Parental investment and cognitive ability: new evidence from Chinese data

Tian Chen, Licheng Sun

April 27, 2022

Abstract

The goal of this paper is to examine the question of how children's cognitive ability affects parental investment in their education. The paper draws evidence from China Family Panel Survey (CFPS) data and find that a one percent increase in the children's cognitive ability increases parental investments in their education by about 2.88%. Moreover, our empirical results suggest that mothers will invest more in their children's education and play a more important role. Parental education also increases children's education investment. Specifically, families with mothers who received higher education invest 53.3% more in a children's education regardless of children's cognitive ability.

Introduction

Understanding the family resource distribution is among the essential issues of economists and policymakers. Parental decisions on child education investment are one of the family resource allocation problems that have important implications on policies such as compensatory education and other related government-sponsored education programs (Becker and Tomes, 1976; Rosenzweig and Schultz, 1982). Depending on the households' preferences, subsidies and support provided to families who need those programs have unknown effects on increasing human capital investment for disadvantaged children. As a result, some programs with the intention to help disadvantaged children may fail.

Apart from policy concerns, there are also concerns about reinforcing parental investments in children's education. This concept was theorized by Heckman as parents' preference development of investing in children who have displayed high cognitive ability in early childhood (Heckman, 2008). He points out that such children's education preference development has harmful effects on the disadvantaged children's socioeconomic success, as the lack of investments in human capital in early childhood is exceptionally costly in adulthood (Cunha and Heckman, 2007). Moreover, investing too many resources among few gifted children has a direct impact on overall human capital accumulation and economic growth. Thus, it is important for us to discuss whether such a relationship preexists in parental investment in children's education in recent years across countries.

Beholding that goal, in this paper, we investigate how cognitive ability impacts parental investments in a child's education, using CFPS data from 2010. Based on the famous fetal origin hypothesis proposed by Barker in 1995, we investigate the causal relationship between children's cognitive ability and parental investment in their education, using the Instrumental Variable (IV) model (Becker 1995). By instrumenting cognitive ability with birth weight, the reverse causality and measurement bias is greatly mitigated. The results show that children’s cognitive ability is positively correlated with parental investment in a children's education. The results pass the robustness test. We also find that other independent variables, including the father’s age, mother’s education level, and family income level, play an essential role in parental investment decisions. The result of this paper indicates that Chinese parents intentionally reinforce the difference in educational outcomes among children.

The rest of the paper will be organized as follows. We will first talk about the method and the econometric strategy used for empirical analysis. Next, we will describe the details of the data and present the estimates of the models. Lastly, we will provide the robustness check, summarize the key findings, and points out the limitation.

Literature Review

Many studies have focused on parental reinforcing behavior investment in children's education across different countries. For instance, Frijters et al. find that, in the U.S., one standard deviation increase in children’s cognitive ability increases one-third more in parental investment in cognitive stimulation and emotional support (Frijters et al. 2013). Rosenzweig and Schultz find that in India, parents consider the potential outcome of a child when deciding investment in his or her human capital (Rosenzweig and Schultz, 1982). Among this research strand, cognitive ability is an essential factor when conducting past research As Heckman proposes, cognitive skills are critical determinants of educational and socioeconomic success (Heckman 2008). They reveal that cognitive ability strongly affects children's educational enrollment. Therefore, understanding the causal relationship between endowed cognitive ability is the key part of the research on intrahousehold allocation of resources.

However, measuring the cognitive ability of a person, not to mention children is challenging. Previous studies often rely on using the standardized cognitive test scores, such as Armed Force Qualification Test (AFQT), or the other cognitive tests in national panel surveys. However, the results of the standardized tests may not represent the respondent's cognitive ability. In fact, cognitive test scores could lead to biased measurement of an individual's cognitive ability. Hanushek points out that many cognitive tests lack external validation. Also, test questions are determined by internal criteria that can favor certain students consistently on the same test. Thus, even a small change of wording among questions may alter the results of the test significantly. This will lead to measurement errors as the outcome of such a test cannot reflect the true cognitive abilities (Hanushek 1979).

Other problems of using the standardized test in intra-household redistribution study include the reverse causality and the simultaneous equation bias. In some surveys, agencies carry out the cognitive test and collect information about parental investment at the same time, which creates simultaneous equations bias as parental investments in education is related to both children's cognitive ability and test results (Stock and Watson, 2015). Moreover, when the test scores and parental investments are gathered simultaneously, reverse causality can also happen due to the correlation between the error term and test scores. These biases will render the explanation of the estimated coefficient of test scores biased as well.

Among the problem mentioned, this paper serves as an additional verification and validation of previous results on the relationship between parental investment and child cognitive ability. First, we use a new Chinese dataset and shed light on whether the same patterns hold in China. Second, to better control for the potential measurement errors, we use the IV model in which the instrumental variable is a child's birth weight to mitigate biased estimation. This IV selection is inspired by the fetal origin hypothesis proposed by Barker as many empirical studies show a strong correlation between birth weight and latent cognitive ability (Barker 1995). While it is theoretically impossible to test the instrument exogeneity assumption. Based on previous studies, the exogeneity assumption should be satisfied if we drop children with low birth weight. With the IV model, the study provides evidence that Chinese parents invest more in a child's education if their children have the strong cognitive ability.

Methodology

In this section, we discuss the IV model we used for analysis. Due to the bias concerns mentioned above, we use the instrumental variable to mitigate both the measurement and the simultaneous equation bias. Our selection of instrumental variable Z needs to satisfy two assumptions: instrument relevance and instrument exogeneity (Stock and Watson, 2015). In the regression model of this study, the impact of the instrument variable on parental investment can only happen through the child's cognitive ability. We here use birth weight as our IV, and we get this idea from Barker (Barker 1995). Barker firstly points out that fetal undernutrition, measured by low birth weight, can induce a higher rate of some diseases in adulthood. The strong linkage between in bad environment and afterward disadvantaged physical development is called the fetal origin hypothesis. Most economic research on the fetal origin hypothesis suggests that a negative relationship between early age malnutrition and later cognitive development across many countries (Baker 1995; Currie et al. 1999; Black et al. 2007; Cheadle and Goosby 2010; Almond et al. 2007). This relationship is also observed in the data (CFPS 2010) we used for analysis. Table 1 shows the results of the OLS regression of birth weight on the cognitive test score. Column (1) reports the row correlation between birth weight and cognitive test scores.

The result of the simple OLS model shows a significant relationship between birth weight and cognitive test score at the 1% level. This relationship is robust even when we control for other exogenous variables. Column (2) reports the estimates of the model with exogenous variables, including personal features, parental features, and family backgrounds. With controls, the relationship still holds, and the estimation is still statistically significant at the 1% level. This gives us enough confidence in the relevancy assumption of selected IV.

While the birth weight and cognitive test scores are strongly correlated, we also need to show that the instrument selected is exogenous. Unfortunately, it is impossible to test that assumption of the IV model using the data. However, to the best of our knowledge, the second assumption will be satisfied if the model only uses the data from the respondents with normal birth weight and is supported by other literature as studies show that there is little evidence of parental reinforcement based on a normal child's birth weight. Lynch and Brooks (2013) suggest that US parents do not have a preference to distribute more family resources to children with different birth weights (Lynch and Brooks, 2013). Restrepo also reports that American highly educated mothers treat their children equally regardless of the difference in ability (Restrepo 2016). These results all give us some confidence that the IV selected satisfies the exogenous assumption.

However, we also fear that Chinese parents are likely to reinforce the initial health condition. In the case that low birth weight directly affects parental investment in education, the second assumption of the IV model will not be satisfied. To avoid this problem, I drop the children with a birth weight lower than 2500 grams, the WHO benchmark of a low-birth-weight child (WHO 2014). In this case, parents should not have a bias in education investment if their child has a normal birth weight. By dropping the low-birth-weight children, the IV estimates of should be unbiased as the difference in birth weight does not affect parental investment. In other

Dependent variable:	Log parental investment
Log cognitive ability test	2.296***
	(0.667)
Gender	-0.0662
	(0.0792)
Urban	0.0175
	(0.0856)
Age	0.155***
	(0.0248)
Mother's age	0.0167
	(0.0126)
Mother's education	0.775***
	(0.254)
Log family income	0.0876***
	(0.0328)
Log family net asset	0.0980***
	(0.0370)
Father's age	-0.0138
	(0.0121)
Father's education	-0.0750
	(0.197)
N	1082
R^2	0.098
adj. R^2	0.090
F	12.45

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Results of robustness check

words, we assume that when deciding the amount of investment, parents do not take the initial health condition of a child into account because they believe all normal birth children will grow healthy. This helps us ensure the IV's exogenous assumption is satisfied. With the IV selection illustrated, we will nest present the model we used for empirical analysis.

Model:

The study uses both the OLS regression model and the IV model with the Two-Stage Least Squares (TSLS) estimation and uses the log form model for a better explanation and to mitigate the heteroscedasticity problem.

First, for individual i, the OLS regression model and the second stage equation of the IV model i

$$Invest_i = \alpha_0 + \beta_1 CA_i + \beta_2 Child_i + \beta_3 Parents_i + \beta_4 Family_i + \varepsilon_i \quad (1)$$

where α_0 denotes the constant term. CA_i denotes the cognitive test scores; $Child_i$ denotes a vector of variables relating to child's information, including age, gender, and location of residence; $Parents_i$ is a vector of parental features including the education level and age; the $Family_i$ is a vector of characteristics of family including the total income, net wealth and the number of siblings; the ε is the random error term. The estimated parameters are β_1, β_2, β_3, and β_4. β_1 measures the impact of the cognitive ability on parental investments in child education; β_2 captures the impacts of other child's characteristics on parental investment in child education; β_3 measures the effects of parental characteristics on parental investments in child education; the coefficient β_4 grabs the impacts of family traits on parental investments in child education.

The study adopts Hausman test for model's endogeneity and necessity of 2SLS. The null hypothesis is that the coefficient of the endogenous variable in both the OLS and the IV model approaches to the same value given large sample. Rejecting the null hypothesis is essentially saying that IV model should be adopted. In the study, the result of Hausman test estimated by Stata shows that the p-value is significant at the 1% level: the cognitive test score is an endogenous variable and IV model is necessary to use. Thus, for individual i, the first stage equation of the IV model is deifned as:

$$CA_i = \pi_0 + \pi_1 BW_i + \pi_2 Child_i + \pi_4 Parents_i + \pi_4 Family_i + v_i \ (2)$$

where π_0 denotes the constant term; BW_i denotes the birth weight. The parameters are defined by π_1, π_2, π_3 and π_4. π_1 measures the impacts of birth weight on the cognitive test scores; π_2 seizes the impacts of other features of children on cognitive test scores; π_3 is the effects of parental features on the cognitive test scores; π_4 captures the influence of variables relating to family's information on the cognitive test scores.

The reduced-form equation is:

$$Invest_i = \gamma_0 + \gamma_1 BW_i + \gamma_2 Child_i + \gamma_3 Parents_i + \gamma_4 Family_i + \omega_i \ (3)$$

where γ_0 denotes the constant term. The coefficient γ_1 measures the effects of birth weight on parental investment in child education; the coefficients γ_2, γ_3, γ_4 are the effects of child's characteristics, parental traits, and family features on parental investment on child education.

Data Description

The data is from the China Family Panel Survey (CFPS) in 2010. The CFPS, beginning in 2010, is a national longitudinal social survey project, focusing on the economic and non-economic welfare of Chinese citizens. The total sample of the 2010 baseline survey consists of 16,000 households in 25 provinces in Mainland China (Institute of Social Science Survey, 2015). As shown in Figure 1, the sources of the CFPS data can represent the major population in mainland China, especially from the areas with prosperous economic activities.

The CFPS includes five questionnaires: the community questionnaire, the family roster questionnaire, the family questionnaire, the family roster questionnaire, the child questionnaire, and the adult questionnaire. The study uses the information of children above ten years old from the family questionnaire, the child questionnaire, and the adult questionnaire. In the study, the family's data comes from the family questionnaire, the child's information comes from the child questionnaire, including the endogenous variable of interest, the child's cognitive test score, and the parent's data comes from the adult questionnaire.

The CFPS adopts two types of cognitive question sets to evaluate the cognitive ability of respondents older than ten years old. In 2010 and 2014, the CFPS survey applied the word test and math test to measure cognitive ability. Nevertheless, a different question set was implemented in the 2012 and 2016 baseline surveys to improve the accuracy of the test. According to the institution, the cognitive test questions in 2012 and 2016 come from the Health and Retirement (HRS) designed by the University of Michigan, including the word recall test and number series test. The study uses the question set consisting of the word test and the math test in the main models, and the HRS question set for robustness checking.

One major problem of the CFPS data is the lack of information and the misreporting of some respondents. As a national panel survey, the data collecting process is extremely challenging. For example, some households have a negative family income and family net assets. To avoid the biased estimators caused by measurement errors, I drop the illogical value. After I cut the abnormal observations, the sample size decreased drops from 2,213 to 2,176. Furthermore, as I discuss in section III, to satisfy the second assumption of the IV model, I drop the children with low birth weight, which is 2,500 grams. Lastly, I choose the children with no missing information for each variable and drop 91 children with zero value in either parental investment, cognitive test scores, family income, or a family net asset to use logarithmic transformation. The final sample size is 1,295.

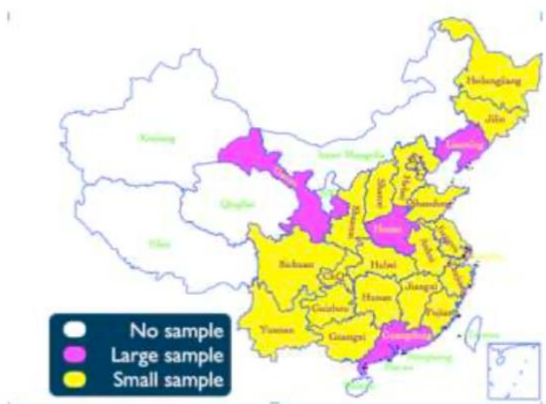

Figure 1: The sources of CFPS samples at provincial level

Source: CFPS User's Manual (3rd Edition)

Table 2 reports the descriptive statistics of data. On average, parents spend 1,539 RMB on a child's education, but a large difference exists among different families. The highest educational expenditure is 44,200 RMB, but the lowest one is 8 RMB, indicating that the family spends no money on a child's education. The average cognitive test scores are 33.94, with a maximum scores 58 and the minimum scores 0, meaning that the cognitive ability of people is

Variable	Description	Unit	Mean	Q1	Q3	SD	Min	Max
Parental Investment	Educational expenditure in 2010	RMB	1539.23	250.00	2000.00	2652.20	8.00	44200.00
Cognitive test score	Mean score of word test and math test in 2010	Score	33.94	27.00	42.00	10.31	2.00	58.00
Birth weight	Child's birth weight	Gram	3286.21	3000.00	3500.00	489.18	2500.00	6400.00
Gender	if Male, gender equals 1	Dummy	0.52	0.00	1.00	0.50	0.00	1.00
Urban	if live in urban areas in 2010, urban equals 0	Dummy	0.48	0.00	1.00	0.50	0.00	1.00
Age	Child's age in 2010	Age	12.47	11.00	14.00	1.73	10.00	15.00
Mother's age	Mother's age in 2010	Age	38.76	36.00	41.00	4.17	30.00	60.00
Mother's education	if graduate from 3-year college or 4-year university , it equals 0	Dummy	0.06	0.00	0.00	0.24	0.00	1.00
Father's age	Father's age in 2010	Age	40.65	38.00	43.00	4.43	33.00	75.00
Father's education	if graduate from 3-year college or 4-year university , it equals 0	Dummy	0.08	0.00	0.00	0.27	0.00	1.00
Family income	Family income in 2010	RMB	36178.76	15222.50	40499.50	47180.39	15.00	847865.00
Family net asset	Family net asset in 2010	RMB	308928.31	63987.57	270000.00	1024933.16	1.00	30014000.00
The number of siblings	The number of siblings under 22 in 2010	Number	0.90	0.00	1.00	0.94	0.00	7.00

Table 2: Summary statistics

heterogeneous. After dropping the low-birth-weight children, the mean birth weight of respondents is 3,286.21 grams, with the maximum 6,400 grams and the minimum 2, 500 grams. The gender distribution is almost even in the sample, with 52% boys and 48% girls. 48% of children are living in urban areas, and 52% children are living in rural areas. The average age of respondents is 12.47 years old, with the maximum 15 years old and the minimum 10 years old.

The features of mother and father are divergent. The average age of the mother is 38.76 years old, which is slightly smaller than the average age of the father. In addition, while only 6% of mothers have a degree from a 3-year college or 4-year university, 8% of fathers hold a degree from an institution of higher education. A small proportion of the parents who have a chance to receive tertiary education reflects the inequality in education in China.

The last three rows of Table 2 present the information about family backgrounds. The descriptive statistics of both the family income and family net assets reveal the inequality in family socioeconomic status in China. The mean family income is 36,178.76 RMB, with a maximum of 842,465 RMB and a minimum of 15 RMB. The distribution of family net assets is more uneven. The average family net asset is 308,928.76 RMB, with a maximum of 30,014,000 RMB and a minimum of 1 RMB. Lastly, the average number of siblings under 22 years old is 0.9, with a maximum of 7 and a minimum of 0.

Results

The results of the OLS and the IV model estimated by Stata in Table 3 all show that parents reinforce the child's cognitive ability. The literature applies six models of specifications in total. With each method, I define three models:(1) the model with covariates relating to the only child; (2) the model with covariates relating to the child and mother's information and

Dependent variable:	Log parental Investment					
		OLS			IV	
	(1)	(2)	(3)	(4)	(5)	(6)
Log cognitive test score	0.952***	0.617***	0.620***	3.413***	2.962***	2.884***
	(0.105)	(0.103)	(0.103)	(0.838)	(1.089)	(1.053)
Gender	-0.0827	-0.113	-0.112	-0.00716	0.000317	-0.00269
	(0.0716)	(0.0686)	(0.0687)	(0.0885)	(0.0939)	(0.0924)
Urban	0.506***	0.232***	0.225***	0.204	0.113	0.113
	(0.0726)	(0.0736)	(0.0740)	(0.131)	(0.0996)	(0.0971)
Age	-0.0135	0.0450*	0.0444*	-0.308***	-0.243*	-0.235*
	(0.0242)	(0.0243)	(0.0244)	(0.103)	(0.135)	(0.131)
Mother's age		-0.0178**	-0.0262**		-0.0116	-0.0304*
		(0.00882)	(0.0126)		(0.0115)	(0.0167)
Mother's education		0.726***	0.674***		0.508***	0.533***
		(0.147)	(0.167)		(0.167)	(0.164)
Log family income		0.277***	0.276***		0.237***	0.241***
		(0.0426)	(0.0427)		(0.0650)	(0.0637)
log family net wealth		0.0172	0.0158		-0.0172	-0.0162
		(0.0270)	(0.0270)		(0.0358)	(0.0346)
The number of siblings		-0.257***	-0.259***		-0.0461	-0.0616
		(0.0405)	(0.0407)		(0.110)	(0.104)
Father's age			0.0110			0.0240
			(0.0116)			(0.0167)
Father's education			0.0982			-0.0340
			(0.152)			(0.169)
First stage F-statistics				30.99	16.97	17.86
N	1298	1298	1298	1298	1298	1298
R^2	0.124	0.223	0.224	.	.	.
adj. R^2	0.121	0.218	0.217	.	.	.
F	45.70	41.12	33.75			

Standard errors in parentheses; model (4) (5) (6) with robust standard errors

Constant terms are not reported

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Regression results of the OLS and the IV models

family background; (3) the model with covariates relating to the child, mother and father's information and family background. Columns (1) to (3) report the results of the OLS estimates, and columns (4) to (6) show the results of the IV model.

Column (1) reports the OLS estimates of the model with only the child information. The estimated coefficient of log cognitive test scores is 0.954, with statistical significance at the 5% level, indicating that a 1% increase in cognitive ability scores is associated with a 0.952% positive change in parental investment in education. The location of the residence of a child has a massive impact on parental investment in this OLS specification. The estimated effect of Urban, is 0.506, indicating that living in urban areas raises parental investment by 50.6%.

Controlling for exogenous variables pertain to the child, mother, and family situation, column (2) shows that the model in column (1) overestimates the effects of a child's cognitive ability on parental investment in education. The estimated coefficient of cognitive test score drops to 0.617, even though it is still statistically significant at the 5% level. In this specification, except for family net asset and age, all covariates influence parental investment in education. Being a girl reduces parental investment in education by 12.1%, living in urban areas increases parental investment in education by 23.2%-, and a one-year increase in age increases parental investment in education by 4.50%. Surprisingly, the result also shows that mothers' education plays an essential role in the decision to invest in children's education. One year increase in maternal age decreases the amount of investment by 1.78%. And a family with a mother graduating from a 3-year college or 4-year university invests 72.6% more in a child's education than a family without a mother who obtained a degree from an institution of higher education. Family income and the number of siblings affect parental investment in education as well. One percent increase in family income increases parental investment by 0.277%. Also, having one more sibling under 22 years old decreases parental investment in a child's education by 25.7%.

While mothers' feature is critical to deciding investment of education in a child within the family, as shown in column (3), the father's age and the father's education level do not play a significant role in parental investment in a child's human capital. The estimated coefficients of them are not statistically significant, even at the 10% level. The model specification in column (3) slightly changes the estimate of log cognitive test score, the coefficient of it increases from 0.617 to 0.620, indicating that there is a weak negative correlation between cognitive test score and father's age or father's education.

Column (4), (5), and (6) reveals that instrumenting cognitive test scores with birth weight can deal with both measurement errors and reverse causality caused by the cognitive test. The OLS regression considerably underestimates the effects of a child's cognitive ability on parental investment in a child's education. The first-stage F statistics of all IV model specifications exceed 10, satisfying the benchmark of a rule of thumb in the IV model and indicating that birth weight is a strong instrumental variable (Stock and Watson, 2015).

The result of the model specification in column (4) shows that a 1% increase in cognitive test scores increases parental investment in a child's education by 3.413%. Furthermore, while living in urban areas does not have an impact on parental investment anymore, an additional year of a child's age reduces parental investment in education by 30.8%.

In the IV model, the mother's education still plays a critical role in intra-household distribution. Column (5) reports that omitted variable bias occurs if the model does not include variables relating to mother and family backgrounds. After controlling these variables relating to backgrounds, a 1% increase in cognitive ability raises parental investment in education by 2.962%. The coefficient of maternal education level is robust, even in the IV model. Having a degree from an institution of higher education enhances parental investment in a child's education by 50.8%. Lastly, a 1% increase in family income increases parental investment by 0.237%.

The full model in column (6) verifies the fact that in comparing to mothers' features, fathers' characteristics are less significant. Coefficients of Both father's age and father's education are statistically insignificant even at the 10% level. The coefficient of cognitive ability decreases from 2.962 to 2.884, indicating that the corrected cognitive test score is likely to have a negative correlation with fathers' age or have a positive relationship with fathers' education. Therefore, omitted variable bias may occur if the model excludes the father's features.

In summary, what stands out most in Table 3 is that the IV model substantially changes the coefficient of the cognitive test score, indicating that measurement errors and reverse causality may underestimate the level of parental reinforcing behavior. The finding also supports the hypothesis proposed by Becker and Tomes (1976); parents are more likely to invest more human capital in an advantaged child within a family because they take the efficiency and quality into the decision of investment if they have a budget constraint.

Another exciting aspect of the results is that mothers' education level considerably affects the intra-household allocation of resources. A mother with a higher education level is essential for a child's education, especially in China, and the difference in impacts between mother and father exists. This finding is consistent with Brown (2006), who shows that mothers are more important than fathers in deciding the amount of investment in a child's education.

Last but not least, family economic status does matter even though it has small effects. A model specification suggests that a more affluent family can invest more in a child's education. This finding is consistent with Heckman (2008), who argues that family socioeconomic status is vital to a child's human capital accumulation.

Robustness Test

The study uses the CFPS data in 2016 to check the robustness of the results. The data in 2016 are different from that in 2010. Firstly, the respondents of the child questionnaire in 2010 are all excluded from the same survey in 2016 because the child questionnaire of CFPS only includes children between 10 years old and 15 years old. Furthermore, the new cognitive test from the HSR survey in the US was adopted in both 2012 and 2016. I choose the CFPS data in 2016 rather than that in 2012 because the Institute of Social Science Survey (2015) argues that the results of the cognitive test in 2016 have better quality. After the same selecting process, the final sample size is 1,082. The model specification is almost the same as the model in column (3) of Table 3. However, the model does not control the number of siblings whose life depends on the parent's support because of the lack of information.

The result of OLS regression with multiple aggressors shows the same tendency as that of Table 3. As shown in Table 4, a 1% increase in cognitive test scores is associated with a 2.296% increase in parental investment in education. Also a mother's education contributes significantly to parental investment in a child's education as well. A mother with a degree from an institution of higher education raises parental investment by 77.5%. Furthermore, the coefficients of both family income and net family asset are statistically significant at the 5%

	(1) Log test score	(2) Log test scores
Log Birth weight	0.387****	0.319****
	(5.29)	(4.95)
Gender		-0.0570***
		(-3.07)
Urban		0.0260
		(1.30)
Age		0.124****
		(22.14)
Mother's age		0.00292
		(0.87)
Mother's education		0.0595
		(1.29)
Log family net income		0.0262**
		(2.35)
Log family net asset		0.0118
		(1.61)
The number of siblings		-0.0835****
		(-7.72)
Father's age		-0.00626**
		(-2.04)
Father's education		0.0566
		(1.35)
N	1451	1347
R^2	0.019	0.351
adj. R^2	0.018	0.346
F	27.98	65.65

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$

Table 1: Regression of birth weight on cognitive test score

level, even though their small values of them indicate that family economic status has only tiny effects on parental investment in education.

Conclusion

The study finds that Chinese families reinforce cognitive ability, which is partly determined by the initial health condition of a child. The study strengthens the idea that parents take the efficiency and quality of children when making investment decisions within a family, as proposed by Becker and Tomes (1976). The findings will be of interest to both policy implementation and policy evaluation. For policymakers who intend to alleviate the inequality within society by providing the transfer to poorer households, they have to consider the intra-household redistribution when implementing policies. Otherwise, the policies will fail because parental behavior widens the gap between the advantaged and the disadvantaged children measured in cognitive ability.

In addition, the literature sheds new light on how to deal with measurement errors and reverse causality. The IV results suggest that measurement errors and reverse causality remarkably underestimate the effect of cognitive ability on parental investment in education. In this case, using an instrumental variable can handle the low quality of the results of the cognitive test. Moreover, the estimates of the first stage equation of the IV model verify the strong association between cognitive ability and birth weight.

Lastly, the results of the models also suggest that mothers' education plays an essential role in children's development. A family with a more educated mother invests more in a child's education, regardless of a child's cognitive ability. Therefore, educated mothers can compensate disadvantaged children in a family and contribute more to the human capital accumulation of the younger generation. Furthermore, the less significant role of the father's feature indicates that adult education programs for the household with low socioeconomic status should target women rather than men. Higher education levels can not only help mothers succeed in careers but also encourage families to invest more in their children, which is essential for the human capital accumulation of the younger generation.

One limitation of this study is that the study does not adopt the family fixed effect or sibling fixed-effect model. Even though adopting the IV model can correct the bias caused by measurement errors and a part of the reverse ability, estimation bias caused by unobserved variables may still happen. Extensive previous studies apply the fixed effect model or the IV model with fixed effects to deal with unobserved heterogeneity. Nevertheless, the small sample size of respondents in 2010 whom the CFPS successfully chased in 2014 does not allow us to apply the fixed effect model but to avoid the selection bias at the same time. Selection bias may also occur because the study only focuses on children with no missing information and normal birth weight. However, the robustness check shows that the statistical significance of the coefficient of cognitive test scores is still robust even in data with different respondents and different cognitive test question sets. Future studies can use a wider dataset, maybe even cross-countries, to better mitigate the problems and provide more clarity to the question.

Work Cited:

Almond, D. and Currie, J. (2011). Killing Me Softly: The Fetal Origins Hypothesis. The Journal of Economic Perspectives, 25(3):153–172.

Almond, D., Edlund, L., Li, H., and Zhang, J. (2007). Long-term effects of the 1959-1961 china famine: Mainland china and hong kong. Working Paper 13384, National Bureau of Economic Research.

Barker, D. J. (1995). Fetal origins of coronary heart disease. BMJ: British Medical Journal, 311(6998):171.

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

Black, S. E., Devereux, P. J., and Salvanes, K. G. (2007). From the Cradle to the Labor Market? The Effect of Birth Weight on Adult Outcomes. The Quarterly Journal of Economics, 122(1):409–439.

Brandt, L., Siow, A., and Wang, H. (2015). Compensating for unequal parental investments in schooling. Journal of Population Economics, 28(2):423–462.

Brown, P. H. (2006). Parental education and investment in children's human capital in rural China. Economic Development and Cultural Change, 54(4):759–789.

Cameron, S. V. and Heckman, J. J. (2001). The Dynamics of Educational Attainment for Black, Hispanic, and White Males. Journal of Political Economy, 109(3):455–499.

Cheadle, J. E. and Goosby, B. J. (2010). Birth weight, cognitive development, and life chances: A comparison of siblings from childhood into early adulthood. Social Science Research, 39(4):570–584.

Cunha, F. and Heckman, J. (2007). The technology of skill formation. American Economic Review, 97(2):31–47.

Currie, J., Hyson, R., and Hyson, N. . (1999). Is the Impact of Health Shocks Cushioned by Socioeconomic Status? The Case of Low Birthweight. American Economic Review, 89(2).

Datar, A., Kilburn, M. R., and Loughran, D. S. (2010). Endowments and parental investments in infancy and early childhood. Demography, 47(1):145–162.

Frijters, P., Johnston, D. W., Shah, M., and Shields, M. A. (2013). Intrahousehold Resource Allocation: Do Parents Reduce or Reinforce Child Ability Gaps? Demography, 50(6):2187–2208.

Hanushek, E. A. (1979). Conceptual and Empirical Issues in the Estimation of Educational Production Functions. Journal of Human Resources, 14(3):351–388.

Heckman, J. J. (2008). Schools, skills, and synapses. Economic Inquiry, 46(3):289–324.

Hsin, A. (2012). Is Biology Destiny? Birth Weight and Differential Parental Treatment. Demography, 49(4):1385–1405.

Institute of Social Science Survey, P. U. (2015). CFPS User's Manual (3rd Edition). Technical report.

Lazear, E. (1977). Education: Consumption or Production? Journal of Political Economy, 85(3):569–598.

Li, H., Rosenzweig, M., and Zhang, J. (2010). Altruism, Favoritism, and Guilt in the Allocation of Family Resources: Sophie's Choice in Mao's Mass Send-Down Movement. Journal of Political Economy, 118(1):1–38.

Lynch, J. L. and Brooks, R. (2013). Low Birth Weight and Parental Investment: Do Parents Favor the Fittest Child? Journal of Marriage and Family, 75(3):533–543.

Pasqua, S. (2005). Gender bias in parental investments in children's education: A theoretical analysis. Review of Economics of the Household, 3(3):291–314.

Restrepo, B. J. (2016). Parental investment responses to a low birth weight outcome: who compensates and who reinforces? Journal of Population Economics, 29(4):969–989.

Rosenzweig, M. R. and Schultz, T. P. (1982). Market opportunities, genetic endowments, and intrafamily resource distribution: child survival in rural India. American Economic Review, 72(4):803–815.

Stock, J. H. and Watson, M. W. (2015). Introduction to Econometrics.

WHO (2014). Global nutrition targets 2025: Low birth weight policy brief. Technical documents. Wooldridge, J. (2012). Introductory Econometrics: A Modern Approach.