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Research Article

On Time Effect of Preschool Education: Social Analysis Based on CUCDS

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Cognitive ability is an important aspect of children's development, but there is still room for discussion about the impact of preschool education on children's cognitive ability. Based on the data of China Urbanization and Children Development Survey (CUCDS) of Tsinghua University, this paper categorizes cognitive ability into Chinese language cognition and mathematical cognition. It is discovered that the impact of preschool education on children's cognitive development differs depending on the cognitive ability and the length of time. In particular, preschool education has both short-term and long-term effects on children's Chinese cognitive ability, while there is only a short-term effect on the development of children's mathematical cognitive ability without long-term effect.

1. Introduction

Cognitive ability is a very important aspect of development for children. It can in a sense even be claimed that cognitive ability constitutes the basis of children's upward mobility. Due to the close relationship between education and ultimate class status acquisition, the fundamental role of cognitive ability in the promotion of status is prominently manifested as its influence on education acquisition. Relevant research was first conducted through the Wisconsin model, with the mediating role of "intelligence" and other social-psychological variables in the causal chain of "family background-education acquisition" being found [1]. Since then, with the improvement of measurement technology and the abundant accumulation of data, more and more research studies on intelligence and cognitive ability have been conducted. It has become a consensus that the basic role of cognitive ability accounts for improving status. It was proved not only to be an effective indicator for predicting academic achievement and educational acquisition [2–4] but also to have significant effect on job acquisition, career performance, and economic income in the labor market [4–7]. Moreover, a recent study combined cognitive ability with family background for analysis and found that cognitive ability can compensate the disadvantage of family background and ultimately help children from those disadvantaged families to gain higher economic status [8]. In view of the increasing recognition of the important role of cognitive ability, some scholars even put forward the concept of "cognitive capital" to represent a kind of accumulated asset that can be employed to create and grasp opportunity and extend well-being to cope with environmental challenges and pressures [9].

The above empirical studies on the importance of cognitive ability regard it as an independent variable, while actually cognitive ability is also a resulting variable impacted by various sociological factors such as education. Preschool/early education is one of the possible factors. Preschool education experience may affect cognitive development from two aspects—educational opportunity and quality.

There are still significant rural-urban and regional differences in preschool education opportunities of Chinese children. Therefore, this paper focuses on the impact of preschool education opportunities and analyzes the impact of preschool education experience on children's cognitive ability development by exploring the national sample data of China, which is relatively rare in existing literature. This paper endeavors to answer the following questions. (1) Does preschool education opportunity have significant impact on children's cognitive development? (2) If the first question is true, is the influence different upon different levels or aspects of cognitive ability? (3) Considering ageing, is the effect short term, long term, or both?

2. Literature Review and Assumptions

Although theories affecting cognitive development are full of contradictions and controversies ("genetic determinism" and "environmental determinism"), there is a consensus on the main aspect, that is, changes in cognitive environment and stimuli will lead to differences in cognitive ability. Biological basis is the fact that a growing brain is plastic. During the growth period, especially in the process of brain development, different stimuli may lead to different cognitive levels.

In short, the development of cognitive ability bears sensitive and critical period. The early childhood (0–6 years old) is usually regarded as the sensitive and critical period of growth, not only because many brain structures and biochemical pathways are developed at this stage but also because the brain development speeds at this stage [10, 11]. In this critical period, implementation of appropriate mild intervention will help to improve health and well-being, education effectiveness, skill potential, employment status, and quality of life. Oppositely, negative stimuli will instead lead to depreciation of cognitive capital, damage of physical and mental health, and reduction of education effectiveness and life opportunities [12]. The idea of "critical period" is the foundation of the implementation of preschool education. Because the cognitive ability and behavior of children are more malleable than adults, investment in early childhood education has a higher return on investment than compensation education in middle and late stages [11]. The World Bank estimates that the return on investment in early education is about 7% to 18%, much higher than the return on financial capital. The return on investment of early education in China is also within this range, roughly between 7% and 15% [13]. In view of this, investing in early childhood education is regarded as the most effective intervention to help disadvantaged families/children to break the intergenerational transmission of poverty [14, 15].

There are two senses for preschool education, broad and narrow. In broad sense, preschool education refers to all forms of education that preschool children receive, such as school, family, and society. In the narrow sense, it only refers to the formal education implemented by specialized preschool education institutions. This paper only concentrates on the narrow sense. It deeply impacts the growth of a child whether or not he/she receives formal and standardized preschool education at the right age and whether or not the quality of preschool education is sound, especially the cognitive development. Existing empirical data from countries outside of China almost unanimously confirm that the cognitive level or academic achievement of children with formal preschool education is generally higher than those without [16, 17]. The role of preschool education, especially higher quality preschool education, in reducing the impact of risk (such as poverty) on children's cognitive development/academic achievement is also firmly validated [18]. Empirical studies from China have similar findings, but there is a lack of national samples. Chen and Liu, applying the survey data of the Program for International Student Assessment (PISA) in Shanghai, found that preschool education has dual effect of "cultivating excellence" and "making up the gap," which can promote not only academic achievement but also educational equity among students [19]. But the findings were limited to Shanghai, China. Luo et al. conducted a study in six state-level poverty-stricken counties in Shanxi, Gansu, and Henan provinces. Through the analysis of 505 children aged 4–5, they found that there was a significant correlation between cognitive ability of children and formal preschool education experience [20].

As far as the duration of the effect of preschool education on cognitive development is concerned, the literature consistently shows that preschool education has a short-term effect on children's cognitive development [21]. However, it is still controversial whether preschool education has a long-term effect. Some studies have found that there is truly long-term effect [22], while some do not support this [23]. The literature within China also consistently confirms the short-term effects of preschool education, but conclusions towards long-term effects are not uniform. Two studies using the data of "China Education Tracking Survey" (CEPS) found that preschool education has a long-term effect on the development of cognitive ability [24, 25]. Another analysis using the data of "China Family Tracking Survey" (CFPS) found that there was no significant correlation between preschool education and children's cognitive ability, without long-term effect from preschool education to cognitive ability [26]. Both CEPS and CFPS are national data, but there is a problem of insufficient coverage of children's age range. The baseline data of CEPS only cover two cohorts of students in grade 7 and grade 9, while Gong and others only used the data of children aged 11–15 in CFPS data.

In addition, most relevant studies simply treat children's cognitive ability as a "whole" for analysis, whereas cognitive ability is actually of multi-level and multi-facet. Some tests may put emphasis on measuring cognitive ability in learning, memory, comprehension, and classification abilities, while some other focus on measuring cognitive ability in reasoning and judgment, logical thinking, abstract thinking ability, etc. [27]. This overall analysis method that does not distinguish between cognitive abilities may cover up some real and interesting information, thereby biasing the conclusions.

Based on the above analysis, via mining the data of China Urbanization and Children Development Survey (CUCDS) of Tsinghua University, a large national sample that covers a wider range of children's ages, this paper endeavors to explore the influence of preschool education experience on different levels of cognitive ability of Chinese children and the duration of effect by dividing the cognitive ability into two categories: the Chinese language cognition and mathematical cognition, and the children into two age groups: 3–10 and 11–15. The Chinese test of CUCDS data focuses on the measurement of common sense, vocabulary, classification, understanding, and reasoning ability. These abilities reflect individual learning and memory, reasoning and judgment, understanding, and comprehensive conceptual thinking ability. Mathematics test pays more attention to the measurement of calculation, problem-solving, and reasoning ability, which reflects an individual's logical and abstract thinking and reasoning ability. The two tests not only measure cognitive abilities but also hold particular emphasis. In terms of time division, the reason explaining why children are divided into two age groups is based on previous practice, with limited data. The maximal age surveyed by CUCDS is 15. Considering the external stimulus of cognitive ability, duration, and preschool education, one can put forward the hypothesis that cognitive ability in different aspects and levels will be affected by preschool education, with both short-term and long-term effects. This can be summarized into the following two assumptions.

Assumption 1. Preschool education experience has both short-term and long-term effects on children's Chinese language cognitive development.

Assumption 2. Preschool education experience has both short-term and long-term effects on children's mathematics cognitive development.

3. Data, Variables, and Model Setting

3.1. Data. The data employed in this paper are from China Urbanization and Children Development Survey (CUCDS) of Tsinghua University. The survey was conducted in 2012. With multi-stage sampling scheme and PPS sampling method, adults and children from 28 provinces, 147 districts and counties, and 500 villages in mainland China except Qinghai, Tibet, and Hainan were randomly selected for the interview. The weighted valid sample size for the question "whether or not they received preschool education" was 4,963.

The test of children's cognitive ability is the main content of module for children in the questionnaire. The 3–12-year-old part of the "children's ability test" was compiled by Hou-Can Zhang in Beijing Normal University, and the 13–15-year-old part was designed by Jean Yeung in National University of Singapore, with reference to the PISA test and the cognitive scale of the module for children in the American Income Tracking Survey. All measuring tools are suitable for Chinese children aged 3–15. The children on the test are divided into 4 age groups: 3–6 years old, 7–8 years old, 9–12 years old, and 13–15 years old. Each age group has a corresponding subtest (local language, mathematics, and English) with the English test being only applicable for the two oldest age groups. Because this paper focuses on the duration of the effect of preschool education on cognitive development and comparison should be conducted among different ages, only the data of children's Chinese and mathematical cognition test are concerned.

As for the test reliability, in view of the non-one-dimensional structure of Chinese and mathematics tests, the alpha coefficient cannot be taken as the most ideal indicator to measure the stability of the test results. Considering that the subtests are basically arranged in a way from easy to difficult, the odd-even method is adopted to judge the stability of test tools by calculating the split half reliability. However, this method of halving the test length will underestimate the test reliability. In order to compensate the error, the Spearman–Brown formula is usually used to correct the split half reliability. Table 1 shows the split half and calibrated reliability of Chinese and mathematics proficiency tests for children of all ages. It can be seen that the tests have a high stability, with the calibrated reliability above 0.84. Especially for mathematics tests, the lowest value of the calibrated reliability also reaches 0.90.

3.2. Variables

3.2.1. Dependent Variables. In this paper, the Chinese language and mathematics cognitive abilities are dependent variables, based on corresponding subtests. The content, difficulty, and duration of subtests were different in different age groups. Test difficulty increases with the age of children. For young children aged 3–6 years, the assessment time takes about 20 minutes, while for older children aged 9–12 and 13–15 years, it takes 30 minutes. The Chinese and mathematics tests for children of different age groups and the time limits for completion are shown in Table 2.

The full score of Chinese and mathematics subtest is 50. Descriptive statistics of Chinese and mathematics cognitive score variables are shown in Table 3.

3.2.2. Independent Variables. The core independent variable of this paper is preschool education. According to the index "whether or not ever been to kindergarten or preschool," the variable discretely classifies the children who have been to kindergarten or preschool as those received preschool education. In the preschool education choice model, preschool education is the dependent variable, with individual, family, and regional variables being the independent ones. Specifically, individual level variables include children's gender and age; family level variables include the parents' educational levels to measure family cultural capital, the number of children aged 0–15 years to measure family structure, and the birthplace of children to measure family economic status; regional level variables include regions (eastern, central, and western) and rural-urban areas (urban or rural). Table 4 lists the descriptive statistics of the main independent variables in this paper.

Table 1: Split half reliability and calibrated reliability of the test.

Test name	Age group (years)	Split half reliability	Calibrated reliability of Spearman–Brown formula
Chinese test	3–6	0.76	0.86
	7-8	0.82	0.90
	9–12	0.78	0.88
	13–15	0.73	0.84
	3–6	0.86	0.92
Mathematics test	7-8	0.88	0.94
	9–12	0.91	0.95
	13–15	0.82	0.90

Table 2: Subtest and time limit (minutes) of children of different age groups.

Age group (years)	Chinese	Mathematics
3–6	10	10
7-8	12	13
9–12	12	18
13–15	15	15

Table 3: Descriptive statistics of Chinese cognitive ability and Mathematics cognitive ability.

Variable	Sample size	Minimum value	Maximum value	Mean	Standard deviation
Chinese	4938	1.00	50.00	26.04	11.04
Mathematics	4798	1.00	50.00	21.18	11.82

Table 4: Descriptive statistics of main variables.

Variables	Weighted mean
Child's gender (1 = male)	0.54
Child's age (years)	9.02 (3.84)
Father's education level	
Primary school and below	0.24
Junior middle school	0.46
Senior high school and equivalent	0.21
University or above	0.08
Mother's educational level	
Primary school and below	0.36
Junior middle school	0.41
Senior high school and equivalent	0.15
University or above	0.07
Birthplace (1 = hospital)	0.77
Number of children aged 0–15 years	1.64 (0.84)
Region	
Western	0.31
Central	0.33
Eastern	0.36
Urban and rural (1 = urban)	0.39
Received preschool education or not (1 = yes)	0.70

Note. Standard deviation is given in brackets. Due to missing values, the percentage sum of some variables may not be equal to 100%.

3.3. Model Setting. We adopt the propensity score matching (PSM) method to analyze the effect of preschool education on children's cognitive development. Most of the existing research studies on the influence of preschool education on children's cognitive development are mainly based on simple comparison between children receiving or not receiving preschool education, often lacking consideration of endogenous problems. Furthermore, children receiving and not receiving preschool education may be two groups with systematic differences. If endogenous problems are never addressed to eliminate possible confounding variable effects, the comparison results cannot be definitely attributed to the influence of preschool education but may be the effect of other confounding variables such as family. Therefore, in order to analyze the "net effect" of preschool education, we need to introduce a method that can eliminate the selective error of confusing variables and solve the endogenous problem. One of the methods is propensity score matching, which is based on counterfactual causality. In this paper, the steps of this method are as follows: the confounding variables that lead to the imbalance between children receiving (intervention group) and not receiving preschool education (control group) are included in the logit regression model, and the propensity score is calculated on this basis. According to the common support domain of propensity score, the intervention and the control groups were matched to find the ideal counterfactor. The Average Effect of Treatment on the Treated (ATT) of the intervention group was calculated for the matched samples.

4. Short-Term Effect of Preschool Education on Children's Cognitive Development

4.1. Establishing Preschool Education Choice Model (3–10 Years Old). With reference to the existing literature and combined with the characteristics of the research, this paper selects the independent variables at three levels of individual, family, and region to establish the preschool education choice model. Considering that the main task of the study is to analyze the "net effect" of preschool education experience to children's cognitive ability, the independent variables included in the model need to meet the requirements to be correlated to both children's access to preschool education opportunities and cognitive ability. The individual level variables ultimately included gender and age. The family level variables are education level of parents, the number of children aged 0–15 in the family, and the birthplace. The current economic status is not suitable because only the family economic status before receiving preschool education can affect the choice of children. According to research of Xu and Xie [28], we indirectly measure the economic status before children's preschool education by their birthplace (born in hospital or at home). At the regional level, regional (eastern, central, or western) and rural-urban (urban or rural) variables are selected. This is because there is evident imbalance in regional advance of preschool education in China, not only between urban and rural areas, but also between eastern, central, and western provinces. Statistics released by the Ministry of Education show that the national gross enrollment rate for preschool education has been steadily increasing, from 56.6% in 2010, 67.5% in 2013, to 81.7% in 2018. However, the growth cannot cover up the significant differences between rural/urban areas and among regions. Taking the year 2013 as example, the average gross enrollment rate of preschool education in China was 67.5%, accounting for 45.0% in urban areas and only 22.5% in rural areas. The situation of discrepancy is extensive. In terms of regional differences, taking the gross enrollment rate of preschool education as index, the value in Tibet is only 52.0%, and that in Yunnan Province is 54.0%, while that in Zhejiang, Jiangsu, Fujian, and Guangdong provinces is higher than 95.0%, with this index in Shanghai even being 100.0%.

Let preschool education be a binary variable (1 = received; 0 = not received) and the aforementioned individual, family, and regional level variables be independent variables; then, fit the logit model (Table 5). The results show that gender and education level of fathers have no significant influence to whether children receive preschool education, whereas the lack of preschool education experience is more likely attributed to low educational level of mothers, multiple children, poor family economic status, and regional factors. The significant effect of age may indicate that some younger children simply do not receive preschool education at the right age.

4.2. Matching Samples and Balance Test (3–10 Years Old). Based on the establishment of preschool education choice model, the matching score of preschool education is calculated, and then one-fourth of the standard deviation of this score is adopted as the caliper. The nearest neighbor matching within the scope of caliper is taken as method for sample matching to find the relatively ideal "counterfactor" between the children receiving and not receiving preschool education. Because the cases outside the common support domain (the overlapping part of the probability density distribution) will be excluded when the propensity score is matched, the samples are effectively utilized with larger common support domain of the intervention and the control groups. Figure 1 shows that the common support domain of the two groups is large, which meets the basic condition of propensity score matching.

As for the effect of matching, a balance test is required, that is, to test whether there are systematic differences in confounding variables between the matched intervention and control groups. The test method is determined according to the measurement level of confounding variables. Generally, chi-square analysis and analysis of variance are applied to test categorical and continuous variables, respectively. Table 6 shows the balance test results. Before matching, there were significant differences between the two groups of children in other confounding variables except gender. After matching, the systematic differences between the two groups of children in other variables other than region disappeared, indicating that the overall matching sample passed the balance test well, and then one can use the matched samples for impact effect analysis.

4.3. On Short-Term Effect. The effect of preschool education on children's cognitive ability was calculated by using matched samples. It is found that the Chinese language cognitive ability ($N = 1463$) and mathematics cognitive ability ($N = 1425$) of children who have received preschool education are significantly higher than those without preschool education, with a difference of 1.79 points in Chinese language and 2.13 points in mathematics cognitive ability (Table 7). Since the analysis is for children aged 3–10 years who are receiving or just completed preschool education, this result indicates that preschool education has immediate or short-term effects on cognitive development.

5. Long-Term Effect of Preschool Education on Children's Cognitive Development

Through the same logic, this paper analyzes the influence of preschool education on the cognitive development of children aged 11–15 years. Firstly, the choice model of preschool education is established to calculate the propensity to receive preschool education. Then, the nearest neighbor method within the range of caliper is taken for sample matching and balance test. Finally, ATT is calculated by employing the matched samples.

5.1. Establishing Preschool Education Choice Model (11–15 Years Old). The variables included in the model are the same as those for children aged 3–10 years with conclusions being basically similar (Table 8). In addition to the child's gender and father's education level, the variables that have no significant impact on preschool education also include the child's age. Still, those children with higher education level of mothers, fewer siblings, better family economic status, birthplace in eastern or Central China, and in urban areas are more likely to receive preschool education.

Table 5: Logit model for predicting the tendency to receive preschool education (3–10 years old).

Variables	Coefficient
Child's gender (1 = male)	−0.11 (0.09)
Child's age (years)	0.22 (0.02)***
Father's education level (reference group: primary school and below)	
Junior middle school	0.14 (0.12)
Senior high school and equivalent	0.22 (0.16)
University or above	0.08 (0.26)
Mother's education level (reference group: primary school and below)	
Junior middle school	0.29 (0.11)*
Senior high school and equivalent	0.36 (0.17)*
University or above	0.71 (0.28)*
Number of children aged 0–15 years	−0.25 (0.06)***
Birthplace (1 = hospital)	1.24 (0.13)***
Region (reference group: western)	
Central	0.50 (0.11)***
Eastern	0.73 (0.12)***
Urban or rural (urban = 1)	0.73 (0.11)***
Intercept	−1.89 (0.25)***
N	3008
Log likelihood	−1469.77***
Virtual R^2	14.8%

Note. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$; standard error is given in brackets.

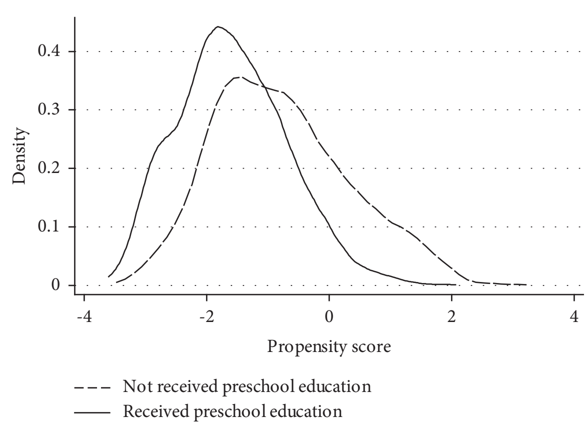

Figure 1: Probability density distribution of propensity score matching between intervention group and control group (3–10 years old).

5.2. Matching Samples and Balance Test (11–15 Years Old). Figure 2 shows that the common support domain of intervention and control groups is large, which is suitable for propensity score matching.

One-fourth of the standard deviation of the propensity score is still utilized as the caliper standard for nearest neighbor matching. After matching, the samples pass the balance test. The test results are shown in Table 9.

5.3. On Long-Term Effect. Table 10 shows that the Chinese language ($N = 729$) and mathematics cognitive ability ($N = 705$) of children who have received preschool education are both higher than those without receiving preschool education, where the Chinese cognitive ability is 2.07 points higher and the mathematics is 0.86 points higher. However, the difference in mathematics cognitive level between the two groups of children does not reach the significance level of 0.05. In other words, preschool education has a long-term effect on children's Chinese cognitive development than mathematical ability. It can be interpreted by the theory on fluid intelligence and crystal intelligence, which holds that the general factor of human cognitive ability can be attributed to fluid and crystallized intelligence. Fluid intelligence is based on individual physiological conditions, depending on innate endowment, and is not or less affected by education and life experience, whereas crystallized intelligence is acquired through learning, which is deeply influenced by education and daily experience [29]. Mathematics cognitive ability belongs to the former. Therefore, preschool education experience has no significant long-term impact on it. Of course, this conclusion still deserves further testing.

Table 6: Balance test of intervention group and control group (3–10 years old).

Variables	Before matching (F or χ^2)	After matching (F or χ^2)
Child's gender	0.51	1.22
Child's age	111.25***	1.12
Father's education level	67.94***	5.09
Mother's education level	69.26***	10.65
Number of children aged 0–15 years	77.56***	1.96
Birthplace	144.60***	4.82
Region	64.25***	22.74***
Urban or rural	76.62***	5.75

Note. ** $p < 0.01$; *** $p < 0.001$.

Table 7: Effect of preschool education on children's cognitive development (3–10 years old).

	Intervention group (mean)	Control group (mean)	ATT
Chinese	26.08	24.29	1.79 (0.56)**
Mathematics	22.23	20.10	2.13 (0.63)***

Note. ** $p < 0.01$; *** $p < 0.001$; standard error is given in brackets.

Table 8: Logit model for predicting the tendency to receive preschool education (11–15 years old).

Variables	Coefficient
Child's gender (1 = male)	−0.14 (0.11)
Child's age (years)	−0.06 (0.04)
Father's education level (reference group: primary school and below)	
Junior middle school	−0.19 (0.13)
Senior high school and equivalent	−0.00 (0.19)
University or above	−0.25 (0.38)
Mother's education level (reference group: primary school and below)	
Junior middle school	0.73 (0.13)***
Senior high school and equivalent	0.99 (0.23)***
University or above	1.12 (0.42)**
Number of children aged 0–15 years	−0.27 (0.07)***
Birthplace (1 = hospital)	0.64 (0.12)***
Region (reference group: western)	
Central	0.50 (0.13)***
Eastern	1.24 (0.14)***
Urban or rural (urban = 1)	0.70 (0.13)***
Intercept	0.44 (0.58)
N	1452
Log likelihood	−1043.74***
Virtual R^2	16.9%

Note. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$; standard error is given in brackets.

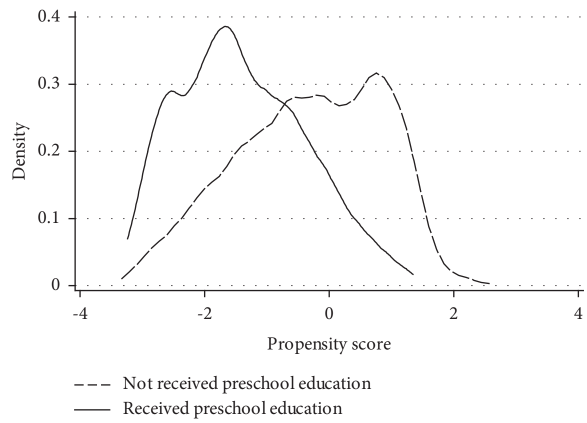

FIGURE 2: Probability density distribution of propensity score matching between intervention group and control group (11–15 years old).

TABLE 9: Balance test of intervention group and control group (11–15 years old).

Variables	Before matching (F or χ^2)	After matching (F or χ^2)
Child's gender	0.07	0.05
Child's age	1.73	2.93
Father's educational level	76.80^{***}	0.56
Mother's educational level	136.24^{***}	4.41
Number of children aged 0–15 years	68.35^{***}	2.00
Birthplace	172.53^{***}	0.05
Region	113.07^{***}	7.33
Urban or rural	92.57^{***}	1.37

Note. $^{**}p < 0.01$; $^{***}p < 0.001$.

TABLE 10: Effect of preschool education on children's cognitive development (11–15 years old).

	Intervention group (mean)	Control group (mean)	ATT
Chinese	27.19	25.12	$2.07\ (0.85)^{*}$
Mathematics	20.97	20.11	0.86 (0.92)

Note. $^{*}p < 0.05$, $^{**}p < 0.01$, and $^{***}p < 0.001$; standard error is given in brackets.

6. Conclusion, Suggestion, and Limitation

In this paper, based on CUCDS data, the selection tendency for preschool education was analyzed through logit regression, and PSM was employed to estimate the impact of preschool education on children's cognitive development. The following conclusions were reached:

(1) Preschool education experience has important influence on children's cognitive development, but this influence varies with different levels, facets, and time effects of cognitive ability. Specifically, preschool education has both short-term and long-term effects on the development of children's Chinese language cognitive ability, while there are only short-term effects on the development of children's mathematical cognitive ability. Previous studies simply claim that preschool education has significant impact on children's cognitive ability but without temporal scales. There are only research studies on the duration of the influence effect, either finding that preschool education has both short-term and long-term effects on cognitive development or finding that preschool education only has short-term but no long-term effects on cognitive ability. Evidently, the conclusion of this paper is distinct from previous studies because it subdivides cognitive ability into different aspects.

(2) Family background exerts important influence on whether children have access to preschool education as well as their cognitive development. It can be attributed to three aspects of capital, namely, family literacy, structure, and economy. In families with rich literacy capital, parents with high educational level tend to pay more attention to education and have higher expectations for the development of children. This kind of attention and expectation will be transformed into children's enthusiasm for learning, which is conducive to the development of cognitive ability; moreover, parents with high education level are willing to provide financial support and especially attention for cognitive development. More importantly, they are able to provide guidance being more appropriate and effective and assistance to the cognitive and academic development, and this

aspect is especially prominent for mothers since they play the primary role of caregivers in most families. The internal logic of the influence of family structure is "resource dilution theory" [30], that is, with prescribed family resources (including the attention resources of main caregivers, especially parents, besides economic conditions), greater number of children is a disadvantage to cognitive development because less resources can be allocated to each child. Family economic capital has impact on children's cognitive development by means of resource transformation, such as attending high-quality kindergartens, attending tutorial classes, and purchasing learning materials. The region where children are located has an important influence on whether children receive preschool education and their cognitive development. This is mainly due to the evident imbalance in the regional development of preschool education in China. Distinctions among different stages of education, rural-urban areas, and eastern, central, and western provinces are undoubtedly the main content of the unbalanced and insufficient development of Chinese education. The fundamental reason for this difference lies in the dualistic division of Chinese education system—the division between rural and urban areas and the internal division of all stages of education, from kindergarten to university. The former leads to prominent differences in education between urban and rural regions, while the latter leads to the distinction between the key and ordinary schools. The essence of dualistic division is that limited education funds are allotted to urban schools and key schools [31].

Based on the above analysis, policy recommendations are given in the subsequent paragraphs. Children from disadvantaged families are more likely to be at significant disadvantage in cognitive level due to the lack of preschool education and other reasons. Such families are mainly distributed in rural and western regions, and because the important influence of preschool education and family cultural capital were marked by parents' educational level on cognitive development, in order to block the severe circle of intergenerational transmission of poverty and to promote social mobility, especially the realization of upward mobility of children from disadvantaged strata, primary areas and appropriate strategies should be determined for intervention, in addition to certain specific assistance means. There is no doubt that education should be the focus of intervention. In particular, we should pay attention to the education problems in rural, western, and other underdeveloped areas. We should not only develop and popularize preschool education and improve the quality of compulsory education to "directly intervene" children's cognitive development but also vigorously develop high school education in underdeveloped areas, improve the enrollment rate of universities, and increase the average years of education in the region to promote children's cognitive development indirectly.

In addition, considering that long-term effect of preschool education only applies to Chinese cognitive ability, the enlightenment to relevant assistance departments and personnel may be that for those children without preschool education experience, targeted reinforced training in Chinese may be more important in the process of academic assistance and improvement.

Admittedly, there are still some limitations. First, cognitive development is affected not only by the environment acquired but also by natural biological factors. As the acquired environment affects the degree, genetic factors also bring limitations to the scope of cognitive development. Due to the lack of collection of genetic information data, it is impossible to identify the involvement of genes and environment in cognitive test results. This also affects the accuracy of the evaluation of the effects of preschool education on cognitive ability. Second, although propensity score matching is an effective method to confirm causality, it is only an alternative choice in the absence of tracking data, which has the limitations of losing sample size and changing research conclusions due to different confounding variables included in the model. Third, cognitive ability is extremely complex, and relevant research to date has still been in primitive stage. Therefore, the division of cognition by Chinese language and mathematics in this paper cannot cover all of its contents. However, since cognition has different levels and aspects, the measurement results of Chinese and mathematical cognition with different emphases are bounded to reflect these differences. In addition, existing studies have confirmed that the supply of education welfare in China has a ladder-like decline pattern of "good in the east and bad in the west," and education welfare is a manifestation of the problem of educational balance in terms of quality. Compared with preschool education opportunities, the impact of the quality of preschool education on cognitive development should be a more interesting issue. Due to data limitations, the task to offer solutions can be left to the future.

Data Availability

The data used to support the findings of the study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Supplementary Materials

I use the data of Tsinghua University which has been uploaded in supplementary material. (*Supplementary Materials*)

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