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The Study on the Income Distribution Effect of Public Education Expenditure

Wang Rui[1,a,*]

[1]*School of Economics, Yunnan University of Finance and Economics, Kunming, China*
[a]*wangrui2024@stu.ynufe.edu.cn*
[*]*Corresponding author*

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Abstract: Based on existing research on public education expenditure and income disparities, the paper investigates the relationship between the proportion of public education spending in local fiscal budgets and the urban-rural income ratio in China. Utilizing data from 26 provinces and autonomous regions from 2004 to 2020, a Systematic Generalized Method of Moments (GMM) model was developed to analyze the effects of public education expenditure on income distribution. The results reveal that public education spending, irrespective of time frame, widens the income gap, suggesting a need for more equitable distribution strategies in education funding.

1. Introduction

Since the reform and opening-up, China has experienced over 40 years of sustained economic growth, yet income inequality among residents remains significant. The government has employed various policy tools to intervene in residential income distribution, with public education expenditure widely regarded as playing a key role in promoting income distribution equity. On one hand, increasing investment in public education is a crucial way to enhance human capital; on the other hand, as a component of government fiscal spending, public education expenditure can have a direct redistributive effect on residents' income.

Theoretical research has revealed a close relationship between education and income distribution, with uneven distribution of human capital potentially leading to differences in income distribution. Early scholars such as Schultz (1960)[1], Becker and Chiswick (1966)[2], and Mincer(1974)[3], through the construction of human capital models for studying income distribution, all pointed out that the distribution of education and educational expansion are major factors affecting income inequality. Knight and Sabot (1983) [4], and Karim and Rezaul (2021)[5] believed that public education can enhance income distribution more effectively than private education by promoting economic growth, thus reducing income inequality. Indongo and Robinson (2021)[6]also proved that in the short-run, government expenditure on education has a balancing or reducing effect on income distribution However, Sylwester (2002)[7] noted that public education does not always narrow the income distribution inequality among residents, particularly in developing countries, where it might even exacerbate inequality. Jimenez (1986)[8]and Chen L(2022)[9]also suggested that the public

education system could potentially intensify income inequality. Studies by Gruber and Kosack (2015)[10] and Kudasheva (2014)[11] similarly confirmed that under the public education system, income does not necessarily converge.

2. Research Design

2.1. Theoretical Analysis and Hypothesis

There is a pronounced imbalance in the distribution of educational resources across regions in China. Some local governments place greater emphasis on educational investment, providing superior educational resources, while other areas face shortages and low-quality educational resources. This discrepancy leads to unequal educational opportunities, with affluent families being able to afford better educational resources for their children, whereas children from impoverished families encounter greater educational challenges, further exacerbating the Matthew Effect. The uneven distribution of educational resources among certain regions or groups, coupled with urban-biased policies that lead local governments to invest more in towns with higher income elasticity, results in a concentration of talent in urban and developed areas, widening the income gap among residents.

Based on the above analysis, this paper proposes the following research hypothesis:

H1: The expansion of public educational investment intensifies the income distribution gap among residents across regions.

2.2. The Basic Modle

To examine the relationship between income inequality and fiscal educational expenditure at the macro level, this section constructs the following econometric model:

$$Gini_{it} = \alpha_0 + \alpha_1 Edu_{it} + \sum_{k=2}^{M} \alpha_k Control_{it} + \mu_i + +\gamma_t + \varepsilon_{it} \quad (1)$$

$$Control_{it} = \alpha_2 Third_{it} + \alpha_3 Urban_{it} + \alpha_4 Open_{it} \quad (2)$$

Where i represents the cross-sectional variable for provinces, and t represents the time variable for years. Referencing previous studies, using the inter-provincial income Gini coefficient to measure the degree of income inequality (Jamalshargh S and Khosravinejad.A,2021[12]; He L and Zhang X, 2022[13]; Selem-Amachree and Ezekwe, 2021[14]).the dependent variable $Gini$ is the inter-provincial Gini coefficient of household income, which is calculated using income data from 289 prefecture-level cities and reflects the level of income inequality among residents. The explanatory variable Edurepresents the scale of public education investment, measured by the proportion of provincial fiscal educational expenditure in the total fiscal expenditure of the current period. The control variables $Control$ include exogenous variables that affect the income gap among residents, excluding public education investment.$Third$ represents the proportion of the output value of the tertiary industry in the total output value of the region, indicating the regional industrial structure; $Urban$ is the proportion of urban population in the total resident population at the end of the year in each province, indicating the level of urbanization in each province; $Open$ is the proportion of the total import and export value of goods in the gross regional product of each province, indicating the degree of openness of each province. γ_t represents the time trend, ε_{it} represents random error term.

Additionally, the degree of income inequality among residents exhibits a strong autocorrelation, the current level of income inequality is significantly influenced by the previous period. Therefore, a dynamic panel model is employed to analyze the impact of public educational expenditure on income inequality. This involves including a one-period lagged variable of the dependent variable.

The dynamic panel model is set up as follows:

$$Gini_{it} = \alpha_0 + \alpha_1 Gini_{i(t-1)} + \alpha_1 Edu_{it} + \sum_{k=2}^{M} \alpha_k Control_{it} + \mu_i + +\gamma_t + \varepsilon_{it} \quad (3)$$

In line with the approach used in most studies, the paper employs the Generalized Method of Moments (GMM) estimation technique to conduct a regression analysis on Model (3).

2.2.1. Data Sources

The data used in the study spans from 2004 to 2020 and consists of provincial panel data. The income grouping data for calculating the Gini coefficient is sourced from the "China City Statistical Yearbook" and the "China Regional Economic Statistical Yearbook." Due to the fact that the data for municipalities in the "China Regional Economic Statistical Yearbook" is based on urban area data and is significantly incomplete, the data for the four direct-controlled municipalities—Beijing, Tianjin, Shanghai, and Chongqing—is excluded at the provincial level. Data on per capita income and population comes from the "China Statistical Yearbook." Public education expenditure data is obtained from the "China Education Finance Statistical Yearbook." Calculations for regional per capita GDP, the level of opening up to the outside world, the output value of the tertiary industry, and the urbanization rate are all sourced from the "China Statistical Yearbook" and the provincial statistical yearbooks.

The paper has collected and organized data from 2004 to 2020, encompassing 26 provinces and autonomous regions with a total of 442 samples. To overcome the issue of individual heterogeneity in simple cross-sectional data, a panel data model is employed. Descriptive statistics for the main variable indicators are presented in Table 1.

Table 1: Explanation of Model Variables

Variable Name	Number of Samples	Mean	Standard Deviation	Minimum Value	Maximum Value
Gini	442	0.2440	0.074	0.03	0.56
Edu	442	0.1646	0.025	0.10	0.22
Thrid	442	0.4180	0.067	0.29	0.60
Urban	442	0.5092	0.105	0.26	0.74
Open	442	0.2281	0.252	0.01	1.62

3. Empirical Results and Analysis

To address the endogeneity issues of the model, this paper employs the Systematic Generalized Method of Moments (GMM) estimation method to empirically test the impact of current public education expenditure on the income gap among residents. To avoid the potential impact of heteroscedasticity on the estimation results, the System GMM estimation results are compared with the Ordinary Least Squares (OLS) regression results and the fixed effects regression results. The benchmark regression results are shown in Table 2. Columns (1) and (2) use the System GMM method, while columns (3) and (4) report the results using OLS and fixed effects regression models, respectively. Model (1) includes only the first-order lag of the Gini coefficient and the current public education expenditure, while model (2) adds control variables such as industrial structure, urbanization rate, and the level of openness to the outside world.

The results indicate that, in the inter-provincial sample data over 17 years, the core explanatory variable of public education expenditure has passed the significance test at the 1% confidence level, with a positive estimated coefficient. This suggests that the scale of fiscal education expenditure

exacerbates the income inequality among residents, confirming Hypothesis H1. The other control variables have generally passed the significance test. As other control variables are added step by step, the impact of public education expenditure on income inequality increases. Nationally, the increase in public education investment has not improved the income distribution gap; instead, it has widened the income gap among Chinese residents.

It is worth mentioning that, among all the control variables, the urbanization rate is the only variable that shows a significantly negative relationship with the income gap. An increase in the level of urbanization in a region is usually accompanied by the development of industry and services, generating more employment opportunities. This provides rural residents with the opportunity to leave the agricultural sector and enter non-agricultural fields for higher income and social security. Cities also offer more educational and training resources, which help to improve the education level and skill set of residents.

Table 2: Regression Results of the Impact of Current Public Education Expenditure on the Income Gap of Residents

	GMM (1)	GMM (2)	OLS (3)	Fixed Effects (4)
L1.YGini	0.666***	0.500**	—	—
	(8.51)	(3.29)	—	—
Edu1	0.0480***	0.0609***	0.0481***	0.0684*
	(4.28)	(3.89)	(-3.42)	(0.25)
Thrid		0.289*	0.0618	-0.0341
		(2.48)	(0.93)	(-0.25)
Urban		-0.257*	-0.222***	-0.143
		(-2.41)	(-4.85)	(-0.67)
Open		0.127*	0.115***	0.0908
		(2.77)	(7.29)	(1.32)
AR(1)	0.015	0.022	—	—
AR(2)	0.142	0.251	—	—
Hansen Test	0.547	0.362	—	—
Number of Observations (N)	442	442	442	442

Note: *, **, *** indicate significance levels of 10%, 5%, and 1%, respectively. The values in parentheses are z (or t) statistics. The reported values for AR(1), AR(2), and Hansen test are all P-values.

4. Conclusions

Through theoretical analysis of China's public education expenditure and income inequality among residents, this paper argues that the expansion of public education expenditure has widened the income gap among Chinese residents. The larger the public education expenditure, the greater the income gap among Chinese residents. Simply increasing the proportion of public education expenditure in total fiscal expenditure cannot effectively solve the income differences between regions. China's public education expenditure structure faces an irrational situation, resulting in the "Matthew effect" of public education expenditure. Therefore, while pursuing an increase in the total amount of public education expenditure, it is also necessary to pay attention to the internal structure of public education expenditure, ensuring the fairness of public education expenditure.

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