

## Number of Births and Quality of Education- Evidence from CEPS and a New Explanation

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**Keywords:** Child education; Quantity-quality; Social interaction model

**Abstract.** The purpose of this paper is to identify the quantity-quality causality in children's education. This paper uses the data of China Education Tracking Survey CEPS, using social interaction model and instrumental variable method, and found that non-only children will perform better in cognitive ability test, but they will have some performance in self-assessment of academic performance. decline. The study concluded that, in a more comprehensive evaluation perspective, the increase in the number of family births does not cause a loss of education quality. Even within a certain range, the quantity of education will play a positive role in quality.

### Introduction and Literature Review

Quantity and Quality Trade-off is one of the most important research directions in educational economics. With the development of the economy, the phenomenon of “child labor” will gradually decrease, and people will pay more attention to education. In the long run, investment in education will bring higher returns (Hazan,etal, 2002).[1].

There is a large body of literature that provides a detailed analysis of this problem: Considering that family fertility choices may have different forms of endogeneity, solutions include exogenous fertility by using twins as IV (Rosenzweig and Zhang, 2009)[2], however, Studies have also shown that an increase in the number of family births from one to two will significantly increase enrollment (Qian, 2009).[3].

This article will continue to explore the quantity-quality issues of children's education based on previous research. To identify the causal relationship between quantity and quality, we must first control the explanatory variables that also affect the quality of education.

Traditional exogenous explanatory variables, such as teacher characteristics and class size, have an impact on student performance, while household income has a smaller impact (G.Rivkin, Hanushek, 2003)[4]; in addition, another paper discusses public school finances. The impact of input on student performance, and the higher the financial input, the quality of education that students receive (Jackson, 2018)[5].

In addition to the traditional exogenous explanatory variable framework system, in recent years there have also been literatures discussing the impact of peer effects on student performance. On the one hand, Peer effects are mainly reflected in the mutual influence of learning effort and the degree of participation in social activities (Sacerdote, 2001)[6]; on the other hand, the influence of peer effects on student performance may also be through the way of “teaching each other”. Produced, that is, good students may play the role of a teacher (Kimbrough, 2017)[7].

However, so far few studies have used social interaction models to identify quantity-quality issues. In this paper, the IV method is used to identify the causal effect between quantity-quality under the premise of the endogenous companion effect.

### Data and Exploration Analysis

The data selected for the study was from the China Education University's "China Education Tracking Survey 2013-2014 School Year Survey", referred to as CEPS. This article will select the first seven grade data of the survey, including all questionnaire information for students, parents, teachers, and principals in the seventh grade.

This article will use the students' cognitive test scores and academic performance as the explanatory variables; and the student's family size, that is, whether it is an only child, is the main explanatory variable. Considering that although CEPS uses a multi-stage probability-to-scale (PPS) sampling method, we still need to test whether the randomness of the sample is sufficient. First, we examine the statistical distribution characteristics of students' grades. The data collected the cognitive test scores of the seventh-grade students and the test scores of the various subjects.

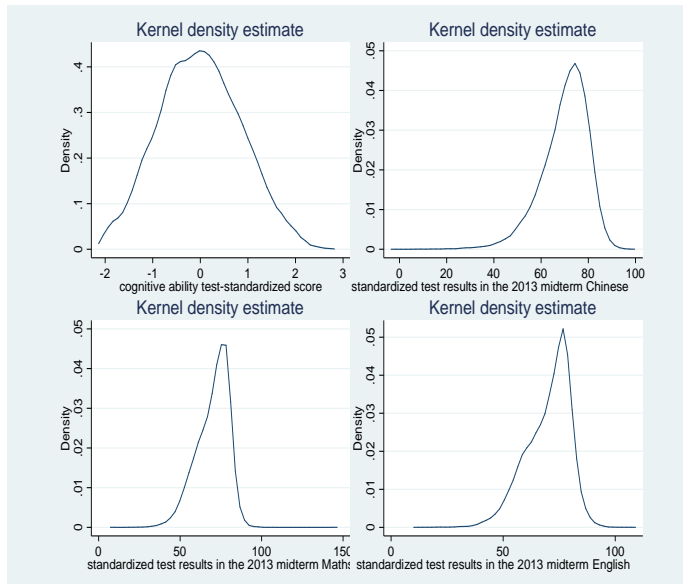


Figure. 1

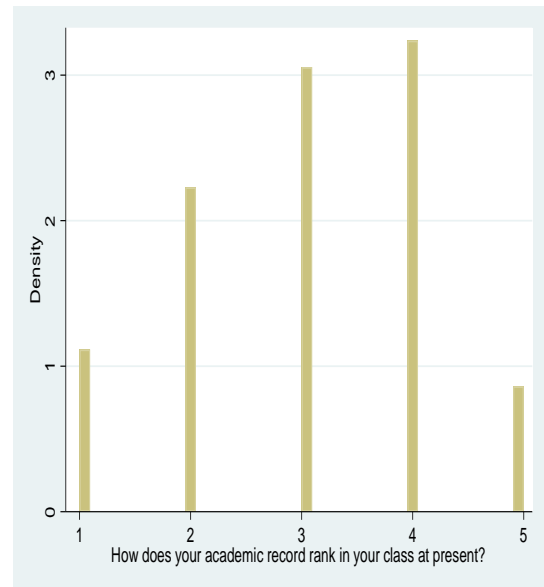


Figure. 2

It can be seen that the empirical distribution of cognitive ability is close to a normal distribution. The results prove that the randomness of the sample is sufficient. Among them, the cognitive ability test is more representative of the overall quality of students than the scores of various subjects. Therefore, in the analysis below, the cognitive ability test score will be the main proxy variable for student performance.

The second part is the analysis of family size. The phenomenon of patriarchal patriarchy in China can be simply summarized as follows: If the first child is a daughter, even under the supervision of the family planning policy, there will be a strong willingness to try to give birth to a second child. If the first child is a boy, the probability will be abandoned. Second child.

Table 1

Variable	Obs	Mean	Std.Dev.	Min	Max
a01	19,216	1.486105	0.4998199	1	2

In the simple description of the gender composition of the sample, it can be found that the ratio of male to female in the sample is relatively balanced. But here we need to further explore the composition of the sample individual brothers and sisters.

Construction statistics:

Fertility boy willingness = gender male\*sister + gender female\*younger brother

Fertility girl willingness = gender female\*have brother + gender male\*have sister

Table 2

Variable	Obs	Mean	Std.Dev.	Min	Max
boyfirst	19,216	0.7892902	0.4078233	0	1
girlfirst	19,216	0.6729808	0.4691365	0	1

Obviously, the average value of the willingness to give birth to a boy is higher than the average value of the will of the child. To some extent, this statistic shows that the family size in the sample is endogenous.

The third part is the descriptive statistics of exogenous variables. Since the data used in this paper is not panel data, controlling the observable group fixed effects is a simple and feasible alternative to reduce the effects of fixed effects. Teacher characteristics are the fixed effects of the class, while financial allocations represent the fixed effects of the school.

Table 3

Variable	Obs	Mean	Std.Dev.	Min	Max
chnb07	13,984	16.51173	8.974206	0	45
matb07	13,545	16.40059	8.547168	0	47
engb07	14,809	15.39125	8.512651	0	50

Teacher characteristics. Hanushek's research shows that teachers' teaching age has a positive impact on student performance over three years (2003). The statistical results show that the average age of the sample teachers is more than fifteen years, so it is necessary to consider the influence of teachers.

Table 4

Variable	Obs	Mean	Std.Dev.	Min	Max
plal18	17,218	1071.612	743.7801	0	4358

Financial allocation. Jackson's research shows that although the impact of fiscal allocations on student performance is not clear, more financial allocations do generally make students perform better (2018).

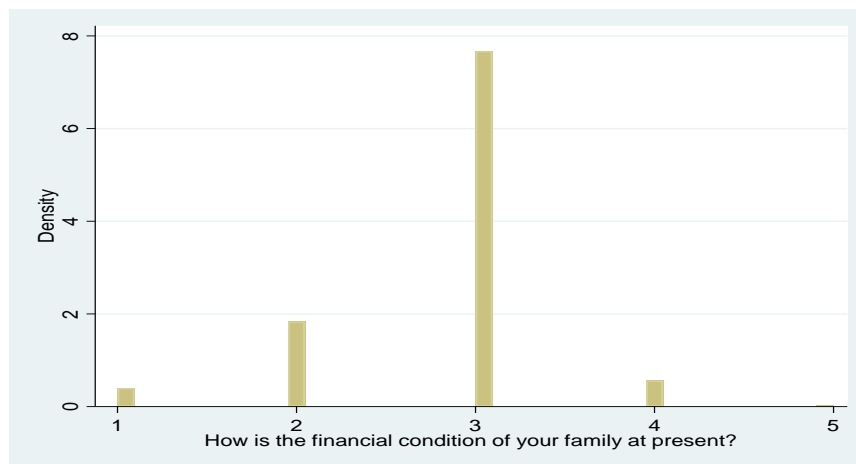


Figure. 3 1-5 indicates that the family's economic situation is from poor to good

Individual students spend at school. The better the family's economic situation, the weaker the causal effect between quantity and quality. The survey data did not provide specific household income data. The description of the family's economic situation in the questionnaire was derived from the parents' own evaluation from 1-5, which may have measurement errors. This article uses the family as the proxy variable for children's expenditure in school. The statistical characteristics in the figure show that middle-income households have the highest proportion, which is one of the evidences of the quantity-quality causal effect.

## Identification Strategies, Estimates and Results

This paper will use the social interaction model and the instrumental variable method to identify the quantity-quality causal effect. Among them, the role of the social interaction model is to control peer effects, and the instrumental variable method is to exclude the main explanatory variables - whether or not the endogenous problem of the only child. The model is as follows:

$$y_{ijk} = \lambda_1 \mathbf{W}y_{ijk} + \lambda_2 \mathbf{W}x_{ijk1} + x_{ijk2}\beta + \alpha_{ij} + \eta_{ijk}$$

Among them,  $y_{ijk}$  indicates the quality of the individual's education, which can be expressed by his academic performance, test scores, etc.;  $x_{ijk1}$  indicates individual explanatory variables with peer effects, including his family's expenditure at school, and  $x_{ijk2}$  indicates individual explanatory variables without peer effects. That is, the main focus of this paper is whether he is an only child;  $\alpha_{ij}$  represents teacher characteristics and school characteristics, and enters the regression equation as a fixed effect here.  $\eta_{ijk}$  is the error term.

For the endogenous problem mentioned above, that is, the influence of potential patriarchal thoughts on fertility decision-making, this paper constructs a tool variable to deal with this problem. The tool variables are organized as follows:

$$IV^* = \text{sex female} * \text{have brother} + \text{gender male} * \text{have sister}$$

Obviously, this IV is related to the one-child variable, and the construction of this variable avoids the correlation with the willingness of the family to have a boy. Under the screening of this IV, individual families with the willingness of a second-born boy will be excluded.

In addition, for another endogenous variable, the group's cognitive test scores,  $\mathbf{W}y_{ijk}$  this paper uses the method of Lee (2007) to use the population variables of other exogenous variables as IV. The final IV is as follows:  $IV = (IV^*, \mathbf{W}\alpha_{ij}, \mathbf{W}x_{ijk1}, \mathbf{W}^2x_{ijk1})$

This article has done six regressions. The first column uses cognitive test scores as explanatory variables, but does not include school fixed effects; the second column adds school fixed effects. From the results, we can see that non-only children are doing better. At the same time, the addition of a school fixed effect has little effect on the outcome. The third column uses the cognitive test scores under the 3PL model. The result is that the non-only children have a positive impact on the test scores, but the results are not significant.

The last three columns use the student's school grades, that is, the standardized scores of the recent midterm exams in the three majors of Chinese, Mathematics, and English as the explanatory variables. The regression results of these three columns are contrary to the previous ones. The effects of non-only children on school performance in school are negative and the results are not significant. Therefore, in traditional education projects, quantity-quality theory may still be established.

## Conclusion

In this paper, the previous research has been further expanded. The tool variables are used to exclude the possible gender preference endogeneity, and the social interaction model controls the class peer effect, which leads to a certain explanatory conclusion: the increase in the number of family children There may be a negative effect on children's schoolwork performance, but it has a significant improvement effect on children's comprehensive quality and thinking ability. This conclusion expands the quantity-quality theory: when the quality of education is not limited to the results in the class, there may be an optimal solution for the number of family births. The likely reason is that children at home may also have positive peer effects, which is subject to in-depth discussion of new data and research.

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