migrate for part of the year.

well as current quality because teachers in Gansu typically follow individual cohorts through primary school. Third, scores on the cognitive development test vary significantly by age. Thus, the cognitive development test scores are translated into Z-scores by age measured in half-year increments.

4 The Impact of Investments on the Estimated Effect of Parental Education

Studies from both developed and developing countries have suggested that investments in education are an important means by which parental education affects child learning, and Brown (2005) shows that parental education influences the provision of education-related investments in rural China. Moreover, simple cross-tabulations show that education-related investments are highly correlated with test performance (table 2). To further investigate the nature of these relationships, the "baseline" determinants of children's test scores (equation 1) are estimated using OLS. The regression analysis is then repeated with controls for investments in goods and time and their interactions with parental education (equation 2). Reductions in the point estimates for households undertaking investments are interpreted as evidence that the relationship between parental education and child learning is partly attributable to more educated parents making greater investments in their children's human capital production.

Table 3 presents OLS estimates of the determinants of children's language test scores (converted into Z-scores, defined as standard deviations from the county/grade mean score). Table 4 presents analogous estimates, but attemts to reduce omitted variable bias by controlling for household wealth, the teacher quality ranking, child cognitive ability, and village fixed effects. Grade dummies are included in all specifications and heteroskedasticity-corrected t statistics are calculated. Column 1 presents the baseline estimates (equations 1 and 3). Columns 2 through 4 control for goods investments via dummies for whether the household spends at least as much on non-required education-related goods as the median household (column 2), whether the household has children's books (column 3), and whether the household has a designated study area (column 4). Columns 5 through 7 control for time investments via dummies for whether the household allocates at least as much time to helping children with homework as the median household (column 5), whether parents read to the sampled child (column 6), and whether parents discuss the sampled child's schooling with his or her teachers (column 7).

Father's education has a strong impact on language test scores (table 3). An additional grade of completed schooling increases a daughter's predicted test score by 0.026 standard deviations from the county/grade mean (significant at the 0.05 level) and increases a son's predicted test score by 0.033 standard deviations (significant at the 0.01 level). The effect of mother's education is weaker for both sons and daughters, with an additional completed grade raising test scores by 0.016 standard deviations for sons and 0.019 standard deviations for daughters, both significant at the 0.10 level. Including household wealth, the teacher quality ranking, cognitive ability, and village fixed effects (table 4) reduces the estimated effect of father's education to 0.022 standard deviations per grade completed at the mean for daughters, but the estimated effect is virtually unchanged for sons (both significant at the 0.05 level). The estimated effect of mother's education on girls' test scores increases to 0.024 standard deviations per grade completed (significant at the 0.05 level). The higher estimated effect of mother's education with additional controls suggests that mother's education may correlate negatively with some village characteristic to generate the downward bias in the estimates presented in table 3. Any correlation is stronger for daughters than for sons, however, as the effect of mother's education on sons' test scores falls slightly when village fixed effects are included.[7]

Boys perform significantly worse than girls on languages tests, although dropouts in this age group are much more likely to be girls, suggesting that the coefficient is biased upwards (**?**). Age also has a negative effect on test scores. As noted above, because grade controls are included, age may indicate lower ability if these children start school later. The sign changes as village fixed effects are added to the regression, suggesting that age of enrollment is subject to local norms and that – conditional on enrolling at the same time as their cohort – older students perform somewhat better (although the estimate becomes insignificant).

[7]Measurement error would also bias the estimates downward, but I doubt that this is the case. First, there is no systematic difference in the reported education levels of mothers of daughters in the sample and mothers of sons in the sample. Second, even if there is a true difference in the education levels of mothers of daughters and mothers of sons, I find it implausible that mothers of daughters would misreport their education while mothers of sons would not.

Investments in goods and time positively impact test scores. For example, children whose parents discuss their academic performance with teachers score 0.17 standard deviations higher than their peers (not quite significant at the 0.10 level). Parental reading to children raises predicted language test scores by 0.13 standard deviation and the availability of children's reading materials raises predicted test scores by 0.15 standard deviations. Above-median spending on education, above-median time allocated to helping children with homework, and the presence of a designated study area have smaller effects, all positive. However, the effects of investments on test scores are largely mitigated as parental education rises as seen by the negative coefficient on the parental education - investment interaction term. In addition, the estimated effects of these six investments in goods and time are not significant at conventional levels; if most of the variance in the investments is due to variation in parental education, then this finding is not surprising. If the inclusion of investments nevertheless reduces the estimated coefficients on parental education, this suggests that these are mechanisms by which parental education affects children's learning.

In households that spend more on education-related goods and services than the median household, the estimated effect of one year of father's education on daughters' scores falls to 0.021 standard deviations, a reduction of 20.4 percent from the estimates for all households in the sample (column 1). In such high-investing households, the estimated effect of father's education on sons' test scores falls by 15.4 percent. The estimated effect of mother's education on daughters' and sons' test scores falls by 30.6 percent and 37.4 percent, respectively. The availability of other goods investments also impacts the estimated effect of parental education on children's test scores. For example, in households in which children's books are provided, the estimated effect of father's education on daughters' test scores falls by 16.2 percent and that on sons' test scores falls by 12.0 percent. For mothers, the reductions in the point estimates for daughters' and sons' test scores are 6.7 percent and 4.9 percent respectively. Similarly, the availability of a designated study area for children reduces the estimated effect of father's education on daughters' test scores by 14.2 percent and reduces the estimated effect of father's education on sons' test scores by 9.0 percent. The estimated effect of mother's education on daughters' test scores is reduced by 12.1 percent and the estimated effect of mother's education on sons' test scores falls by 14.1 percent. Although Wald tests show that these changes in the parental education point estimates are not significantly different from zero, the consistently smaller coefficients is at least suggestive that goods investments may explain some of the relationship between parental education and child test scores.

The estimated effects of parental education similarly fall in households in which time investments are undertaken. For example, in households in which parents allocate more than the median number of hours to helping children with homework, the estimated effect of one year of father's education is to raise test scores by 0.23 standard deviations, a reduction of 10.0 percent from the point estimates for all households. The effect of father's education on sons' test scores in these high-investing households falls by 7.8 percent. The estimated effects of mother's education on daughters' and sons' test scores fall by 7.3 percent and 8.6 percent, respectively. In households in which parents read to the sampled child, the estimated effect of father's education on children's test scores fall by about 4.7 percent while the estimated effect of mother's education falls by 28.5 percent for daughters and by 33.1 percent for sons. In households in which parents discuss schooling with the children's teachers, the estimated effects of father's education on daughters' and sons' test scores fall by 18.5 percent and 15.1 percent, respectively; for mother's education, the estimates for daughters and sons decline by 15.5 percent and 19.0 percent, respectively. Again, Wald tests show that these changes in the point estimates are not significantly different from zero, yet the fact that all of the point estimates for parental education fall when controlling for time investments again suggests that time investments explain some of the relationship between parental education and child learning.

Including investments in the regressions continues to reduce the estimated effects of parental education when controlling for household wealth, the teacher quality ranking, cognitive ability, and village fixed effects.[8] For example, in households that have a designated study area, the estimated effects of father's education on daughters' and sons' test scores fall by 13.3 percent and 21.4 percent, respectively and the effect of mother's education on daughters' and sons' test scores falls by 7.1 and 12.5 percent, respectively. Again, although most of changes in the point estimates are not significantly different from zero, the wide reduction in the point estimates suggests that parental education is at least partially explained

[8] The exception is the estimated effect of mother's education on sons' test scores in households with children's reading materials. Here, the point esitmate rises, although it should be noted that mother's education and its interaction with the investment are both quite weak regressors.

by education-related investments in goods and time.

4.1 Discussion

Father's education has a strong effect on children's test scores, with an additional grade increasing test scores by between 0.026 and 0.033 standard deviations from the mean. The effect of mother's education is smaller, increasing scores by between 0.010 and 0.024 standard deviations at the mean. Investments in education-related goods and time also positively affect test scores. Moreover, comparing the estimated effect of parental education on children's test scores in households that invest in human capital to those in all households suggests that investing in goods and time are important means by which parental education impacts children's learning.

All of these estimates may nevertheless be subject to endogeneity bias. Simultaneity is a particular concern because low test scores may prompt additional investment in education by concerned parents rather than investment spurring higher test scores. Furthermore, education-related expenditures and hours spent helping children with homework may be subject to measurement error. Omitted variable bias may also be problematic because investments in education may reflect characteristics of the child, parent, household, schools, and community, some of which are not observed in the data. IV estimation may be used to control for these biases, but good IVs remain elusive in that various exogenous determinants of household wealth (e.g. the household's allocation of high quality land and the quality of the previous year's harvest) did not explain sufficient variation in investments to produce precise estimates. The second-best strategy adopted here was controlling for as many omitted variables as possible, e.g. household wealth, teacher quality, child cognitive ability, and characteristics of the school and village. Simultaneity, measurement error, and omitted variable bias may nevertheless remain.

Even if these biases affect the point estimates, however, parental education is clearly correlated with investments in children's human capital development, and subsequent research should emphasize finding appropriate instruments. Moreover, although these measures of investment explain a share of the relationship between parental education and child learning, much is left unexplained. This suggests that other investments may more fully explain the relationship, and field researchers should emphasize other investments in data collection.

5 Conclusion

The literature has documented a strong relationship between parental education and child human capital development, a relationship that persists despite the inclusion of controls for household and community background factors. This relationship is often attributed to higher levels of investment in children's human capital made by more educated parents, but the nature of such investments is not well understood. This paper, the second in a series of two papers, analyzes the extent to which investments in goods and time help to explain the robust empirical relationship between parental education and children's test scores.

To assess this relationship, the estimated effect of parental education on children's test scores in households undertaking human capital investments is compared to estimates for all households; reductions in the point estimates in the former suggest that a given investment explains part of the relationship between parental education and children's learning. Specifically, an additional grade of father's education increases predicted test scores by between 0.020 and 0.033 standard deviations and an additional grade of mother's education increases predicted test scores by up to 0.024 standard deviations. In households that invest in their children's human capital, the estimated effects of parental education decline. For example, the estimated effect of parental education falls by between 9.0 percent and 14.2 percent in households that have a designated study area for children's use. The estimated effect of parental education falls by between 15.1 percent and 19.0 percent in households in which parents discuss their children's schooling with their teachers. The point estimates on parental education fall even when controlling for household wealth, a teacher quality ranking, a measure of the child's cognitive ability, and school/community fixed effects.

It is thus evident that more educated parents make larger investments in their children's human capital accumulation in rural China, and these investments are an important mechanism – though certainly not the only mechanism – by which parental education affects children's learning. Because endogeneity bias may remain, future work on this topic should emphasize the search for appropriate instruments for education-related investments.

Table 1: Variables and Summary Statistics

Variable	Unit	Mean	Std. Dev.	Min	Max
education-related expenditures	RMB	46.519	55.595	0	836
household has children's books	dummy	0.544	0.498	0	1
household has designated study area	dummy	0.588	0.492	0	1
time spent helping with homework	hours/week	4.121	4.953	0	35
parents read to sampled child	dummy	0.657	0.475	0	1
parents discuss school with teacher	dummy	0.762	0.426	0	1
father's education	grades	6.985	3.515	0	15
mother's education	grades	4.19	3.514	0	12
father's age	years	37.411	4.846	27	57
mother's age	years	35.06	4.21	25	55
household wealth	RMB	14773.81	16963.81	115	209740
father's village residency	months/year	9.935	3.475	0	12
mother's village residency	months/year	11.732	1.547	0	12
male child	dummy	0.539	0.499	0	1
child's age	years	11.019	1.069	9	12.917
grade	current level	4.301	1.343	1	9
cognitive score	points	17.693	10.036	0	43
other enrolled children	number	0.866	0.714	0	4
non-enrolled children	number	0.452	0.638	0	4
teacher quality ranking	0 = probation, 1 = rank 1, 2 = rank 2, 3 = highest	1.468	0.953	0	3
Observations	1918				

Table 2: Education-Related Investments and Test Scores

		Language Test Scores			
		Quartile			
Variable	Unit	1	2	3	4
education-related expenditures	RMB	43.81	46.21	46.79	47.04
household has children's books	dummy	0.49	0.51	0.56	0.61
household has designated study area	dummy	0.57	0.58	0.59	0.61
time spent helping with homework	hours/week	3.97	3.89	4.20	4.36
parents read to sampled child	dummy	0.59	0.67	0.68	0.68
parents discuss school with teachers	dummy	0.74	0.76	0.77	0.77

Table 3: Effect of Investments on Language Test Scores (OLS)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
father's education	0.0260**	0.0283**	0.0265*	0.0299**	0.0275**	0.0253	0.0396**
	(2.43)	(2.48)	(1.83)	(2.42)	(2.11)	(1.60)	(2.38)
mother's education	0.0193*	0.0229**	0.0162	0.0227	0.0208	0.0244	0.0330*
	(1.67)	(2.01)	(1.12)	(1.63)	(1.61)	(1.40)	(1.77)
father's age	-0.0053	-0.0054	-0.0051	-0.0056	-0.0053	-0.0045	-0.0054
	(0.70)	(0.71)	(0.66)	(0.73)	(0.70)	(0.60)	(0.70)
mother's age	0.0043	0.0048	0.0026	0.0044	0.0043	0.0035	0.004
	(0.51)	(0.58)	(0.31)	(0.53)	(0.52)	(0.42)	(0.48)
male child	-0.2395**	-0.2406**	-0.2403**	-0.2451**	-0.2392**	-0.2386**	-0.2346**
	(2.23)	(2.23)	(2.24)	(2.26)	(2.22)	(2.22)	(2.22)
age	-0.0697**	-0.0700**	-0.0638**	-0.0683**	-0.0689**	-0.0681**	-0.0670**
	(2.40)	(2.40)	(2.22)	(2.35)	(2.36)	(2.36)	(2.28)
other enrolled children	0.0208	0.0283	0.0284	0.0202	0.0208	0.025	0.02
	(0.60)	(0.77)	(0.81)	(0.58)	(0.6)	(0.72)	(0.57)
non-enrolled children	0.0549	0.0569	0.0653	0.0558	0.0554	0.0594	0.0567
	(1.39)	(1.43)	(1.62)	(1.41)	(1.41)	(1.50)	(1.44)
father's ed. * male	0.0072	0.0077	0.0073	0.0079	0.0072	0.0068	0.0071
	(0.51)	(0.52)	(0.51)	(0.55)	(0.51)	(0.48)	(0.50)
mother's ed. * male	-0.003	-0.0032	-0.0025	-0.0029	-0.003	-0.0029	-0.0032
	(0.21)	(0.23)	(0.17)	(0.20)	(0.21)	(0.20)	(0.22)
non-required spending		0.0535					
		(0.4)					
has children's books			0.153				
			(1.26)				
has child's study area				0.0916			
				(0.84)			
help with homework					0.0449		
					(0.44)		
parents read to child						0.1271	
						(1.28)	
discusses with teacher							0.17
							(1.62)
father's ed * investment		-0.0076	-0.0047	-0.0076	-0.0041	-0.0005	-0.0184
		(0.58)	(0.31)	(0.54)	(0.32)	(0.04)	(1.14)
mother's ed * investment		-0.0095	0.0019	-0.0058	-0.003	-0.0106	-0.0167
		(0.67)	(0.14)	(0.39)	(0.2)	(0.61)	(0.90)
Constant	0.6857*	0.6578	0.6503	0.6137	0.6573*	0.5949	0.5649
	(1.71)	(1.65)	(1.60)	(1.45)	(1.66)	(1.46)	(1.42)
Robust std errors	yes	yes	yes	yes	yes	yes	yes
Observations	1876	1876	1876	1876	1876	1876	1876
R-squared	0.037	0.038	0.041	0.037	0.037	0.039	0.039

Grade dummies included
Robust *t* statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Effect of Investments on Language Test Scores with Additional Controls (OLS)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
father's education	0.0224**	0.0255**	0.0231*	0.0289**	0.0322**	0.0260*	0.0320**
	(2.21)	(2.23)	(1.73)	(2.25)	(2.60)	(1.80)	(2.07)
mother's education	0.0238**	0.0258**	0.0221	0.0275**	0.0298**	0.0303*	0.0434**
	(2.23)	(2.33)	(1.59)	(2.01)	(2.37)	(1.91)	(2.59)
father's age	-0.0039	-0.0039	-0.004	-0.0041	-0.0045	-0.0032	-0.0036
	(0.51)	(0.51)	(0.52)	(0.54)	(0.59)	(0.41)	(0.47)
mother's age	0.0044	0.0052	0.0041	0.0047	0.0047	0.004	0.0037
	(0.51)	(0.60)	(0.48)	(0.55)	(0.55)	(0.47)	(0.42)
male child	-0.2077**	-0.2086**	-0.2089**	-0.2132**	-0.2081**	-0.2080**	-0.2054**
	(2.03)	(2.04)	(2.04)	(2.05)	(2.03)	(2.05)	(2.03)
age	0.0146	0.0147	0.0158	0.0127	0.0149	0.0132	0.0158
	(0.49)	(0.49)	(0.53)	(0.42)	(0.50)	(0.45)	(0.53)
other enrolled children	-0.0037	0.0141	-0.0046	-0.0043	-0.0035	-0.0044	-0.0024
	(0.10)	(0.36)	(0.12)	(0.11)	(0.09)	(0.12)	(0.06)
non-enrolled children	0.0208	0.025	0.0221	0.0203	0.0225	0.0233	0.0256
	(0.55)	(0.66)	(0.57)	(0.53)	(0.59)	(0.62)	(0.67)
household wealth	0.0829***	0.0850***	0.0779**	0.0856***	0.0843***	0.0821***	0.0825***
	(2.74)	(2.80)	(2.56)	(2.83)	(2.77)	(2.71)	(2.73)
teacher quality	-0.014	-0.0144	-0.0149	-0.0138	-0.0164	-0.0144	-0.0134
	(0.43)	(0.44)	(0.46)	(0.43)	(0.51)	(0.44)	(0.41)
cognitive ability	0.3359***	0.3385***	0.3349***	0.3365***	0.3402***	0.3337***	0.3357***
	(7.84)	(7.89)	(7.77)	(7.82)	(8.09)	(7.77)	(7.78)
father's ed. * male	0.0091	0.0094	0.0089	0.0097	0.0092	0.0092	0.0096
	(0.62)	(0.64)	(0.60)	(0.65)	(0.62)	(0.63)	(0.65)
mother's ed. * male	-0.0142	-0.0143	-0.0135	-0.0137	-0.0137	-0.0144	-0.0145
	(1.01)	(1.01)	(0.95)	(0.98)	(0.98)	(1.04)	(1.03)
non-required spending		0.0012					
		(0.01)					
has children's books			0.0794				
			(0.69)				
has child's study area				0.0592			
				(0.56)			
help with homework					0.1200		
					(1.25)		
parents read to child						0.1517	
						(1.46)	
discusses with teacher							0.1102
							(1.01)
father's ed * invest		-0.0092	-0.0021	-0.0113	-0.0204	-0.0072	-0.0129
		(0.69)	(0.14)	(0.78)	(1.51)	(0.51)	(0.82)
mother's ed * invest		-0.0059	0.0022	-0.0054	-0.0087	-0.0106	-0.0234
		(0.42)	(0.17)	(0.36)	(0.61)	(0.64)	(1.36)
Constant	-1.4211***	-1.4878***	-1.4198***	-1.4644***	-1.5066***	-1.5089***	-1.4775***
	(3.06)	(3.2)	(3.07)	(3.08)	(3.26)	(3.27)	(3.28)
Village FE	yes	yes	yes	yes	yes	yes	yes
Observations	1876	1876	1876	1876	1876	1876	1876
R-squared	0.213	0.215	0.214	0.214	0.215	0.214	0.215

Grade dummies included
Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%