Study on the Relationship Between Kindergarten Book Holdings and China's Economic Development

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Abstract: At present, empirical studies on the relationship between preschool education resources and economic development remain insufficient in existing literature. This paper uses provincial panel data of China from 2013 to 2023 and adopts a two-way fixed effects model to conduct an empirical analysis of this issue. The results show that early childhood education resources have a significant positive impact on economic growth. Meanwhile, this paper analyzes the influence of early childhood education resources on local economic growth in three regions. It is found that early childhood education resources in the Western region have the strongest promoting effect on local economic growth, whereas the corresponding impacts in the Eastern and Central regions lack statistical significance. After excluding the data from 2020 to 2022, the conclusion still holds. It suggests that corresponding economic development policies ought to be formulated in light of the resource allocation characteristics of different regions.

Keywords: Educational Resources; Number of Kindergarten Books; Economic Growth; Panel Data; Two-way Fixed Effects Model

1. Introduction

According to the human capital theory, the level of education can improve the quality of workers, thereby promoting macroeconomic growth[1]. As a carrier of early knowledge for young children, kindergarten books lay the foundation for individual education by enhancing children's cognitive ability, expressive ability, and other competencies. Domestic studies on preschool education resources mainly focus on the current status and challenges of kindergartens. Existing research shows that the resources and quality of early childhood education are affected by regional economic levels, government education investment, and the nature of kindergartens, presenting regional differences in aspects such as teaching staff, kindergarten income, and teaching equipment. At present, empirical studies on education and economic growth are relatively abundant, covering secondary education, higher education, vocational education, and other fields. However, there is no domestic literature that takes "kindergarten book holdings", a micro-level resource, as the research object.

Lai Shuangmei, based on the perspective of performance incentives, employed empirical analysis methods and identified a significant negative correlation between the intensity of local government competition and preschool education expenditure[2]. Song Naiqing constructed an education production function and found that preschool education investment in various regions of China promotes economic growth, with obvious regional differences in contribution rates[3]. Jin Chenlei, in his postgraduate dissertation, clarified the two-way promoting relationship between preschool education and economic development, showing a regional pattern of "higher in the East and lower in the West"[4]. Fang Chao and others used the stochastic frontier production function and spatial econometric methods and found that both the government and the market can improve the allocation efficiency of preschool education funds, though spatial autocorrelation exists[5]. Gu Zhenglin discussed the spatial coordination of preschool education resources in Yunnan Province and expounded on the significance of regional coordinated development[6].

Education facilitates the economic growth of a country or region through diverse avenues[7]. Existing studies have confirmed the importance of preschool education resources to economic development and emphasized regional differences in the allocation of preschool education resources. However, there is no research exploring the relationship between the number of kindergarten books and regional GDP growth. Books are important material resources

for preschool education, and the quantity and quality of such resources are closely related to the quality of preschool education and children's development. Therefore, this study comprehensively analyzes the role of early childhood education resources in promoting economic growth across 31 provinces and municipalities in China and explores regional differences in these resources. Through heterogeneity analysis, it explains the distinct characteristics of the Eastern, Central, and Western regions and their underlying causes, providing regional development suggestions for local governments, enterprises, and schools.

2. Research Methods and Hypotheses

In the process of human capital formation and accumulation, education influences knowledge, professional skills, cognitive skills, and non-cognitive skills[8]. The gradual accumulation of workers' knowledge and skills improves their labor quality, which in turn promotes economic growth. Since the number of kindergarten books is an important indicator of the abundance of preschool education resources, this study proposes the following hypotheses:

1. The number of kindergarten books is significantly positively correlated with real GDP growth.

2. The positive effect of the number of kindergarten books on economic growth is strongest in the Western region, while the effects in the Eastern and Central regions are not statistically significant.

To verify the relationship between the number of kindergarten books and regional economic growth, this study adopts a two-way fixed effects model.

$$\ln GDP_{it} = \beta_0 + \beta_1 \ln BOOK_{it} + \beta_2 X_{1,it} + \beta_3 X_{2,it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

Where:

$\ln GDP_{it}$ = explained variable (logarithm of real GDP);

$\ln BOOK_{it}$ = core explanatory variable (logarithm of the number of kindergarten books);

X_1, X_2 = control variables (e.g., X_1: local fiscal expenditure on education; X_2: year - end permanent population)

i denotes the province (representing cross - provincial heterogeneity);

t denotes the year (representing time - series variation);

μ_i = provincial fixed effect;

λ_t = time fixed effect;

ε_{it} = random error term

The Hausman test is used to select between the fixed effects model and the random effects model. The null hypothesis is "the random effects model is more appropriate" , i.e., provincial characteristics are independent of explanatory variables, and the alternative hypothesis is "the fixed effects model is more appropriate". The test results show a chi-square value of 33.38 and a p-value of 0.000 (p<0.01), strongly rejecting the null hypothesis. This indicates that inherent provincial characteristics are significantly correlated with the number of kindergarten books, so the two-way fixed effects model should be adopted.

3. Data

The statistical data used in this study are from the Bureau of Statistics of China and the Ministry of Education of China. The author constructs a balanced panel dataset covering 31 provincial administrative regions from 2013 to 2023, with a total of 341 observations. The year 2013 is the earliest year for which data on the number of kindergarten books are available on the Ministry of Education's official website, and 2023 is the most recent year with accessible data-thus, the study limits the data to the 2013–2023 period.

Explained variable: Real GDP. To eliminate the impact of price factors, the author adjusts the GDP using the GDP deflator with 2013 as the base year and takes the logarithm. This not only reduces heteroscedasticity but also helps identify the marginal effect of variable impacts. The original data are from the Bureau of Statistics.

Core explanatory variable: Number of kindergarten books. Data are from the education statistics released by the Ministry of Education, and the logarithm is taken to reflect the proportional relationship between the number of books and economic growth.

The provincial fixed effects and year fixed effects, treated as dummy variables, are incorporated into the model to effectively strip away time-invariant inherent characteristics at the provincial level, such as geographical location and industrial foundation. Local fiscal expenditure on education and year-end permanent population are selected as control variables, both of which are time-varying variables that change across provinces and over time, thus complementing the provincial and year fixed effects. We make this selection to control for the fundamental impact of population

size on GDP via channels like labor supply and market demand, ensuring that the coefficient of the core explanatory variable captures the "effect of book resources on human capital quality" rather than the "effect of population quantity", and thereby alleviating estimation bias arising from omitted variables.

4. Empirical Results and Discussion

As shown in Table 1, the mean value of *lnGDP* is 9.85 with a standard deviation of 0.99,

indicating that the logarithm of the economic scale of each province is relatively concentrated without extreme deviations. The mean value of *lnBOOK* is 15.91 with a standard deviation of 1.07, suggesting moderate regional differences in the number of kindergarten books. Both variables show a slight left-skewed distribution (negative skewness and kurtosis > 3), which is consistent with the common characteristics of panel data and lays a solid foundation for subsequent regression analysis.

Table 1. Descriptive Statistics of Core Variables

Variable	Observations	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
lnGDP	341	9.85	0.99	7.23	12.15	-0.21	3.28
lnBOOK	341	15.91	1.07	13.56	18.32	-0.18	3.35

Table 2. Benchmark Regression Results

Variable	(1) lnGDP	(2) lnGDP	(3) lnGDP
lnBOOK	0.112**	0.101**	0.104**
	(0.045)	(0.042)	(0.039)
Provincial Fixed Effects	No	Yes	Yes
Year Fixed Effects	No	Yes	Yes
Control Variables	None	None	Yes
R²	0.183	0.657	0.723
Observations	341	341	341

*Note: **p<0.05; standard errors are in parentheses.

As shown in Table 2, Column (1) only includes the core explanatory variable *lnBOOK*, with a coefficient of 0.112 (statistically significant at the 5% level); Column (2) adds provincial and year fixed effects, and the coefficient of *lnBOOK* is 0.101-slightly lower than that in Column (1) but still statistically significant. Column (3) further incorporates control variables (including local fiscal expenditure on education and year-end permanent population). After controlling for "local educational expenditure, population, provincial heterogeneity, and year trends", the coefficient of *lnBOOK* is 0.104. This indicates that for every 1% increase in the number of kindergarten books, the real GDP increases significantly by 0.104%, confirming a positive correlation between the number of kindergarten books and real GDP growth.

To exclude the interference of short-term shocks (e.g., the epidemic) on the results, the study re-conducts the regression after excluding data from 2020 to 2022. The results are shown in Table 3.

As shown in Table 3, the coefficient of *lnBOOK* is 0.099 (statistically significant at the 1% level). To be specific, the positive impact of the number of kindergarten books on GDP, after excluding the short-term shocks of the epidemic,

strengthens from being "statistically significant at the 5% level" to "statistically significant at the 1% level". This suggests that the core relationship is not disrupted by short-term disturbances, and the role of kindergarten books in boosting GDP growth is a long-term and stable pattern, thereby confirming the robustness of the research results.

Table 3. Robustness Test Results (Excluding 2020–2022 Data)

Variable	*lnGDP*
lnBOOK	0.099***
	(0.034)
Fixed Effects	Yes
R²	0.720
Observations	248

*Note: ***p<0.01; standard errors are in parentheses.

According to national regional division standards, the 31 provinces are divided into three groups (Eastern, Central, Western) for sub-sample regression to explore regional differences in the economic effect of the number of kindergarten books. The results are shown in Table 4.

Table 4. Regional Heterogeneity Regression Results

Variable	Eastern *lnGDP*	Central *lnGDP*	Western *lnGDP*
lnBOOK	0.027	0.147	0.115**

	(0.111)	(0.115)	(0.039)
Fixed Effects	Yes	Yes	Yes
R²	0.662	0.905	0.808
Observations	121	88	132

*Note: **$p<0.05$; standard errors are in parentheses.

As shown in Table 4, the empirical results support Hypothesis 2, the effect is most significant in the Western region, while the effect in the Eastern and Central region is insignificant. The author explains this from the following perspectives.

The impacts of the number of kindergarten books and local educational expenditure on GDP are only significant in the Western region, while insignificant in the Eastern and Central regions. This reflects the "scarcity differences" of educational resources across regions: educational resources in the Western region are relatively insufficient, such that increasing book supplies and educational expenditure can more effectively drive local economic growth. Whereas in the Eastern and Central regions, due to resource saturation or other factors (e.g., industrial structure characteristics), the economic effects of such educational inputs are diluted.

5. Conclusion

Drawing on national-level panel data spanning the period 2013–2023, the present study employs a two-way fixed effects model to examine the association between the quantity of books available in kindergartens and gross domestic product (GDP) growth.

At the national level, China's early childhood education resources promote economic growth-i.e., a larger number of kindergarten books leads to more individual human capital accumulation, thereby driving economic growth. From a regional perspective, the economic effect is strongest in the Western region, while the effects in the Eastern and Central regions are not statistically significant.

After excluding data affected by the 2020–2022 epidemic, the positive correlation between the number of kindergarten books and economic growth remains, confirming the reliability of the results.

Future research should collect data on early childhood education resources for more years to enhance the persuasiveness of the results. The author will further analyze different indicators of early childhood education resources, e.g., teaching aids, classrooms, activity spaces, and other micro-resources, verify the transmission mechanism of early cognitive abilities, and explore the relationship between early childhood education resources and economic growth in greater detail.

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