

Chinese Family Education Input-output and Gender Differences in Junior High School Stage

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Abstract

The purpose of this study is to use the baseline data and follow-up data of the China Education Panel Survey (CEPS) and take the training mode of junior high school students in grade eight as an example under the background of China's "exam-oriented education" system to analyze the influence of students' gender on the input and output of family education by taking time inputs, capital inputs, students' achievement, cognitive ability and family economic conditions as indicators. The study found that family inputs in education is the direct way to obtain children's education, and the differences in parents' inputs in children of different genders is an important mechanism that causes gender differences in education. It is found that no matter whether students are male or female, extracurricular inputs have significant positive effect on children's test scores, but the time inputs is not the more, the better. Therefore, the purpose of this study is to explore the differences in the mechanism of gender in the decision-making of family education inputs, and to propose implementation suggestions to guide family education inputs.

Keywords

Education economy; "Double reduction" policy; Children's education; Parent-child relationship; Academic performance.

1. Introduction

In July 2021, the General Office of the Central Committee and the General Office of the State Council issued the "Opinions on Further Reducing the Burden of Homework and Off-Campus Training for Compulsory Education Students (the "double reduction")", which clearly pointed out that schools should improve teaching quality and reduce students' heavy homework burden, family education expenditure and parents' corresponding energy burden. In the previous stage of compulsory education, Chinese traditional family education generally provided the necessary conditions and resources for children's education through intergenerational transfer. The economic burden of family education and the academic pressure of teenagers increased at the same time and led to a vicious circle, forcing domestic education to become involuted. The trend of transformation is becoming more and more obvious, and the education ecology continues to deteriorate. In view of this, this paper takes the selection of talents by the test-oriented education system as a logical starting point, and uses the baseline and tracking data of the "China Education Panel Survey (CEPS)" project to study the differences in educational input and output between girls and boys by gender, including differences in test scores, parental companionship, parental inputs, extracurricular development, etc, which provides theoretical basis for explaining, predicting and dealing with the practical problems of the lack of an economic theory of family education and the increasing economic burden. Moreover, focusing on whether parents invest differently in the education of boys and girls will help us to have a deeper understanding of the mechanism of gender differences in education. (Gu et. al., 2021) [1].

2. Analysis Framework

Based on a large-scale survey, the Coleman Report found that the economic status of parents has a greater impact on academic performance (Han & Sun, 2022) [2], and families with different social and cultural backgrounds have differences in educational inputs, learning methods, and educational environment. From the current broad point of view, family education inputs includes both economic expenditure and non-monetary expenditure such as time (Liu, 2012) [3]. Therefore, the main inputs methods of families in children's education are divided into two types: economic inputs and time inputs. On the one hand, high-income families are better able to meet the cost and material security of their children's education than low-income families (Stevenson & Baker, 1992) [4]. They choose schools with better environment and participate in high-quality private tutoring to improve students' academic performance, which makes children's academic performance more closely related to families. The significant positive relationship between economic income also produces the social phenomenon that children from rich families win at the starting line (Darcy Hango, 2007) [5]. On the other hand, the company of parents can not only bring happiness to children, but also help to apply family cultural atmosphere to children's physical and mental health, interest cultivation, character development, etc.

In general, researchers generally believe that girls are generally better than boys in terms of academic performance (Gu & Gu, 2018) [6], and the academic performance of men and women will greatly affect the performance of major choices, work and employment and other future directions of struggle. Therefore, it is necessary to properly tap the learning potential of boys to alleviate the gender imbalance in education on the basis of ensuring that girls get full respect and the right to education. Some studies suggest that there are slight differences between men and women at the same developmental stage, but the mental gap is by no means as alarming as the test scores show. However, there are gender differences in performance in some subjects, such as the learning of students in junior high school. In the process of Chinese reading teaching, girls' learning is more practical than boys', which makes girls have a better foundation; in addition, girls are usually at a disadvantage in science due to the differences in logical thinking between men and women; what's more, cross-country research has also confirmed that education system, economic, and cultural factors play an important role in explaining gender differences in academic performance, although boys' academic difficulties or girls' academic advantages are widely found worldwide; however, there is still insufficient evidence to explain the source of gender differences in academic performance. It is necessary to conduct an in-depth analysis of the educational input-output mechanism and its gender heterogeneity, especially the role of family education inputs and family education concept under the influence of children's academic inputs and the cross influence of the two.

3. Data Sources

The data in this paper come from the baseline and 2014-2015 tracking data of the "China Education Panel Survey (CEPS)" project in 2013-2014. The project takes eighth-grade students as the research object and randomly selects 438 classes from 112 schools in 28 county-level administrative units (counties/districts/cities) in China, with a total of about 20,000 students. Since some variables in the follow-up data are missing, the data in the baseline needs to be quoted, so the baseline and follow-up data are horizontally merged with the student's personal code. The sample size is slightly less than the total sample size. In the end, 10,279 8th grade students were successfully matched in the tracking data from 2014 to 2015. The sample characteristics are 5,427 boys and 4,852 girls, and the proportion of boys is 11.85% higher than that of girls. The variables used in this study are the total score of the three subjects of Chinese, mathematics and English, parental companionship, extracurricular inputs, family economic

conditions, cognitive ability and gender. The scores include the original test scores and the full marks of each subject test; the parental company includes both after-school tutoring time and entertainment time.

The reasons why this paper selects the follow-up data of the eighth-grade junior high school students as the research object are as follows: First, under the educational background of Chinese "exam-oriented education" based on fractional theory, the importance of test scores is indescribable. Second, compared with the baseline data, the object of the follow-up data is stable, the planning is strong, and the laws of the data can be found to obtain more valuable information. Third, the 8th grade students are in puberty, and there are obvious differences between boys and girls in psychology, learning and thinking at this stage.

Definition and explanation of variables: The test scores are expressed as "score". The main processing is to first convert the scores of the three subjects of Chinese, Math and English into a percentile system, then convert them into the same standardized scores, add them and round them up; horizontally merge the baseline and follow-up data, merge the gender data to generate a new variable, replace the gender value of boys with 0, and replace the gender value of girls with 1; family economic conditions are expressed as "fam", which is to sort the data from very difficult to very wealthy, divided into 5 levels: 1 is very difficult, 2 is relatively difficult, 3 is medium, 4 is relatively rich, and 5 is very rich; extracurricular inputs is expressed as money. The data is replaced, and two new variables are generated after processing; one is the new variable "lnmoney", and the other is the extracurricular inputs variable "money_3" in thousands; parental companionship is divided into parental tutoring for children's homework and accompanying children's entertainment time, and total parental companionship is expressed as "all_time8", and its processing is that parents tutor their children's homework, add and sum up the time spent on entertainment with the children, and replace the value of more than 8 hours with 8; the cognitive ability is expressed as "Cognitive_Ability".

Descriptive Statistics for Variables

Variable	Variable Definition	Girl		Boy	
		Mean	Std.Dev.	Mean	Std.Dev.
Score	score of Chinese, Maths and English	206.200	53.060	179.900	62.370
Cognitive abi	cognitive ability score	21.530	8.610	20.720	9.370
Money inp	students' extra-curricular inputs expenses, the conversion unit is thousand yuan	1.114	2.883	0.974	3.488
Time inp	time for parents to accompany their children to study and play	1.730	2.170	1.670	2.180
Family eco	1= very poor ,2=poor,3=normal,4=rich, 5= very rich	2.840	0.570	2.830	0.580

4. The Way of Family Education Inputs and Academic Performance

By examining the male and female divisions in the performance histogram in Figure 1, on average, girls are concentrated in the 230-250 segments, with the lowest scores being 0, the highest being 297, and the average being 206.2; for boys, the distribution is between 230 and 250. The lowest score is 0, the highest is 293, and the average is 179.9. Compared with boys, the distribution of girls' scores is more dispersed, with more high scores and less low scores; the average score of boys is 26.3 points lower than that of girls, and the number of students in the lower grades is greater than that of girls, indicating that boys have a poor learning

foundation, the ratio of males and females in each grade is unbalanced, and girls have significantly higher learning advantages than boys. In junior high school, girls have relatively high minds, so they can concentrate more on learning. However, boys are relatively young in psychological age junior high school is the age when students are playful and boys are relatively active, so this may also be the case. This will make teachers prefer well-behaved girls in daily teaching.

In the cumulative frequency of extracurricular inputs, there are differences between men and women at the initial stage, but they become more and more similar in the later stages. Both boys and girls have a large number of zero values in their extracurricular input frequencies, among which boys have more zero values. Logarithmic extracurricular inputs have a larger growth rate in stages 5-7, indicating that most families choose educational economic inputs in this stage, and finally tend to be one. In addition, the distinction degree of extracurricular economic inputs is very high, which shows that the differences in the amount of education inputs are relatively large. Under the background of China's examination-oriented education system, family economic capital can provide children with better learning opportunities, but at the same time, it also leads to the uneven development of students' education. Compared with poor children, children from wealthy families can obviously get more extracurricular learning resources to achieve better academic performance.

In the cumulative graph of time inputs frequency, the points of time inputs will be close to normal distribution; among them, girls with zero company account for about 43%, boys account for about 45%, and the gap is not particularly large. This shows that whether it is a boy or a girl, parents hope to improve students' academic performance by participating in their children's daily life, and alleviate the current situation of educational inequality in different family backgrounds. Most families choose to invest 2-4 hours in their children's education. After 4 hours, fewer parents choose to accompany their children to study. This shows that some parents have regular and purposeful choices in the process of choosing to accompany their children. This is because a good parent-child relationship will be more likely to make the parents' participation in primary and secondary school students have a positive impact on their children's academic performance while too much participation in student learning may lead to this positive impact weakened or even negatively affected.

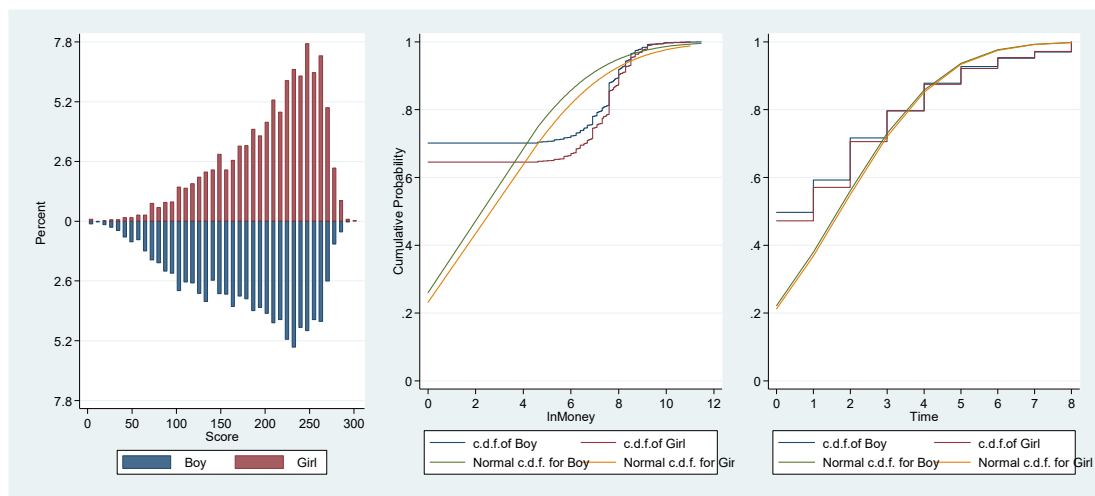


Figure 1. Family education input-output distribution diagram

5. Family Education Production Function and Action Mechanism

In Figure 2, the effect of economic inputs on students' academic performance is 0. There is a positive correlation between economic inputs and academic performance, and the differences between males and females gradually decrease with the increase of economic inputs, indicating that economic inputs in educational decision-making have a significant impact on students' academic performance. The student achievement is positive and significant. The more economic inputs, the better the student achievement. In addition, the performance of boys improves faster than that of girls, and the disadvantage of academic performance will decrease with the increase of economic inputs; when the initial value is close to 0 inputs, there is a significant gender difference in the scores of men and women, which shows that in junior high school, boys' scores return on inputs in education is lower than that of girls, so girls are more likely to get good grades.

By examining the average scatter plot of the impact of time inputs on scores, it can be seen that there is an "inverted U-shaped" relationship between the parents' educational time inputs and their children's academic performance, in which the scores of males and females are positively correlated within 0-4 hours. And it is highly consistent, and it shows a downward trend after the inflection point of 4 hours; this shows that the optimal value of time input is 4 hours. Although parents accompanying their children are generally considered to promote their children's ability development, emotional development and academic performance, parents don't invest as much time as possible. Sometimes, too much time with low quality can't play its due positive role because the eighth-grade students have relatively mature mental development, independent thinking ability, obvious behavioral preferences, and they are not easily influenced by parents' suggestions and orders. Too much time with children will lead to "rebellious" psychology.

At the scatter points of the economic and time inputs of educational inputs decision-making, the trend of the fitting line for men and women is basically the same. The economic and time inputs of men and women show a positive development within 0-4 hours, indicating that parental company and extracurricular inputs are promoting. Parents who do not have time to accompany their children are often reluctant to spend money while the richer parents tend to pay more attention to education and are willing to invest time in their children's education; after the critical value of about 5 hours, the economic inputs will decrease accordingly. Parents can alleviate the economic lack by investing in their children's time, but the children do not have extra time for extracurricular tutoring, which leads to low learning efficiency. Among them, when the value of parental companionship and participation is equal, the economic inputs of boys will be higher. This may be because boys are relatively weak in academic foundations, and parents need to increase inputs in extracurricular tutoring. The time and financial inputs of family education require parents not only to invest money in extracurricular inputs, but also to accompany their children in daily learning.

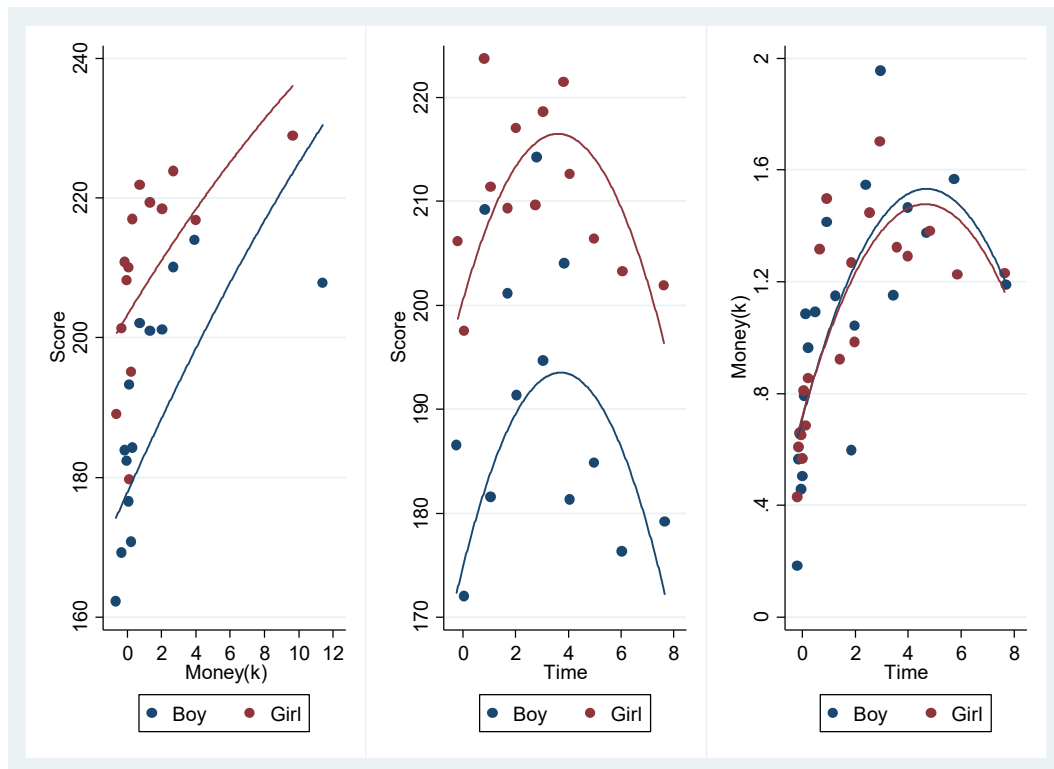


Figure 2. Family education input-output mechanism diagram

6. The Way of Family Education Inputs and Cognitive Ability

In the background of the test-oriented education system, we not only need to pay attention to the test scores, but also pay attention to the implicit decisive factor behind the test scores, that is, cognitive ability. Through the average scatter plot of students' scores and cognitive ability in Figure 3, it can be seen that there is basically no gender difference between grades and cognitive ability and there is a positive correlation. The higher the student's score, the stronger the cognitive ability, indicating the impact of grades on cognitive ability is significantly positive. In addition, in the case of the same score, the cognitive ability of boys has always been slightly higher than that of girls. This is because the differences in thinking between men and women make boys better than girls in logical reasoning and experimental observation.

In the scatter plot of both extracurricular inputs and cognitive ability, the impact of extracurricular inputs on cognitive ability is significantly positive, and the differences between males and females in the impact of economic inputs on cognitive ability are not large. The higher the cognitive ability, the higher the cognitive ability of girls; the cognitive ability of girls in the figure is higher than that of boys without financial inputs, and the later trend is basically unchanged, which shows that economic inputs can alleviate the differences in girls' cognitive ability in thinking. The maximum value of economic inputs for girls is about 10,000 yuan, while the maximum value for boys is about 12,000 yuan. This shows that parents are more willing to spend a lot of money on training boys in terms of positive inputs in cognitive ability; in the lower right corner of the figure, there are individual male and female representative points with lower values and farther from the fitting line, which indicates that some students have a situation where cognitive ability declines due to excessive extracurricular inputs.

In Figure 3, the time inputs and cognitive ability are both scattered, showing an obvious "inverted U"-shaped relationship. Generally speaking, in the case of time inputs, the cognitive ability of girls is generally higher than that of boys. When the critical point is 3-4 hours, the cognitive abilities of both boys and girls show a downward trend, and the cognitive abilities of

boys and girls are basically the same or even slightly higher than girls after the 6-7 dividing line, which shows that the scores and cognitive ability are highly consistent. Too much time spent in accompanying students will also occupy the space for the development of students' cognitive ability; whether it is a boy or a girl, too much company will lead to a decline in cognitive ability, because the students in the eighth grade of junior high school are thinking divergently, and in the stage of strong self-awareness, too much time inputs imprisons students' self-awareness and hinders their development.

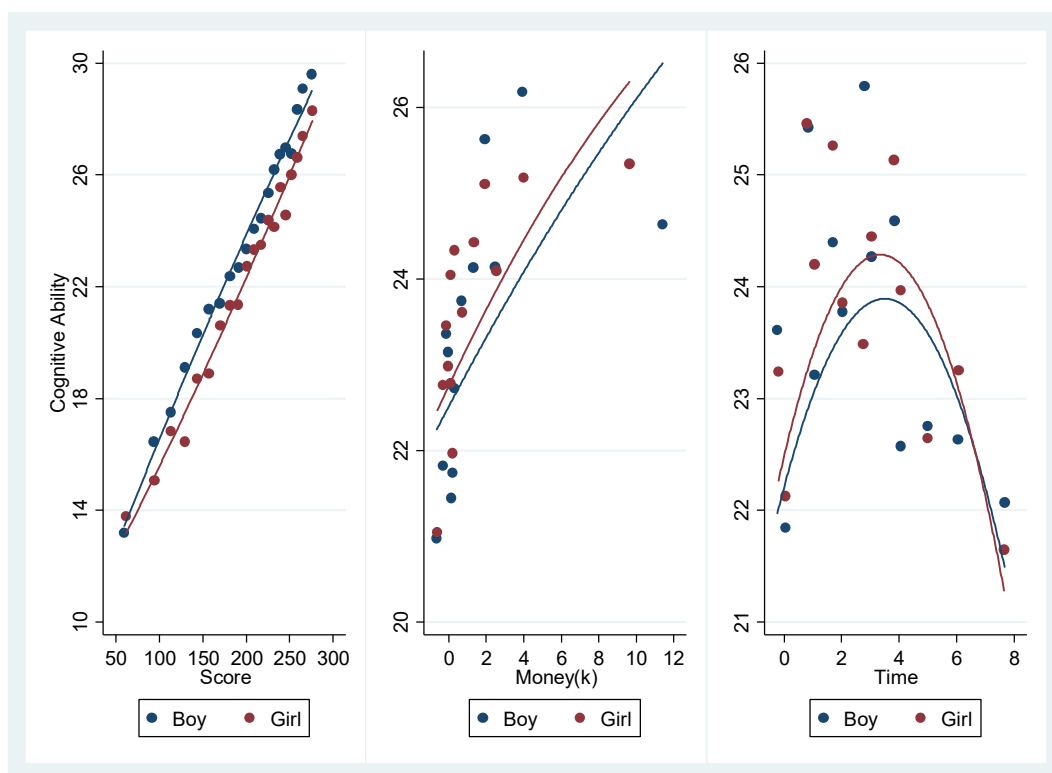


Figure 3. The relationship between family education inputs and cognitive ability diagram

7. Family Education Economic Conditions and Sources of Burden

It can be seen from the uniform scatter plot of family economic conditions on scores in Figure 4 that whether it is boys or girls, family economic conditions have a positive distribution on students' scores. The better the family economic conditions, the higher the students' scores; this is because the family economy capital can provide better learning opportunities for children. Parents can provide their children with excellent material resources through the choice of the environment and schools. With the improvement of family economic conditions, the differences in scores between men and women have gradually expanded, and the differences in scores between men and women reaches the maximum when the family economic conditions are very wealthy, and there are even extreme cases where boys from very wealthy families have poor grades. This shows that the richer the family, the higher the requirements for girls' scores, and the corresponding girls' scores are getting better and better. In the average scatter plot of family economic conditions on extracurricular inputs, we can see that the basic trend of family economic conditions on extracurricular inputs is positively distributed, that is, people with better family economic conditions are more willing to invest money in their children's education; in very difficult and relatively difficult families, the education inputs of boys is significantly higher than that of girls; it shows that in today's poor areas, many families still maintain outdated concepts, which makes girls' chances of receiving

education lower than boys. With the comprehensive victory of my country's poverty alleviation, people's lives have also undergone earth-shaking changes. One of the basic requirements of poverty alleviation is "two assurances and three guarantees." That is, rural poor people are free from worries over food and clothing and have access to compulsory education, basic medical services and safe housing. Therefore, with the improvement of people's economic conditions and the implementation of compulsory education, people have gradually strengthened their emphasis on education, and girls' scores have gradually surpassed men's.

In the scatter plot of both family economic conditions and time inputs, we can see that the basic trend of family economic conditions on time inputs is positive. There are relatively fewer companions, indicating that families in poverty-stricken areas have less discipline for boys and are in a state of "stocking". Consistent with the impact of family economic conditions on extracurricular inputs, as the lives of people who have been lifted out of poverty have improved, the gender differences between men and women are basically the same. Parents will also pay more attention to their children's participation in learning. The richer the family is, the more times they accompany their children, which shows that they attach great importance to the participation of their children in the growth process. Among them, families with better economic conditions accompany girls much more often than men. For men, it may be based on the cultivation of boys' independence and a strong sense of family protection for girls.

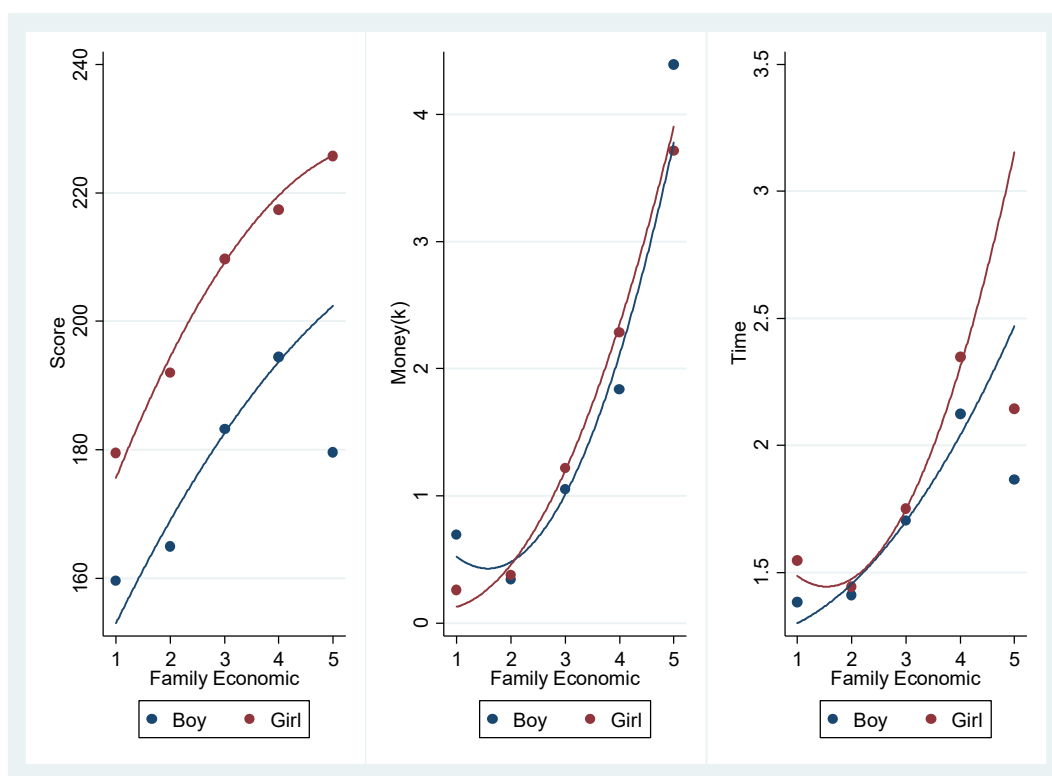


Figure 4. The relationship between family economic conditions and education mode diagram

8. Conclusions and Recommendations

The gender differences in family education inputs have been paid close attention to by scholars for a long time, and the family as an important mechanism to influence students' educational attainment has caused a lot of discussion in recent years. Based on the perspective of the examination-oriented education system and the data of the China Education Panel Survey (CEPS), this paper analyzes the gender differences in the process of family education input and output, and the heterogeneity of this gender differences in family education behavior. First of

all, according to the analysis results, the differences in the amounts of economic inputs for children in family education are large. The wealthier the family is, the more it will invest in the economy. At the same time, the family economic situation has an obvious positive effect on students' achievement. Besides, girls have obvious learning advantages in terms of achievement. Secondly, the time inputs of parents involved in student learning is also crucial. The results show that no matter whether the student is a boy or a girl, the parents' time inputs is not as much as possible, and sometimes low-quality learning participation may play a negative role. Finally, the relationship between children's academic performance and family education economic inputs and cognitive ability is positively distributed, but family education time inputs and cognitive ability have an inverted U-shaped relationship, indicating that when parents spend too much time together, it will have a negative relationship with children's cognitive ability.

According to the study results of this paper, the corresponding policy recommendations are as follows.

First, the key to the "double reduction" of compulsory education lies in how to achieve education fairness and balanced education development. Excessive financial inputs by parents on students not only increases the economic burden of family education, but also increases the inequality of educational resources caused by differences in family backgrounds. In order to implement the "double reduction" policy and adhere to the educational concept of "five educations at the same time", the government should encourage the sharing of resources of off-campus tutoring institutions to avoid monopoly of educational resources; parents need to pay more attention to the all-round development of students instead of blindly investing too much money to increase the involution of education; when faced with the problems caused by gender differences in basic education, schools should create a harmonious learning atmosphere, encourage girls and boys to study cooperatively, and take advantage of each other's learning advantages to alleviate gender performance problems caused by differences.

Second, the importance of family education is highlighted behind the "double reduction policy". High-quality parental participation in learning is conducive to improving students' performance, but in junior high school, parental participation in learning is not always the more, the better. Sometimes, too much company will cause students' rebellious mood and induce the contradiction between parents and children, which is not conducive to students' learning. Therefore, parents should establish an awareness of actively participating in their children's learning, and adopt appropriate learning and participation methods according to their children's age and personality characteristics, and then combine the children's own age to find the best companion frequency node.

Third, in terms of cognitive ability, girls have stronger reading and expression skills, and are better at mechanical memory, image thinking and imitation; in junior high school learning, language memory recitation is very important, which is more beneficial to girls, but the need to pay attention to is that, in the later stage of junior high school, the simple application model is no longer suitable for learning requirements, so parents need to exercise students' logical thinking and innovative awareness; in addition, families and schools need to strengthen home-school cooperation, and strive to promote the "double reduction" process.

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