

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

Xiaojie Tian, Tong Guan, Tianzhu Gu*, Yan Huang

Jiangsu University of Technology, Changzhou, Jiangsu, 213001, China

Abstract

Using the data of China Education Panel Survey (CEPS), we distinguish the similarities and differences between urban and rural families in education inputs decision-making, and explore the training methods of 8th grade students in junior high school under China's "examination-oriented education" system as an example. This paper uses histograms, cumulative frequency charts and uniform scatter plots to conduct empirical analysis, and uses time inputs, capital inputs, student performance, cognitive ability and family economic conditions as indicators to analyze the impact of urban and rural differences on family education input-output. It is found that the economic inputs of urban and rural households have a significant positive relationship with student performance, but more time inputs do not mean better. Therefore, this paper will analyze the decision-making of family education inputs and the differences between urban and rural areas, identify the differences in the mechanism of action between urban and rural areas, and give conclusions and suggestions for the implementation of family education inputs.

Keywords

Education inputs; "Double reduction" policy; Academic performance; Cognitive ability; Urban-rural differences.

1. Introduction

On July 24, 2021, in order to continue to standardize off-campus training, avoid increasing the burden on students in the compulsory education stage, and create a good educational environment, the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council issued the "Opinions on Further Reducing Students' Homework Burden and Off-campus Training Burden in Compulsory Education". The "double reduction" policy was formulated due to the emergence of the reduction of the burden on schools and the increase of the burden outside schools during the stage of compulsory education. The economic burden of family education and the academic pressure of young people increased at the same time, which led to a vicious circle, and the impact of education involution in society was more obvious and continues to deteriorate (Bian & Zhang, 2022) [1]. For families, parents provide their children with necessary conditions and resources through intergenerational transfer, and their main support and training methods are divided into economic inputs and time inputs. In view of this, based on the selection of the test-oriented education system as a starting point, this paper uses the baseline and tracking data of the "China Education Tracking Survey" to conduct empirical research to analyze the endogenous mechanism of parental companionship, extracurricular inputs, academic performance and cognitive ability (Gu et. al., 2018) [2]. This paper analyzes the differences between urban and rural areas in family education inputs decision-making, and analyzes the influence of education inputs decision-making on student performance and the influence factors of family economic conditions on time inputs, extracurricular inputs and performance, in order to examine the comprehensive impact of training methods on children's growth.

2. Analysis Framework

The family's way of supporting and cultivating children's education is achieved through intergenerational transmission, which is mainly divided into two forms: economic inputs and time inputs. In the early narrow sense of human capital theory, family inputs were simply understood as economic expenditure, and then the analysis framework of the broad view also included non-monetary expenditures such as time and energy inputs and character development (Liu & Xie, 2015) [3]. The impact of family economic inputs lies in providing better material resources for children, and arranging extracurricular tutoring for children to assist family education and school education. The role of family time inputs is to reduce inequality due to differences in family backgrounds, to enhance children's self-confidence while conveying care and expectations to their children, and to activate children's nature and promote independence through parental companionship, etc. This also makes the impact of parental companionship on children's academic performance may be greater than that of investing in extra-curricular tutoring (Li & Due, 2019) [4]. Education is the main way to achieve social mobility, the key to the upward mobility of disadvantaged classes, and the main way to realize the "poor family". It will lead to inequality in children's development, because of the differences in family resources and educational inputs among different social classes (Qi & Zhang, 2020) [5].

From the perspective of the two ways of family education inputs, the effects of family education economic inputs and time inputs on children's education are both complementary and replaceable (Gu et. al., 2021) [6]. Studies have found that low-income families usually improve their children's performance by participating in their children's educational activities, while high-income families choose to provide their children with a good educational environment or various tutoring institutions to improve their children's academic performance. However, this does not mean that the more economic inputs and time inputs, the better, because when the family invests too much in education, it will cause children to have a rebellious mentality, thereby reducing their enthusiasm for learning and affecting their academic performance. Based on the fact that family education time inputs and economic inputs usually exist at the same time, and because the economic gap between rural and urban areas is large, and the educational level of parents is different, it will also affect the education of children to a certain extent. For families of different classes, whether there are differences in the decision-making of children's education inputs, as well as the impact on children and the size of the mechanism of action needs to be explored (Li & Zhang, 2020) [7]. Therefore, based on the above analysis of the decision-making framework of educational inputs, this paper will mainly conduct an in-depth analysis of the educational inputs-output mechanism and urban-rural heterogeneity, and deeply explore the impact of urban-rural educational differences on children's academic performance.

3. Data Sources

This empirical study mainly uses the 2014-2015 parent and student follow-up survey data from the China Education Panel Survey (CEPS) to analyze the differences in the impact of urban and rural families' educational time inputs and economic inputs on their children's education. This paper randomly selects 438 classes from 112 schools in 28 county-level administrative units across the country, with a total of about 20,000 students. Due to the lack of some variables in the follow-up data, it is necessary to quote the baseline data. Therefore, the baseline and follow-up data were horizontally combined with the student's personal code, and finally 10,279 8th grade students were successfully matched in the follow-up data from 2014 to 2015. The sample characteristics were: 4,747 in urban areas and 5,532 in rural areas, with a higher proportion in urban areas than in rural areas. The variables used in this empirical study are test scores,

cognitive ability, parental companionship, extracurricular inputs, household registration type, and family economic conditions. Among them, parental companionship includes the average daily time spent by fathers and mothers in tutoring their children's homework and accompanying their children to play.

The reason why this paper chooses the follow-up survey data of 8th grade students and their parents as the main part and the baseline data as the auxiliary part for analysis and research is that: 1. Compared with the baseline data, the follow-up data is more complete and the data is newer; 2. In the test-oriented education system, the family's inputs in children's education is mainly to improve their academic performance in order to obtain better opportunities for further education, and the test scores are the concrete embodiment of the family's educational input-output; 3. In the form of compulsory education in China, the results are more comparable, and the differences can be seen more clearly.

For the definition and description of variables: the test results are expressed as "Score", and the processing is to convert the three scores of Chinese, mathematics and English into a percentage system and then sum them up; the household registration type is represented as "Skyped", and the data is converted into dummy variables with 1=urban, 0=rural; the family economic condition is expressed as "fan", which is to sort the data from very difficult to very rich into 5 levels, 1 is very difficult, 5 is very rich, and the missing value is changed to medium; the extracurricular inputs is expressed as "money", by replacing the data, then adding 1 to the extracurricular inputs to take the logarithm and changing the conversion unit to thousand yuan; parental accompaniment is expressed as "time", and its processing is to add up the time spent by parents tutoring children on homework and accompanying children for entertainment, replacing missing values with 0 and replacing values with time exceeding 8 hours with 8; cognitive ability is represented as "Cognitive_Ability".

Descriptive Statistics for Variables

Variable	Variable Definition	Urban		Rural	
		Mean	Std.Dev.	Mean	Std.Dev.
Score	score of Chinese, Maths and English	201.000	58.660	184.700	59.370
Cognitive abi	cognitive ability score	22.540	8.462	19.870	9.315
Money inp	students' extra-curricular inputs expenses, the conversion unit is thousand yuan	1.666	4.170	0.471	1.784
Time inp	time for parents to accompany their children to study and play	2.075	2.229	1.375	2.072
Family eco	1= very poor ,2=poor,3=normal,4=rich, 5= very rich	2.931	0.533	2.752	0.599

4. The Way of Family Education Inputs and Academic Performance

Through the observation of the score histogram in Figure 1, generally speaking, there are more high-scoring students in urban areas than in rural areas, and the number of rural students in each score segment has a relatively balanced growth and change, which is concentrated between 230 and 250 score segments; urban students are concentrated between the 220 and 260 score segments. Compared with rural areas, urban areas are more concentrated and distributed, with a maximum score of 288 in urban areas and 297 in rural areas. The difference between the highest scores in urban and rural areas is 9 points. Students have relatively

superior learning conditions in this environment and it is easier to improve their academic performance than in the countryside because the educational resources and educational environment in the city are better than those in the countryside. However, students in rural areas have a weak base and may need to help with household chores in their spare time. Compared with urban students, they have less extra-curricular study hours. This is also the reason why rural students' grades are more concentrated and their scores are less high.

In the cumulative frequency of extracurricular inputs, it can be seen that the distance between urban and rural extracurricular inputs is far from the positive distribution and has a large number of zero values, about 20% in urban areas and about 30% in rural areas. Although there are a large number of zero values, it slowly increases in the back. The cumulative distribution function of the urban is about 30% at the beginning while that of the rural is about 19% at the beginning, and the cumulative distribution function of the urban is higher than that of the rural. Because the income of urban parents is higher than that of rural parents, and the family economic conditions are generally higher than those in rural areas, extracurricular inputs has increased a lot in the range of 6-8. This shows that the urban extracurricular inputs are more invested in this part, indicating that this range can be afforded by most families, and finally tends to be the same.

In the cumulative graph of time inputs frequency, it can be clearly seen that the points of time inputs tend to be more normal distributed. Among them, the urban zero value accounts for about 40%, and the rural zero value accounts for about 60%, and the gap is large. The change slope of the concentration difference is the largest in the interval 2-4 and the Gaussian probability curve is nearly parallel, which means that spending time with children is the most concentrated in this interval, and the distribution of the rising rate interval is consistent between urban and rural areas. After 4, it shows that the proportion of parents who spend a lot of time is less, and the urban and rural areas gradually tend to be the same. Compared with the countryside, the city is closer to the normal distribution. The reason why the city is more natural is that the rural parents are influenced by the educational concept and nearly 60% of parents hardly accompany their children. Conversely, parents in urban areas prefer to spend part of their time with their children, even though time is valuable.

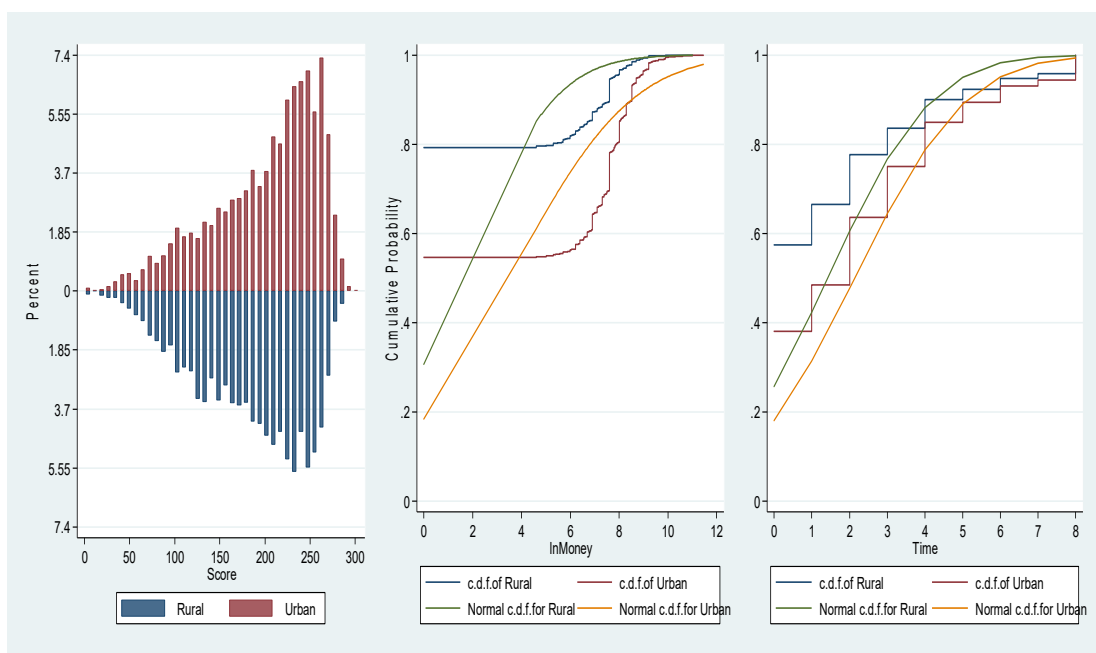


Figure 1. Family education input-output distribution diagram

5. Family Education Production Function and Action Mechanism

In Figure 2, the distribution of extracurricular inputs on grades shows that both rural and urban capital inputs and grades are positively correlated, but urban students generally have higher grades than rural students. There are two abnormal points on the right side, indicating that some individuals have invested more money, but their grades have also declined. This may be because parents have signed up too many extra-curricular cram schools for their children, keeping the children in a high-pressure environment for a long time, which eventually backfires and leads to lower grades. The reasons why urban areas are generally higher than those in rural areas are: First, the educational resources and environment in urban areas are better than those in rural areas, so parents in urban and rural parents spend the same amount of money, but their children can get better educational resources and environment than in rural areas. Second, the economic conditions in urban areas are better than those in rural areas. Parents have higher salary and income levels, and are more capable and willing to spend economic inputs on their children and provide them with better extracurricular resources to improve their abilities.

In the uniform scatter plot of time inputs and performance, it can be seen that there is an "inverted U-shaped" between time inputs and academic performance, and the influence of urban is more significant than that of rural. Rural distribution is fully surrounded by urban, and the gap in the impact of optimal time inputs on performance is further widened and maximized. The optimal time inputs are reached at 4 hours. When the time inputs exceed 4 hours, the impact of time inputs on grades is inversely proportional. Parents invest more time in their children, and their children's grades do not rise but decline, especially in urban. Because the students are in adolescence at this stage and parents accompany them for a long time, keeping children in the company of this kind of education will bring pressure and rebelliousness to children, make their learning atmosphere very depressed and make them no longer love learning.

By analyzing the uniform scatter plot of time inputs to extracurricular inputs, it can be seen that the urban fitting line is more obvious with an inverted U, and the rural fitting line changes more gently. For rural areas, more inputs mean willingness to pay attention and spend more, even after the inflection point, the change is not noticeable. The main reason is the limited family conditions. But for urban, the changes are more pronounced because the city's economic conditions are better and a lot of time and money have been invested. Whether in urban or rural areas, time and money inputs have a great impact on grades, but after a critical value is exceeded, the impact of time inputs on grades and extracurricular inputs will be counterproductive. However, due to different family economic conditions and educational concepts, the time and money invested by rural parents are relatively limited, so too much time inputs have little impact on extracurricular inputs.

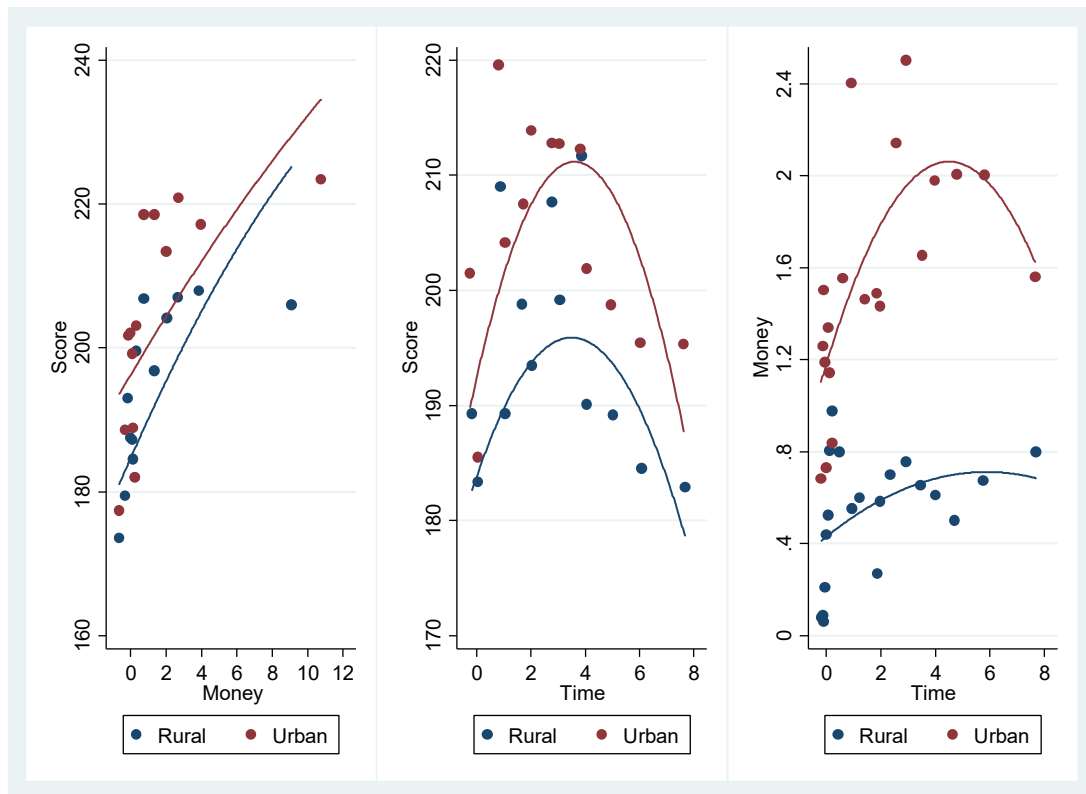


Figure 2. Family education input-output mechanism diagram

6. The Way of Family Education Inputs and Cognitive Ability

Through the analysis of the uniform scatter plot of both academic performance and cognitive ability in Figure 3, it can be seen that there is a difference in performance and cognitive ability, but the gap is not large. Whether in urban or rural areas, the higher the student's grades, the higher their cognitive ability, which is roughly positively correlated, indicating that the influence of grades and cognitive ability is positive and significant, and each point is evenly distributed on the fitting line. Among them, the impact of urban students' academic performance on cognitive ability is slightly higher than that of rural children, which shows that urban children have better access to educational resources than rural children. Under the condition of the same score, urban children's cognitive ability is slightly higher than that of rural children.

In the scatter plot of both extracurricular inputs and cognitive ability, it can be seen that making certain extracurricular inputs for students is conducive to improving cognitive ability. Although the difference between urban and rural areas doesn't exist when people are both prosperous, it seems that for particularly poor families, they can't afford to pay for cram school for their children, and the difference in cognitive ability linked to academic performance is very obvious. On the right side of the figure, there are two lower points in urban and rural, and the distance from the fitting line is far away, which means that there are individual cases that are counterproductive due to excessive extracurricular inputs. When children receive too much knowledge and pressure, their cognitive ability declines instead. The big gap between urban and rural areas is because the rural economy is relatively backward, the general education level is not high, the inputs in education is not as good as that of urban parents, and the economic capacity cannot be well supported.

The uniform scatter plot of both time inputs and cognitive ability shows an obvious "inverted U-shaped". It can be clearly seen that urban time inputs have a higher impact on children's cognitive ability, and urban cognitive ability is generally higher than that of the countryside.

The inflection point of the impact of time inputs on children's cognitive ability is around 3 hours, while the inflection point in urban areas is around 4 hours. Although there are differences in the inflection points and the inflection points in the rural appear faster, the distribution of the rural is not as regular as that of the urban. It turns out that after too much time inputs, children will have a rebellious mentality and low learning efficiency; too much companionship and care will make children lose their ability to learn independently and their enthusiasm for learning, which will make children feel disgusted and unresponsive.

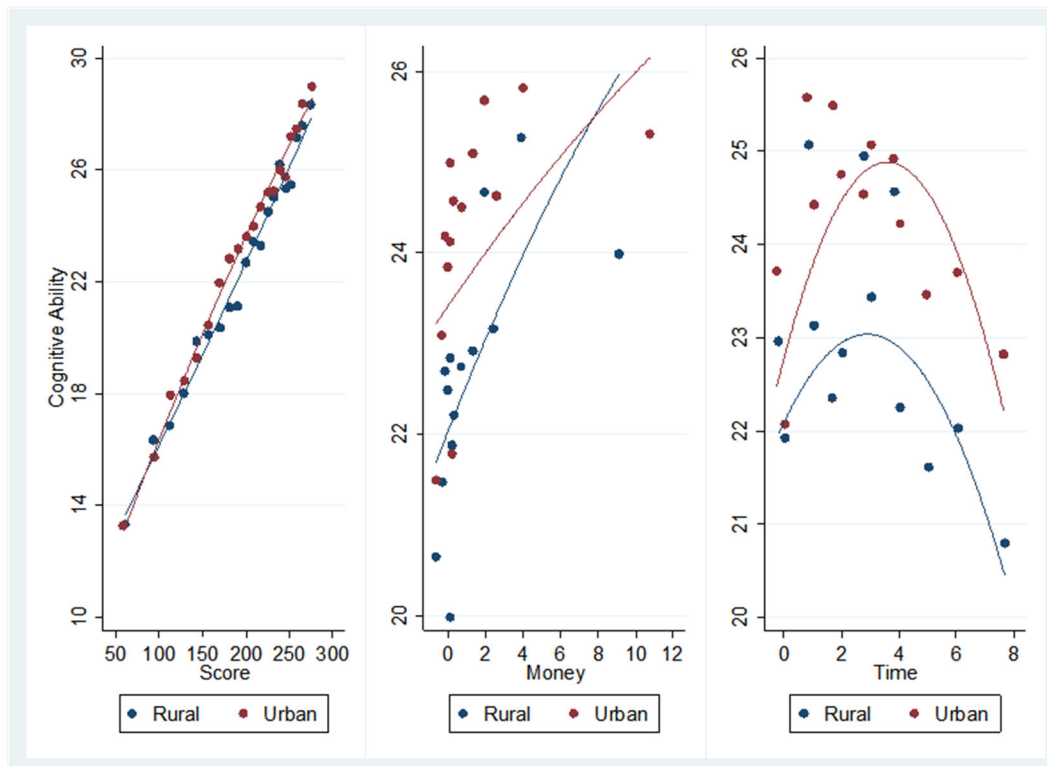


Figure 3. The relationship between family education inputs and cognitive ability diagram

7. Family Education Economic Conditions and Sources of Burden

Through the analysis of the uniform scatter plot of both economic conditions and household achievements in Figure 4, the urban curve grows upward to a certain point and then decreases, while the rural curve shows a "U-shaped" growth. There are a lot of people distributed in the interval 1 to 3, and each point is well fitted, but the later points are far from the fitted line. Before the economic condition is 4, with the improvement of the family's economic ability, the student's performance also improves. There is a positive correlation between family financial ability and student achievement, especially when the family economic condition is 4, and the achievement of both rural and urban students has reached the highest point. After inflection point 4, although the students' family economic conditions are better, the students' grades are declining. This shows that the better the family economic conditions are, the higher the demand and inputs for children will be, and there will be a negative impact to a certain extent.

In the scatter plot of both family economic conditions and extracurricular inputs, it can be seen that although both urban and rural areas have better household economic conditions with more capital inputs, the trend in rural areas has not surpassed that in urban areas. The main reason is that there are very few rich people in the countryside, and only a very few are willing to pay high prices to invest in their children's education. The better the economic conditions, the more extra-curricular tutoring will be provided for children. In addition, urban families generally have stronger educational concepts, which will increase their inputs in student education. On

the contrary, the earning ability of rural families is much lower than that of urban families. Apart from necessary expenditures, they do not have much money to spend on extracurricular inputs for their children. Coupled with their lack of educational awareness, they will reduce their extracurricular inputs in their children.

From the scatter plot of both family economic conditions and time inputs, it can be seen that when the family economic conditions are relatively difficult, the time inputs for children are the smallest in both urban and rural areas. However, when the family economy is relatively difficult and later, the impact of family economic conditions on time inputs is more obvious. It can be seen that family economic conditions are positively correlated with parents' time inputs in children. The better the economic conditions of the family, the more time parents invest in their children, and the time inputs in urban is higher than that in rural areas because urban parents are generally more educated and pay more attention to the impact of time inputs on children's education. Overall, families with better economic conditions are more willing to spend their time.

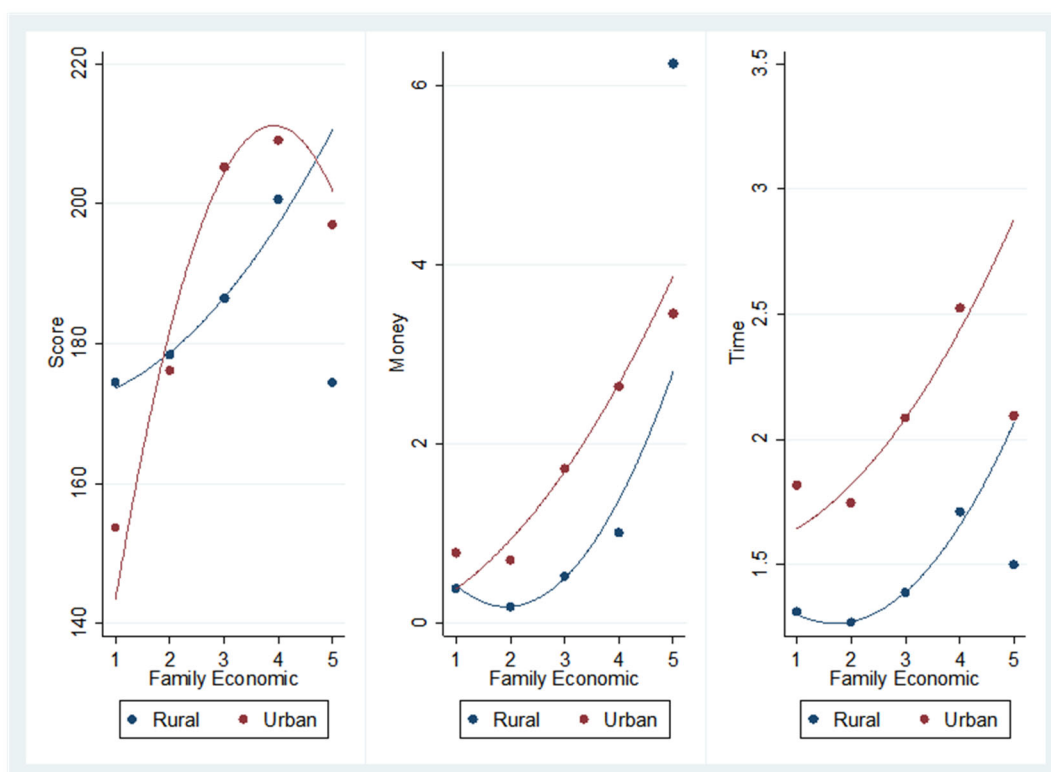


Figure 4. The relationship between family economic conditions and education mode diagram

8. Conclusions and Recommendations

For a long time, the disparity of family education inputs between urban and rural areas has been widely concerned by scholars and aroused many discussions. Based on the examination-oriented education system, this paper uses the data of the China Education Panel Survey (CEPS) to explore the impact mechanism of family education inputs decisions on children's education, and to explore the urban-rural differences in family education inputs, and its heterogeneous impact on children's education under different family economic backgrounds. First of all, there are significant differences between urban and rural areas in the economic inputs and time inputs of families in children's education. Generally speaking, the wealthier the family is, the more time and economic inputs they have, and the inputs in the city will be significantly higher than that in the countryside in the same family conditions. Secondly, the more economic inputs,

the better the children's performance, but the results show that whether in urban or rural areas, when the family education time inputs reach a certain upper limit, it will have a negative impact on children's performance, which means that the more time inputs are not necessarily the better. Finally, the relationship between children's academic performance, family education economic inputs and cognitive ability is positive, but family education time inputs and cognitive ability have an "inverted U-shaped" relationship. This shows that too much company time will have a negative impact on children's cognitive ability, and compared with urban areas, the impact of time inputs on cognitive ability is more obvious in rural areas.

Based on the research conclusions of this paper, the following suggestions are given in combination with the promulgation and implementation of the current "double reduction" policy.

First, with the implementation of the "double reduction" policy, the government should encourage the sharing of educational resources in response to the differences in education between urban and rural areas, and let high-quality educational resources "sink" to rural and remote areas, so as to improve the inequality between urban and rural education. Schools should optimize teaching methods and fundamentally change the situation that "basic knowledge depends on schools, and improvement depends on tutoring". For after-school tutoring institutions, the current situation of "one size fits all" should also be changed, and measures should be taken according to local conditions. For urban with greater pressure on education competition, local after-school tutoring institutions should be controlled with a stricter "cooling down" policy. For rural areas with a relative lack of educational resources and backward, the government should provide certain supportive policies to realize the relative fairness of educational resources, promote the high-quality and balanced development of compulsory education and the integration of urban and rural areas, and effectively solve the problem of "school choice fever".

Second, in the context of the "double reduction" policy, the importance of family education has become more prominent. Family education is of great significance for cultivating children's healthy three views and good qualities. Parents should spare some time to accompany their children's learning and growth, so as to create a good family atmosphere for their children. Parents in rural areas who need to go out to work should properly spare part of their time to accompany their children and participate in their children's educational life. But at the same time, it is not recommended to invest too much time. When the time inputs exceed a certain amount, the opposite effect will occur, causing children to have a rebellious mentality, which will affect their academic performance.

Third, in terms of cognitive ability, urban children are generally higher than rural children under the influence of relatively superior educational resources and family backgrounds. But it is worth noting that when too much time is invested, it will have a negative impact on children's cognitive ability, and parents should control the time spent with their children. At the same time, for the learning stages of middle and late middle school, the old education model no longer meets the learning requirements, so parents should exercise and improve their children's logical thinking and innovation ability. For relatively backward villages, based on the "double reduction" policy, the difficulty and level of classroom teaching in schools can be effectively improved to make up for the lack of family education inputs.

Acknowledgments

This paper was funded by Jiangsu Education Department (Project No. 202211463027Z), Jiangsu Provincial Office for Education Sciences Planning (Project No. C-c/2021/01/46) and Jiangsu University of Technology (Project No. KYY19533). The authors also thank the China

Education Panel Survey (CEPS) project data provided by the China Survey and Data Center of Renmin University of China.

References

- [1] Bian Yufang, Zhang Xinyu. How to Do Well in Family Education Guidance Under the Pattern of "Easing the Burden of Excessive Homework and Off-campus Tutoring for Students Undergoing Compulsory Education" [J]. *China Educational Technology*, 2022(05):8-12+34.
- [2] Gu Tianzhu, Xue Chao, Gu Xihong. Public Education Investment and Private Education Investment: Crowding-in or Crowding-out? —Empirical study on the education Investment from families [J]. *Journal of Nanjing Radio & TV University*, 2018(03):62-68.
- [3] Liu A, Xie Y. Influences of monetary and non-monetary family resources on children's development in verbal ability in China[J]. *Research in Social Stratification and Mobility*, 2015, 40:59-70.
- [4] Li Jiali, Xue Haiping. The Relationship among Parental Involvement, Private Tutoring and Secondary Students' Academic Achievement [J]. *Research in Educational Development*, 2019,39 (02):15-22.
- [5] Qi Xinyu, Zhang Hui. Analysis on the differences of educational investment between urban and rural residents in China[J]. *Journal of Communication University of China (Science and Technology)*, 2020, 27(05): 42-45.
- [6] Gu Tianzhu, Ma Jianfu, Sun Rou. Education Inputs: Time V. S. Money, which is More Important? [J]. *Journal of Education Studies*, 2021, 17(04):148-165.
- [7] Li Jiali, Zhang Minxuan. Income Inequality, Competition in Education, and the Choice of Family Investment in Education [J]. *Education Research*, 2020, 41(08):75-84.