

Will Grandparents' Co-Residence Inhibit Grandchildren's Educational Performance?

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Abstract

This paper explores the impact of grandparents' and children's co-residence on children's educational performance by using data from the 2014 Chinese Family Tracking Survey. Taking 10 - 15 years old children as the research object, this paper conducts an empirical study through an educational output value-added model, and uses Propensity Score Matching (PSM) method to solve the endogenous problem. The overall regression result shows that co-residence between grandparents and children significantly reduced children's educational performance. On the one hand, due to the co-residence of grandparents, children's parents need to bear a heavier burden of family care and the time invested by parents for children's education decreased significantly; on the other hand, the co-residence of grandparents has reduced the family's per capita income, and the family has significantly reduced education expenditures for children in the lower grades.

Keywords

Grandparents, Co-Residence, Children, Educational Performance, PSM Method

1. Introduction

Education is the main factor affecting the accumulation of human capital. The achievement of educational results in adolescence not only affects people's achievement, happiness and their future life opportunities at the individual level, but also affects the quality of a country's labor force at the national level (Heckman, 2011). The performance of educational performance is the result of the combined effects of family, school, and social factors. The Coleman Report published in 1964 states that families have a greater impact on educational performance than schools and society (Coleman, 1966; Chedale, 2008). More detailed

researches on the family factors that affect children's academic performance are mainly focused on the family's economic and social status, such as parents' education level, income, occupation, etc. (Coleman, 1988; Sirin, 2005; Sun et al., 2009; Pang et al., 2013; Li & Qiu, 2016). For example, the "resource dilution theory" believes that an increase in the number of siblings in a family will dilute the educational resources of each child in the family, therefore having a suppressive effect on the development of children's education (Blake, 1989; Downey, 1995; Zhang & Xie, 2015).

Since the 1990s, China's birth rate and death rate have declined, and the problem of population aging has become more prominent. As the population at the peak of birth in the middle of the 20th century gradually enters old age, the early part of the 21st century will be the fastest period for China's population to age. At the social level, population ageing will affect family structure, intergenerational relationships, housing and migration, etc., and place new demands on the health and healthcare system (Peng & Hu, 2011). As average life expectancy increases, more and more people are able to survive to the age of becoming grandparents and participate in the growth of grandchildren. In China, it is a tradition for grandparents to live with their grandchildren as primary caregivers (He et al., 2018). Wang (2014) analyzed the 1% sample database of the 1982, 1990, 2000, and 2010 national censuses and found that three generations of direct families are the main body of the direct families, and their composition is very stable. In the four census years, three generations of immediate families accounted for more than 70% of the immediate families. Although this share decreased in 2010 and was 5.99% lower than in 2000, it was not a significant decrease. Therefore, the coresidence of grandparents and grandchildren is still a common social phenomenon in China.

Grandparents usually provide care and assistance for their grandchildren in daily life. The degree of care can range from "non-participant care" to "occasional help" to "long-term replacement parents" (Hirshorn, 1998). "Live together" to "Live together" (adult children, grandchildren, and grandparents all live together), to "Cross-generational families" (parents do not live together) (Pebbley & Rudkin, 1999). On the one hand, the co-living of grandparents and grandchildren provided care for the grandchildren's early growth, but on the other hand, as the grandparents grew older, this family structure also met the grandparents' elderly care needs (Chen, 2005). While providing educational obligations to young children, families also need to provide elderly care services to older grandparents. So will the demographic structure of the family in which the grandparents and grandchildren live together will dilute the family's investment in children's educational resources and affect the educational achievements of the grandchildren? If the co-residence of grandparents and grandchildren affects the educational outcomes of grandchildren, by what means? With declining birthrates and aging, this issue becomes even more important in China in the 21st century.

The rest of this paper is organized as follows. The literature review is intro-

duced in Section 2. Section 3 describes the data and model. Section 4 presents the empirical results and the mechanism analysis. We conclude in Section 5 with a discussion and remarks.

2. Literature Review

Existing studies have mostly explored the impact of individual characteristics of grandparents on children's educational performance, but due to differences in national or historical backgrounds and differences in models, measures, and data, the existing literature has no fixed conclusion. Warren and Hauser (1997) studied the relationship between grandparents and grandchildren's social status by analyzing data from the 1957 Wisconsin Longitudinal Study, and found that after controlling parental characteristics, grandparents' education level, The effects of grandparents' education level, occupation status, and income on grandchildren's education level or occupation status are not significant. Ferguson and Ready (2011) used survey data from more than 13,000 children in the United States and found that after controlling socioeconomic and demographic characteristics, children with grandparents who had received college education had stronger literacy and mathematical skills before receiving formal education. Jæger (2012) used data from the Wisconsin Longitudinal Study and the 1979 National Youth Longitudinal Survey and found that grandparents', aunts', and uncles' socioeconomic characteristics have few direct effects on educational success. Furthermore, resources in the extended family compensate for lacking resources in low-SES families, which in turn promote children's educational success. However, Chiang and Park (2015) used a longitudinal survey of students and parents in northern Taiwan to find that the education level of grandparents affects the education level of adult children and thus increases the educational inequality of grandchildren, which is also the opposite of the "compensation theory" proposed by Jæger (2012). Song (2016) used the US income dynamic panel data to study whether the educational level of grandparents has a direct impact on the education of grandchildren. The results show that with the increase of grandparents' years of education, the number of years of grandchildren's education has increased significantly. Hällsten and Pfeffer (2017) used data from the Swedish National Register of Administration to study the relationship between grandparents' wealth and the educational achievements of their grandchildren, and found that the socioeconomic status of grandparents had a significant positive impact on the average grade points of their grandchildren in grade nine.

Not only the individual characteristics of grandparents may affect the educational outcomes of children, but the differences in family demographics caused by whether grandparents live with children may also affect the educational performance of children. Two studies by Kuan and Yang (2004), Pong and Chen (2010) both found that students living with grandparents in Taiwan had higher test scores than students living without grandparents, but did not explore the specific mechanism. Levetan and Wild (2015) surveyed 384 "Colored People"

(Mixed) and Black African students in grades 8 and 9 from Cape Town, South Africa, and found that regardless of whether grandmothers live together or not, there is no significant difference in the ability of adolescents of three and two generations to adapt to society. [Bol and Kalmijn \(2015\)](#) used data from the LISS family survey in the Netherlands and found that the impact of grandparents on grandchildren does not increase as the living distance between grandparents and grandchildren is closer. And after controlling the characteristics of parents, the influence of personal characteristics of grandparents on the educational level of children will disappear.

Due to the lack of micro data, there are few studies on the impact of Chinese grandparents on children's academic performance. However, in recent years, with the establishment and quality improvement of China's micro-databases, empirical research at the Chinese family level has become more feasible, scholars have begun to conduct research on grandparents' cohabitation and children's growth. [Zeng and Xie \(2014\)](#) used the 2002 survey data from the Chinese Family Income Project to find that living with well-educated grandparents can significantly reduce the possibility of children dropping out of school in rural areas of China, while living with grandparents with low education level will not affect the education level of the child. This study focuses more on the impact of grandparents' education on children's educational opportunities. However, education acquisition is a continuous process. Without a discussion of the education process, it is difficult to understand the process mechanism in which family background affects children's educational opportunities ([Li & Qiu, 2016](#)). Taken together, there is still little research on the impact of domestic grandparents on children's education, and the existing related research has mostly ignored the solution of endogenous problems. In addition, [He et al. \(2018\)](#) used CHNS data to find that the cohabitation of grandparents had a significant positive impact on children's weight and greatly increased the risk of childhood obesity.

In summary, there is still little research on the impact of co-residence of grandparents and grandchildren on children in China. This paper uses the 2014 micro survey data of CFPS to take children in the compulsory education phase as the research object to explain the children's test results, and directly measures the impact of grandparents' co-residence on children's academic performance. In order to ensure the validity of the results, the article uses OLS regression and Propensity Score Matching (PSM) to make empirical estimates respectively. At the end of the article, the article examines the two ways in which grandparents and grandchildren live together to affect children's academic performance and provides new ideas for future research.

3. Data and Empirical Models

3.1. OLS Regression

The basic empirical regression model is as follows:

$$Y_i = \beta_0 + \beta_1 Z_i + \beta_2 X_i + \beta_3 A_i + \varepsilon_i \quad (1)$$

The estimation method used in this paper is “Educational output value-added model”, Y_i represents the standardized grade of student i , ε_i represents the disturbance term, and X_i represents a series of control variables, including children’s personal, family and school characteristic variables, and province fixed effects. The control variable A_i represents the learning ability of the children before the survey. We add “parents’ evaluation of the children’s learning situation last year” as a proxy variable for children’s learning ability in the previous year. Z_i is a dummy variable, which represents whether the grandparents live with the child i . When a child lives with one or two grandparents, $Z_i = 1$ otherwise, $Z_i = 0$. The coefficient β_1 is the value we are mainly concerned with, which represents the standard deviation of the increase in children’s test scores when the grandparents live with the children.

This model is essentially a “value-added model of educational output”, which controls the cumulative output of various educational inputs received by children before being surveyed. It is a cumulative reflection of the educational production function. Based on this, the estimated results reflect the “net effect” of grandparents living with children over the past year on children’s performance. This model greatly reduces the data requirements and eliminates the effects of fixed factors over time, and is widely used in empirical studies (Zhang & Zhang, 2017).

3.2. Propensity Score Matching (PSM)

The co-residence of grandparents and grandchildren is an individual’s “self-selection”, not random. In practical research, even if we find that there is a negative correlation between the two, we cannot identify them as a cause and effect. The Propensity Score Matching (PSM) effectively circumvents this problem.

In this part, we estimate the probability (PS value) that each child lives with the grandparents, and then select the child B who has a PS value that is very close to the child A but does not actually live with the grandparents as a control observation sample. When each child A who lives with the grandparents in the sample finds a matching child B who does not live with the grandparents, the sample selection bias can be effectively controlled, and the two groups of samples can be compared and studied. In the actual matching process, after the propensity score matching method is converted to PS value matching through multiple characteristic indicators, multiple characteristic indicators are tested by Logit regression model to evaluate the effect of matching, thereby completing multivariate matching.

Finally, we calculated the average effect of the co-residence of grandparents and children on children’s educational performance through various methods. (Average effect of the treatment on the effect, ATT).

3.3. Data

The data used in this study are mainly from the 2014 baseline survey data of the

Chinese Family Panel Studies (CFPS). CFPS is a survey conducted by the China Social Science Survey Center of Peking University. It tracks and collects micro-level data of individuals, families, and communities that reflect China's social, economic, demographic, educational, and health changes. CFPS has officially visited 16,000 households since 2010, covering 25 provinces/municipalities/autonomous regions. This article mainly uses the community questionnaire, family questionnaire, adult questionnaire, and children questionnaire in the CFPS 2014 questionnaire, and uses 2012 survey data in part.

In order to measure children's educational achievements, the CFPS conducted standardized tests on word and math abilities in children aged 10 - 15 in the 2010 and 2014 children questionnaires. This article uses this variable as the main explanatory variable. However, due to the small number of samples participating in the test in 2010 and 2014 and the lack of data in 2010, we only used the cross-section data from 2014.

3.4. Variable Settings

The main explanatory variable for this study was the student's educational performance. This article takes the sum of numbers and word test results as the student's performance variable. Because the data includes children of all grades, this article uses the method of previous literature to maintain the comparability of the entire sample (Zhang & Zhang, 2017; Zhang & Xie, 2015). We standardized the test scores according to the student's grade and used them as explained variables for regression. The core explanatory variable is whether the grandparents live with the children. When one or two grandparents live in a family where the children live, it is recorded as 1 and the rest as 0. Finally, referring to previous studies, we have added two types of control variables to the model: personal characteristics variables "nation", "urban and rural", "gender", "grade", "age" and "personal learning ability"; family, school The characteristic variables "whether the child is in a key school", "the level of parental education", "the level of parental expectation of the child", "the number of children's siblings", and "adjusted family per capita income logarithm", and controlled Province fixed effects. The indicators and constructions of all variables are shown in **Table 1**.

3.5. Statistical Description

In the CFPS survey in 2014, there were 8616 children. After retaining only samples of children aged 10 - 15 who took the word and math test, 2569 samples remained. After using this sample to combine with family and adult data and excluding samples with missing key variables, we finally got the benchmark samples for regression analysis in this article, a total of 2233.

Table 2 reports descriptive statistics of the main variables, including children's education, personal characteristics, and family and social background. In families where the grandparents live with the children, the children are relatively young. The reason may be that the children are younger and require more

Table 1. The indicators, constructions of all variables in this paper.

Variable	Indicators	Constructions
<i>Std_test</i>	Standardized test scores	(0, 1) Standardize by grade;
<i>Co-residence</i>	Whether grandparents live with children	Dummy variables: 0-no grandparents live together, 1-one or two grandparents live together;
<i>Nation</i>	Nation	Dummy variables: 0-minority, 1-han;
<i>Area</i>	<i>Area</i>	Dummy variables: 0-rural, 1-urban;
<i>Age</i>	<i>Age</i>	Children's age at the time of investigation (10 - 14 years);
<i>Grade</i>	<i>Grade</i>	The grades the children attended when they were investigated (grades 1 - 12);
<i>Gender</i>	<i>Gender</i>	Dummy variables: 0-female, 1-male;
<i>Key_school</i>	Whether in a key school	Dummy variables: 1-key school, 0-other;
<i>Education_exp</i>	Parents' expectations for children's education	Dummy variables: 0-high school and below, 1-high school and above;
<i>Education_m</i>	Years of mother's education	Unit: year;
<i>Education_f</i>	Years of father's education	Unit: year;
<i>Child_num</i>	Number of children's siblings	
<i>Fincome</i>	Household net income	Unit: yuan;
<i>Fincome_p</i>	Household per capita net income	Unit: yuan;
<i>Ln_income</i>	Log of household per capita net income	$\ln(\text{Fincome}_p)$;
<i>Learning_eva</i>	Parents' evaluation of children's academic performance last year	Parents evaluated children's language and mathematics by 1 - 4 (poor, medium, good, excellent), this variable uses the average of two values;
<i>Wf1</i>	How often parents and children talk about school	Divided into five levels 1 - 5: the higher the value, the higher the frequency;
<i>Wf2</i>	How often parents check their children's homework	
<i>Tutor</i>	Whether the children received tutoring last year	Dummy variables: 1-tutoring costs in the past year > 0, 0-other.

Table 2. Variables statistical description.

Variable	Grandparents do not live with children		Grandparents live with children		Difference
	Sample size	Mean	Sample size	Mean	
<i>Std_test</i>	1208	0.660	1025	0.630	0.03***
<i>Nation</i>	1208	0.820	1025	0.810	0.0100
<i>Area</i>	1208	0.450	1025	0.370	0.08***

Continued

<i>Age</i>	1208	12.57	1025	12.27	0.30***
<i>Grade</i>	1208	6.330	1025	5.960	0.37***
<i>Gender</i>	1208	0.520	1025	0.540	-0.0200
<i>Key_school</i>	1208	0.230	1025	0.240	-0.0100
<i>Education_exp</i>	1208	0.790	1025	0.810	-0.0200
<i>Education_m</i>	1208	6.630	1025	6.260	0.36*
<i>Education_f</i>	1208	7.780	1025	7.830	-0.0500
<i>Fincome</i>	1208	51485	1025	52364	-879.6
<i>Fincome_p</i>	1208	13132	1025	9848	3283.13***
<i>Tutor</i>	1208	0.310	1025	0.260	0.05**
<i>Wf1</i>	1208	3.320	1025	3.220	0.10**
<i>Wf2</i>	1208	3.020	1025	3.040	-0.0200
<i>Learning_eva</i>	1208	2.230	1025	2.250	-0.0200

Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

involvement of the grandparents. In addition, without controlling any other variables, the per capita net income of households in families where grandparents and children live together, the possibility of children participating in extra-curricular tutoring, and the frequency of parents and children discussing school situations were significantly lower.

4. Estimation Results

4.1. OLS Regression Results

Table 3 reports the OLS regression results of Equation (1). When no control variable is added, the effect of co-residence of grandparents on children's performance is significant at the 1% confidence level; after adding control variables at the individual level such as gender, urban and rural, ethnic, grade, and age. The coefficient is still significant at the confidence level of 10%, but the value of the coefficient has dropped by more than half; When we continue to add characteristic variables representing the background of children's families and schools and control the province's fixed effects, the coefficient is still significant at a confidence level of 5%, and the value of the coefficient is almost unchanged. The regression results show that the co-residence of grandparents and children has a significant negative impact on children's academic performance. The significantly negative coefficient of the gender dummy variable indicates that the educational performance of boys is significantly lower than that of girls. In addition, among the variables representing the social background of students' families, parents' educational expectations of their children and parents' educational level have significant positive effects on children's test results, but the number of children's siblings has a significant negative effect on children's test results.

Table 3. Basic OLS model estimation.

	(1)	(2)	(3)	(4)
	<i>Std_test</i>	<i>Std_test</i>	<i>Std_test</i>	<i>Std_test</i>
<i>Co-residence</i>	-0.033*** (0.008)	-0.013* (0.007)	-0.013* (0.007)	-0.014** (0.007)
<i>Nation</i>		0.024** (0.010)	0.020** (0.009)	0.017* (0.010)
<i>Area</i>		0.037*** (0.007)	0.016** (0.008)	0.015* (0.008)
<i>Age</i>		0.016*** (0.005)	0.021*** (0.005)	0.021*** (0.005)
<i>Grade</i>		0.025*** (0.004)	0.019*** (0.004)	0.020*** (0.004)
<i>Gender</i>		-0.011 (0.007)	-0.018** (0.007)	-0.017** (0.007)
<i>Learning_eva</i>		0.056*** (0.004)	0.047*** (0.004)	0.048*** (0.004)
<i>Key_school</i>			0.016** (0.008)	0.014* (0.008)
<i>Education_exp</i>			0.031*** (0.009)	0.030*** (0.009)
<i>Education_m</i>			0.004*** (0.001)	0.003*** (0.001)
<i>Education_f</i>			0.003** (0.001)	0.003** (0.001)
<i>Child_num</i>			-0.016*** (0.005)	-0.014*** (0.005)
<i>Ln_income</i>			0.005* (0.003)	0.004 (0.003)
<i>cons</i>	0.657*** (0.005)	0.202*** (0.058)	0.030 (0.050)	0.117* (0.062)
<i>Province fixed effect</i>	Not controlled	Not controlled	Not controlled	controlled
<i>N</i>	2233.000	2233.000	2233.000	2233.000
<i>R²</i>	0.007	0.271	0.283	0.292

Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.2. PSM Results

Because the effectiveness of the PSM model in eliminating the sample selectivity bias depends on whether the samples in the matched treated group and the con-

trol group are as similar as possible. As the effectiveness of the PSM model in eliminating the sample selectivity bias depends on whether the matched treated and control samples are as similar as possible. Therefore, before estimating the “net” effect of grandparents’ co-residence on children’s educational performance, we need to test the balance of model matching. In other words, there should be no significant difference in the control variables participating in the two groups of samples after successful pairing, and the indicators should be independent of whether the grandparents live with the children. Conversely, if there are still significant differences between the two groups of samples after pairing, it means that the choice of matching variable or method is inappropriate.

Since the nearest neighbor matching method is the most commonly used among the matching methods and the matching effect is the best and closest to the facts, this article uses the nearest neighbor matching method to illustrate the matching effect of this article. By using the nearest neighbor matching method and Logit regression processing, we get **Table 4**. According to the results shown in **Table 4**, it can be seen that the standard deviation after matching has been greatly reduced, and the standard deviation after matching has been reduced to less than 10%. From the t-test results of the mean, even at the 10% confidence level, the null hypothesis that the two samples are equal in terms of personal, family, and school background cannot be rejected. In short, the balance test results show that the selection of the matching variables and the matching method in this paper are appropriate. The two groups of children samples after pairing have maintained a high degree of internal consistency in the dimensions of individual, family, and school.

As the results in **Table 4** are not intuitive enough, the kernel density function graphs before and after matching are given below. From **Figure 1**, we can clearly see the same analysis results as above: before matching, there is a significant deviation in the index kernel density distribution of each dimension feature. In contrast, after matching, there is no significant deviation in the distribution of the index kernel density of each dimension feature, indicating that the matching effect is better.

After passing the matching balance test, in order to ensure the robustness and rationality of the research results, we comprehensively used the nearest neighbor matching method, radius matching method and kernel matching method to estimate the effect of co-residence of grandparents and children (ATT). **Table 5** reports the matching results. The results show: 1) The results of the treated group are smaller than those of the control group, before or after matching; 2) As can be seen from the “ATT” column, the absolute value of ATT before matching is significantly greater than the absolute value of ATT after matching, which is also an indirect explanation of the elimination of some endogenous factors after matching by PSM method, that is, the matching effect; 3) From the matching results, it can be seen that the ATT in the treated group is smaller than that in the control group, and it is significant at the 5% confidence level. The

Table 4. Results of logit regression model test.

Variable	Unmatched/Matched	Mean		% bias	% reduct bias	t-test	
		Treated	Control			t	p > t
<i>Nation</i>	U	0.81073	0.82202	-2.9		-0.69	0.492
	M	0.81055	0.81157	-0.3	90.9	-0.06	0.953
<i>Area</i>	U	0.37463	0.45033	-15.4		-3.63	0.000
	M	0.375	0.382	-1.4	90.8	-0.33	0.744
<i>Age</i>	U	12.271	12.575	-17.6		-4.14	0.000
	M	12.273	12.324	-3.0	83.2	-0.67	0.503
<i>Grade</i>	U	5.9649	6.3328	-18.6		-4.37	0.000
	M	5.9678	6.0159	-2.4	86.9	-0.55	0.581
<i>Gender</i>	U	0.54146	0.51904	4.5		1.06	0.290
	M	0.54102	0.53001	2.2	50.9	0.50	0.618
<i>Learning_eva</i>	U	2.7488	2.7666	-2.1		-0.49	0.628
	M	2.7485	2.7546	-0.7	65.7	-0.16	0.873
<i>Key_school</i>	U	0.2439	0.23344	2.5		0.58	0.563
	M	0.24414	0.24553	-0.3	86.7	-0.07	0.942
<i>Education_exp</i>	U	0.81073	0.78808	5.7		1.33	0.184
	M	0.81055	0.80718	0.8	85.1	0.19	0.846
<i>Education_m</i>	U	6.2634	6.6283	-8.1		-1.91	0.057
	M	6.2637	6.2232	0.9	88.9	0.20	0.838
<i>Education_f</i>	U	7.8302	7.7831	1.2		0.27	0.784
	M	7.8262	7.7376	2.2	-87.9	0.51	0.613
<i>Child_num</i>	U	1.9776	1.8949	9.5		2.24	0.025
	M	1.9775	1.9649	1.5	84.7	0.32	0.748
<i>Ln_income</i>	U	8.7311	8.9191	-15.9		-3.72	0.000
	M	8.7316	8.7012	2.6	83.8	0.55	0.580

Table 5. Processing effect of propensity score matching.

Method	Treated	Controls	ATT	S.E.	T-stat
Un-matched	0.6247	0.6569	-0.0321	0.0081	-3.95***
the nearest neighbor matching	0.6256	0.6465	-0.0209	0.0102	-2.05**
radius matching	0.6256	0.6432	-0.0176	0.0087	-2.02**
kernel matching	0.6256	0.6431	-0.0175	0.0087	-2.01**

Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

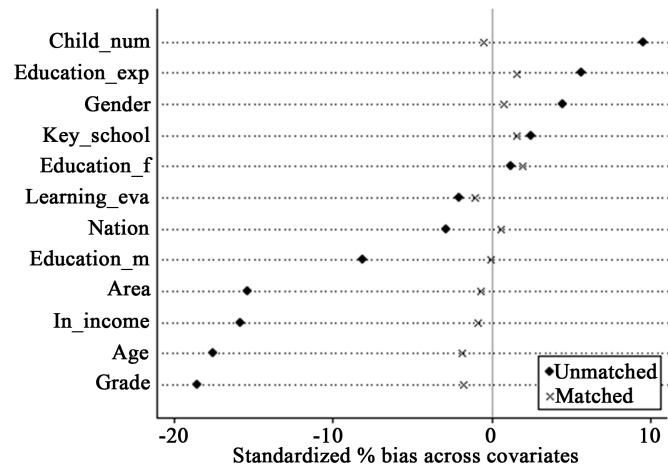


Figure 1. Kernel density function before and after matching.

above empirical analysis shows that, at the 5% confidence level, the co-residence of grandparents and children significantly reduces the performance of children's educational results, which is consistent with the results of previous OLS regression.

4.3. Mechanism Analysis

In this section, the paper discusses the reasons for the negative impact of co-residence of grandparents and children on children's test performance from both time and money. [Mu and Zhang \(2011\)](#) pointed out that the aging of China's population has the characteristics of "being old without getting ready" and "being old before getting rich". As China's population is ageing, family and social resources for elderly care have become relatively scarce ([Peng & Hu, 2011](#)). Therefore, we speculate that there are two possible reasons for the negative impact of co-residence of grandparents and children on children's test results:

1) Due to the lack of a sound social security system, many elderly parents need to rely on living with their adult children to meeting the need for retirement ([Zhang, 2010](#)). Compared with families where grandparents do not live with children, grandparents' co-residence makes it necessary for children's parents to cope with work and take care of their parents within a limited time, thereby reducing the investment of children's education time;

2) From the descriptive statistics, compared with the family in which the grandparents do not live with the children, the average value of the net income of all households in the family where the grandparents live together is not significantly different, but the net income per capita is significantly different. [Luo et al. \(2012\)](#) found that grandparents with relatively poor economic conditions are more likely to live with their grandchildren and provide care. Therefore, we can speculate that with the increase of age, the decline in grandparents' income will lead to an increase in the family's financial burden, and the family will reduce the economic expenditure on children's education.

In order to verify the inference (1), we examined the frequency of parents and children discussing school situations and the frequency of parents checking their children's work in the children questionnaire survey. **Table 6** reports the corresponding regression results. The results show that the co-residence of grandparents and children has significantly reduced the frequency of caring for children's schools, and has a negative impact on the frequency of parents checking their children's homework, but not significant. Therefore, we can assume that parents do reduce their concern about the situation about children's situation in school because of the co-residence of grandparents.

Table 6. Impact of grandparents' co-residence on family investment in children's education.

	(1)	(2)	(1)	(3)	(4)
	<i>Wf1</i>	<i>Wf2</i>	<i>tutor</i>	<i>Tutor Grade < 6</i>	<i>Tutor Grade ≥ 6</i>
<i>Co-residence</i>	-0.095** (0.047)	-0.056 (0.053)	-0.024 (0.065)	-0.211* (0.111)	0.066 (0.082)
<i>Nation</i>	-0.045 (0.067)	-0.062 (0.074)	-0.207** (0.093)	-0.352** (0.165)	-0.149 (0.113)
<i>Area</i>	0.037 (0.054)	0.039 (0.061)	0.480*** (0.071)	0.667*** (0.118)	0.411*** (0.091)
<i>Age</i>	0.001 (0.025)	-0.060** (0.027)	0.031 (0.034)	0.088 (0.068)	0.017 (0.044)
<i>Grade</i>	-0.003 (0.022)	-0.114*** (0.024)	-0.023 (0.030)	0.002 (0.070)	-0.036 (0.042)
<i>Gender</i>	0.040 (0.047)	0.149*** (0.053)	-0.026 (0.065)	-0.167 (0.110)	0.045 (0.084)
<i>Learning_eva</i>	0.201*** (0.029)	0.104*** (0.032)	0.044 (0.039)	-0.036 (0.064)	0.082 (0.050)
<i>Key_school</i>	0.090* (0.054)	0.209*** (0.061)	0.220*** (0.076)	0.478*** (0.130)	0.100 (0.096)
<i>Education_exp</i>	0.112* (0.064)	0.148** (0.069)	0.195** (0.089)	0.206 (0.147)	0.250** (0.114)
<i>Education_m</i>	0.041*** (0.007)	0.035*** (0.008)	0.046*** (0.009)	0.050*** (0.017)	0.047*** (0.012)
<i>Education_f</i>	-0.002 (0.007)	0.024*** (0.008)	0.020* (0.010)	0.020 (0.018)	0.024* (0.014)
<i>Child_num</i>	0.007 (0.033)	0.007 (0.036)	-0.210*** (0.048)	-0.305*** (0.073)	-0.147** (0.066)
<i>Ln_income</i>	-0.023 (0.023)	-0.004 (0.024)	0.135*** (0.037)	0.068 (0.057)	0.173*** (0.047)
<i>cons</i>	3.101*** (0.384)	3.081*** (0.512)	-2.452*** (0.640)	-2.737*** (0.871)	-2.370*** (0.853)
<i>Province fixed effect</i>	controlled	controlled	controlled	controlled	controlled
<i>N</i>	2233.000	2233.000	2232.000	890.000	1335.000
<i>R²</i>	0.082	0.141	0.2291	0.2885	0.2227

Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

In order to verify the inference (2), we used household survey data on children's extra-curricular tutoring costs. Because the standards of tutoring fees vary greatly from place to place, this article uses the Probit model to estimate whether children have participated in tutoring in the past year as explained variables based on the family's investment in tutoring costs. When the cost of extra-curricular tutoring is greater than 0, it means that the child has participated in extra-curricular tutoring and recorded as 1, otherwise it is recorded as 0. According to the regression results in **Table 6**, it can be seen that the full sample regression results show that the co-residence of grandparents and children negatively affects the possibility of children participating in extracurricular tutoring, but the results are not significant. Next, we grouped the samples according to the grade in which the children were surveyed. Taking the sixth grade of the primary school as the boundary, the sample was divided into children groups below the sixth grade and above. Columns (4) and (5) respectively report the impact of the co-residence of grandparents and children on children's participation in extra-curricular tutoring in the two subsamples. The results show that for children who are younger than sixth grade, living together with grandparents will significantly reduce the probability of children participating in extracurricular tutoring, while for children who are in sixth grade and above, living with grandparents will have a positive probability for children participating in extracurricular tutoring, but not significant, and the value is small. In summary, we can conclude that living together with grandparents and children will significantly reduce the family's financial investment in education for children in the lower grades, which affects children's educational performance.

5. Conclusion and Suggestion

This paper explores the impact of grandparents' and children's co-residence on children's educational performance by using data from the 2014 Chinese Family Tracking Survey. Taking 10 - 15 years old children as the research object, this paper conducts an empirical study through an educational output value-added model, and uses Propensity Score Matching methods to make results more credible. From the analysis of the results of empirical tests, we can draw the following conclusions. First, the co-residence of grandparents and children has a significant negative impact on children's test performance, and it is still significant after controlling students' personal characteristics and family and school backgrounds. Second, since living with older parents, adult children not only need to take care of their young children, but also spend more time caring for their parents who are gradually increasing in age. Because of the relatively heavier burden of family care, adult children have to reduce the time invested in education for children. Finally, as grandparents increase in age and work capacity declines, in households where grandparents and children live together, the financial burden falls more on adult children, and the per capita income of the family is significantly lower. As a result, families with grandparents and children

living together are significantly less likely to spend extracurricular education in the lower grades than children with grandparents who are not living together with children.

Therefore, in order to alleviate the negative impact of the co-residence of grandparents and children on the educational performance of children in mainland China, on the one hand, the government can vigorously proceed to build a more comprehensive social elderly care system to reduce the family burden of adult children; on the other hand, the government can increase public spending on basic education, reduce the educational costs borne by families, and improve the quality of teaching in schools in backward areas. In addition, the government can increase the awareness of parenting and increase the efficiency of adult children's education on their children.

Due to data constraints, the robustness test and endogenous issues of this article are still lacking. In future research, with the enrichment of China's micro-panel data, we can use more methods to solve endogenous problems, making the empirical results more credible. Based on the research in the current article, we can know that the co-residence of grandparents and children does affect children's educational performance, so will it affect children's non-cognitive ability at the same time? This issue still deserves our continued study.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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