Migration Letters

Volume: 21, No: S2 (2024), pp. 1064-1088

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)

www.migrationletters.com

Research on the Relationship between Educational Equity and Regional Economic Growth: A Case Study of Guizhou Province

Tianran Liu

Abstract

Based on statistical data from Guizhou Province from 2002 to 2020, this study uses the average years of education as an indicator to establish a provincial Gini coefficient as a measure of educational equity in Guizhou Province. Employing OLS regression model, LASSO regression model, and VAR model, the study explores the economic development status of Guizhou Province. The results show that the educational equity in Guizhou Province has an inverted U-shaped relationship with the overall economic development. Using LnGDP as the dependent variable for regression, it is found that an educational Gini coefficient of 0.232 is most beneficial for economic development. Additionally, the impact of the educational equity level in Guizhou Province on economic development also exhibits some lag. As such, Guizhou should distribute educational funds between regions reasonably. In the long term, educational equity significantly impacts economic growth, but there is no bidirectional causality between the two. This suggests that inherent institutional obstacles within the market economy system not only lead to an increasingly widening income gap, hindering social mobility but also impede economic development. To promote the continuous and steady development of China's socio-economy, it is necessary to persistently and comprehensively promote social and educational equity and overall development.

Keywords： *Education equity, Economic growth, Lasso regression, VAR*

1 Introduction

1.1 Research Background

Following the establishment of the People's Republic of China in 1949, to ensure widespread access to quality education, the country introduced the "national, scientific, and mass" cultural and educational policy guidelines, providing fundamental policy guarantees and conditions for achieving educational equity and universal access. Entering the new era of reform and opening-up, the Chinese government established the strategic priority of "education-first development," restoring the unified college entrance examination, improving educational conditions, and implementing a series of educational management reforms to promote fairness in education. On July 1, 1986, the "Compulsory Education Law" was officially ena[1]cted. The first National Education Work Conference, held from July 13 to 14, 2010, released the "National Medium and Long-term Educational Reform and Development Plan Outline (2010-2020)," emphasizing "promoting fairness as a

Warwick Business School， University of Warwick, CV4 7AL, Coventry, United Kingdom.

fundamental national education policy."

On the afternoon of March 11, during the fourth session of the 13th National People's Congress, Premier Li Keqiang of the State Council attended a press conference in the Golden Hall on the third floor of the Great Hall of the People, answering questions from domestic and foreign journalists from all walks of life. Speaking on the core issue of education, Premier Li Keqiang stated that individual education and health are closely related to the future of every family, nation, and the Chinese ethnicity. He also asserted that children of migrant workers residing in cities should have access to quality education upon successfully obtaining local residence permits, stressing the importance of not allowing children to fall behind due to differences in family background or region. In terms of opportunity equality, educational fairness is always the greatest fairness.

In societal fairness, educational equity is a critical foundation. The realization of educational equity is a cornerstone for maintaining social fairness and justice. Currently, as China is in a critical period of "achieving the great rejuvenation of the Chinese nation," promoting fair development in education and reducing educational discrimination are of significant and positive practical importance for enhancing social fairness, justice, and ensuring social safety and stability. On one hand, the government must persist in policy-focused efforts to promote fair development in education. To eliminate existing educational discrimination in society, it is necessary to continue upholding the principle of equal opportunity, ensure everyone's right to education, and build a multifaceted public education service system to promote balanced development in societal education and maintain educational fairness and justice. Furthermore, attention should be paid to reasonably and effectively allocating public educational resources at all levels as a fundamental measure, further standardizing the establishment and adjustment mechanisms for the distribution of societal educational resources, thereby eliminating the unfair distribution of educational resources. Ultimately, a favorable social atmosphere for promoting educational equity, led by the government and participated in by all sectors of society, should be formed to effectively realize the promotion of social fairness and justice.

1.2 Literature Review

1.2.1 International Research Status and Trends

Internationally, most scholars use the Gini coefficient based on the average years of education per capita as a fundamental indicator to measure the level of educational equity in a region. Lopez et al. (1998) used panel data from 12 Asian and Latin American countries from 1970 to 1994, finding a negative impact of educational inequity on economic growth in these countries. Sauer et al. (2014) conducted a study using data from 143 countries over more than 60 years, concluding different findings - for countries with lower average educational levels, the degree of educational inequity positively correlates with economic growth, while for countries with higher educational levels, there's a non-significant negative correlation between educational inequity and economic growth. Andres et al. (2010) utilized individual-level data in their research, discovering a positive relationship between the degree of educational inequity and the economic growth of the region two years later. Meanwhile, some scholars have used the gender gap in education as an indicator of educational inequity. Knowles et al. (2002) found that this gender gap negatively impacts the growth of the Gross Domestic Product. Klasen (2002) further pointed out that educational equity between men and women can promote national investment and population growth, thereby indirectly affecting the country's economic growth.

1.2.2 Domestic Research Status and Trends

(1) Research on Educational Equity and Economic Growth

Bi Bo (2018) explored the logic pathway from abstract principles to specific theoretical

practice in spatial planning of basic education, using Beijing as an example, under the context of unbalanced and insufficient development in China's current basic education structure. He proposed how to integrate methods of assessing educational spatial equity at the societal level into the existing urban planning and construction system, suggesting strategies for building data platforms and transforming planner roles. Jin Yuying and Ye Guangyu (2019) used the coupling coordination development model with provincial panel data from China between 2003 and 2016, conducting theoretical and model analyses of the relationship between educational equity and regional economic growth. Jin Lu (2019) analyzed the impact and role of urban-rural educational inequity on income disparities among urban and rural residents, seeking solutions and effective improvement methods. The study showed that the government could reduce income disparities between urban and rural areas by narrowing the educational gap. Zhang Ruijing (2019) examined the mechanism of resource input on investment efficiency, the impact of investment efficiency on economic growth, and its spillover effects, analyzing the current state of input and output in China's higher education and proposing scientific and practical policy recommendations to improve investment efficiency. Liu Lihua and Sun Zao (2020) analyzed the transmission mechanisms of income distribution inequity affecting regional economic growth and intergenerational income transmission, using CGSS statistical data and a counterfactual approach. They objectively analyzed income inequality, combining provincial macro survey data to examine the impact of income inequality from various sources on economic growth. Chu Hongqi (2020) proposed that to effectively and systematically advance national social education equity, the government should reconsider establishing a comprehensive policy toolbox. The need to shift from reliance on administrative tools to incorporating economic and social tools was emphasized, along with the introduction of appropriate policy tools or combinations, to precisely address the key and challenging issues of educational equity. Xu Changqing and Mei Guoshuai (2020) noted that while prior research on educational equity principles and social mobility issues was extensive and achieved significant results, there was still room for improvement. Wang Jiaqi and Min Weifang (2021) used per capita fiscal education expenditure data from prefecture-level cities to construct a provincial education Gini coefficient to measure horizontal educational equity across provinces. They explored the impact of provincial educational equity on regional economic growth using a two-way fixed effects model.

(2) Research on Educational Poverty Alleviation and Poverty Status

Yu Xuan (2019) conducted a comprehensive and in-depth analysis of educational development in central and western China, utilizing data from 30 high schools across 14 impoverished areas, including Hubei, Shaanxi, Guizhou, Henan, Gansu, Sichuan, Yunnan, and others. Wang Chengduan (2019) suggested further deepening research on higher education development in the western region, focusing on shared educational modules and "Belt and Road" higher education cooperation. Liao Yier (2019) established a structured indicator testing system based on the concept of financial performance evaluation, analyzing the 2016-2017 fiscal education precision poverty alleviation project in Guangdong Province, revealing the criticality of poverty alleviation but also the inadequacy of basic livelihood guarantees for impoverished targets. Wang Dongxue (2020) summarized the achievements of social organizations in organizing educational poverty alleviation, analyzing current challenges and future opportunities and challenges in solving rural poverty post-2020. Liu Dawei (2020) studied the pathways and effects of urban-rural educational poverty alleviation and its differences using data from 12 provinces from the China Health and Nutrition Survey (CHNS) from 1989 to 2015.

(3) Research on Educational Informatization and Economic Growth

Cui Youbo (2019) explored effective paths for building a learning society in the internet era, finding that the development of network information technology has increased people's

leisure time, broken the spatiotemporal limitations of teaching, and facilitated the realization of educational equity. Gu Xiaoqing, Li Shijin, and Li Rui (2021) conducted an in-depth systematic empirical analysis of 18 artificial intelligence research institutes funded by the National Science Foundation's special program in the United States. Using text analysis research methods, they detailed the global landscape of AI education and elaborated on issues such as large-scale and personalized learning aided by AI, multimodal enhanced learning capabilities, and the sustainability of educational equity. Han Shimei (2021) retrospectively examined the reform practices and effects of using educational informatization technologies to promote educational equity. She analyzed controversial issues, fully grasping the history and current situation, and proposed specific policy suggestions based on China's current and future expectations for high-quality development of educational informatization.

1.3 Research Purpose and Significance

1.3.1 Research Purpose

(1) Based on the rapid economic development of Guizhou Province in recent years, this study aims to explore the linear relationship between the degree of educational equity in Guizhou Province and economic growth. It seeks to determine whether the Guizhou provincial government needs to devote more effort and financial resources to vigorously promote educational equality and universalization.

(2) To investigate the Granger causality relationship between educational equity and regional economic growth in Guizhou Province, with the goal of formulating reasonable policy directions to simultaneously drive the province's economic development and the advancement of educational equity.

1.3.2 Research Significance

(1) As poverty alleviation efforts in Guizhou Province have been ongoing in recent years, this research can provide theoretical and data support for the study of educational poverty alleviation efforts in the province.

(2) Based on the results of model analysis, this research aims to identify the relationship between educational equity and economic development. This will help offer directional suggestions for educational poverty alleviation work and the allocation of educational resources in Guizhou Province.

1.4 Research Framework

The specific research framework of this paper is as follows:

- Part One: Introduction to the research background, purpose, significance, and methods.
- Part Two: Review of domestic and international scholars' research status and achievements in regional economic growth, the establishment of educational equity indicator systems, and their interrelationships.
- Part Three: Building a regression model of educational equity and economic growth based on existing research results, conducting robustness tests, and making adjustments for multicollinearity issues.
- Part Four: Using the R language for VAR modeling, first performing ADF tests to determine the stationarity of the series, then differencing to obtain stable series; based on cointegration tests, establishing a vector error correction model, and ultimately establishing a VAR model to derive the Granger causality relationship between economic growth and educational equity.
- Part Five: Summarization of the basic research and conclusions drawn in this paper, and potential application suggestions in other related fields.

1.5 Innovations

The innovations of this paper mainly include the following three aspects:

- First, unlike previous studies that focused on a national level, this paper specifically investigates the relationship between the degree of educational equity and economic growth in Guizhou Province.
- Second, this paper employs LASSO regression analysis to address the issue of multicollinearity in OLS regression to a certain extent.
- Third, it establishes a VAR model to analyze the Granger causality relationship between economic level and educational equity in Guizhou Province.

2 Relationship Between Educational Equity and Economic Growth in Guizhou Province

2.1 Model Construction

Based on the Solow economic growth model and incorporating human capital formed by education, a basic model is established as follows:

$$Y_t = AK_t^{\beta_1} L_t^{\beta_2} H_t^{\beta_3} \quad \text{(Equation 2-1)}$$

Where Yt represents the economic development level of Guizhou Province in year t, Kt represents the capital investment in Guizhou Province in year t, Lt represents the total labor capital input in Guizhou Province in year t, and Ht represents the social human capital level in Guizhou Province in year t. Taking logarithms on both sides of equation (2-1), we get:

$$lnY_t = \beta_0 + \beta_1 lnK_t + \beta_2 lnL_t + \beta_3 lnH_t \quad \text{(Equation 2-2)}$$

In equation (2-2), an indicator measuring the degree of educational equity in Guizhou Province, the education Gini coefficient, is added. Considering that there might be a significant inverted U-shaped relationship between the degree of educational inequity and economic growth within the province, the square term of Guizhou Province's education Gini coefficient is also added. The improved model is shown as equation (2-3):

$$lnY_t = \beta_0 + \beta_1 lnK_t + \beta_2 lnL_t + \beta_3 lnH_t + \beta_4 G_t + \beta_5 G_t^2 \quad \text{(Equation 2-3)}$$

Where Gt is the education Gini coefficient of Guizhou Province in year t, and Gt2 is the square of the education Gini coefficient for Guizhou Province in year t. As the investment in educational resources has a lag effect on local economic growth, the method of Rodriguez-Pose et al. (2010) can be referenced, using the education Gini coefficient of t-2 period as an indicator to measure the degree of regional educational equity. Furthermore, since the economic development level of a province might impact the educational development level across different areas within it, there might exist a reverse causal relationship between the degree of educational equity and regional economic development level. This study can address the endogeneity problem between educational inequity and economic growth, often caused by their reverse causality, as analyzed above, by transforming the model into equation (2-4):

$$lnY_t = \beta_0 + \beta_1 lnK_t + \beta_2 lnL_t + \beta_3 lnH_t + \beta_4 G_{t-2} + \beta_5 G_{t-2}^2 \quad \text{(Equation 2-4)}$$

2.2 Indicator Selection and Descriptive Statistics

This study employs provincial-level statistical methods to collect and analyze statistical data of Guizhou Province from 2002 to 2020. The main data sources include the "Guizhou Provincial Statistical Yearbook", "China Statistical Yearbook", "China City Statistical Yearbook", and "China Employment and Population Statistics Yearbook", among others.

2.2.1 Proxy Variable for Economic Development Level of Guizhou Province

This study uses the constant-price regional GDP of 1990 as the proxy variable for the economic development level of each province. Real GDP, measured at constant prices, assesses economic output changes between two periods using the same prices or fixed amount to calculate the total value of all commercial products produced in both time frames. GDP Deflator Index = Nominal GDP / Real GDP

(1) Regional GDP and Per Capita GDP

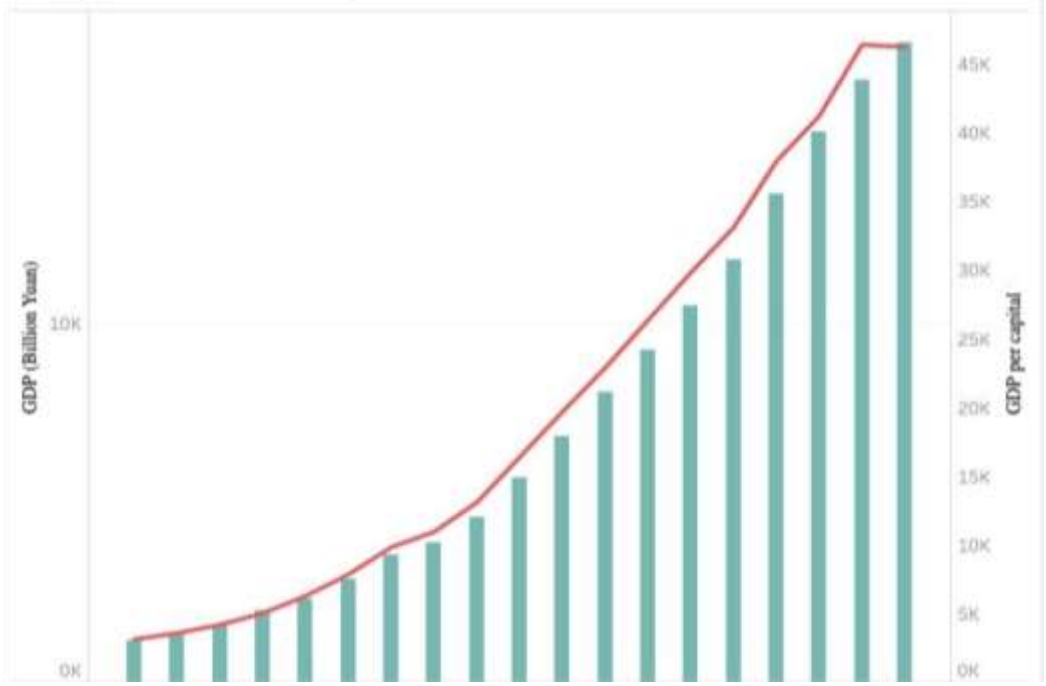

Figure 2-1 Trends in Regional GDP (Billion Yuan) and Per Capita GDP (Yuan)

First, the trend of regional GDP in Guizhou Province from 2002 to 2020 is analyzed. Figure 2-1 shows the changing trend of constant-price GDP and per capita GDP in Guizhou Province, indicating that both have been continuously rising from 2002 to 2020, showing increasing economic development.

(2) Proxy Variable for Capital Input — Capital Stock

This paper uses the capital stock of each province as the proxy variable for capital input, calculated using the perpetual inventory method. The formula is as follows:

$$K_t = K_{t-1}(1-\delta_t) + I_t \qquad \text{(Equation 2-5)}$$

Due to the influence of price factors, the investment value of current prices cannot be directly compared. Therefore, in the perpetual inventory method, capital stock should be converted to constant-price investment before being entered into the formula.

Based on this, the base-period capital stock K1 uses the capital stock of each province in China calculated by Zhang Jun et al. (2004); It is the total investment of Guizhou Province in year t, using the fixed capital formation total (1990) deflated by the fixed asset price index (1990); the economic depreciation rate of 9.6% estimated by Zhang Jun et al. (2004) is used.

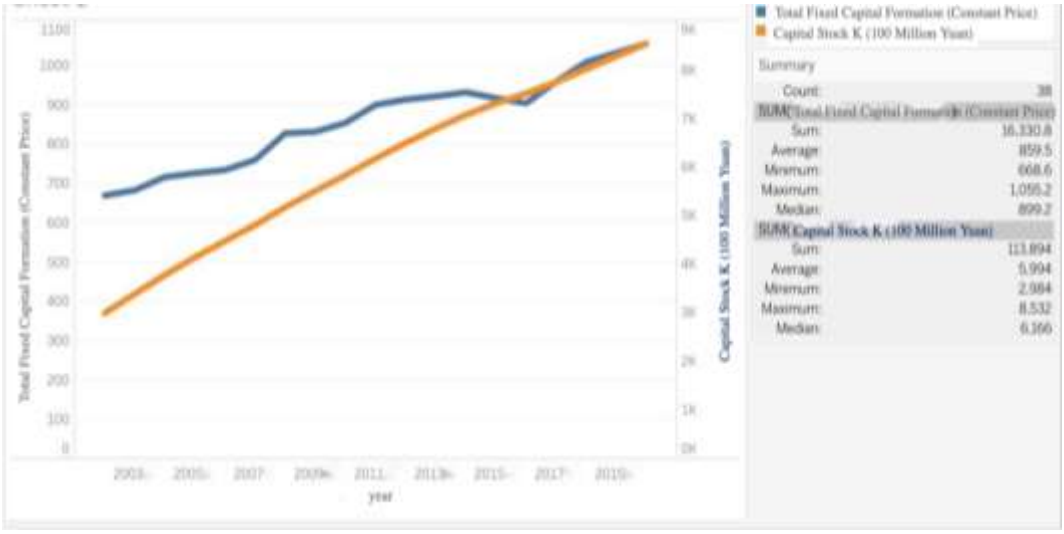

Figure 2-2 Trend of Fixed Capital Formation and Capital Stock

First, the changing trend of the capital input variable in Guizhou Province from 2002 to 2020 is analyzed. Figure 2-2 shows the trend of fixed capital formation in Guizhou Province, indicating a continuous increase from 2002 to 2014, followed by a brief decline, and then an upward trend from 2016. The calculated capital stock has been continuously growing, indicating an overall increase in capital investment in Guizhou Province.

2.2.2 Proxy Variable for Educational Equity in Guizhou Province

In terms of educational equity, equal distribution of educational resources is a necessary condition for achieving fairness. Past studies have suggested that average schooling years only reflect the level of education an individual receives, while the investment in educational resources an individual receives can indicate the quantity and quality of education. In this context, per capita fiscal expenditure on education in Guizhou Province was analyzed, and a provincial-level education Gini coefficient was established as a proxy variable to measure the average level of educational equity in Guizhou Province.

(1) Fiscal Expenditure on Education

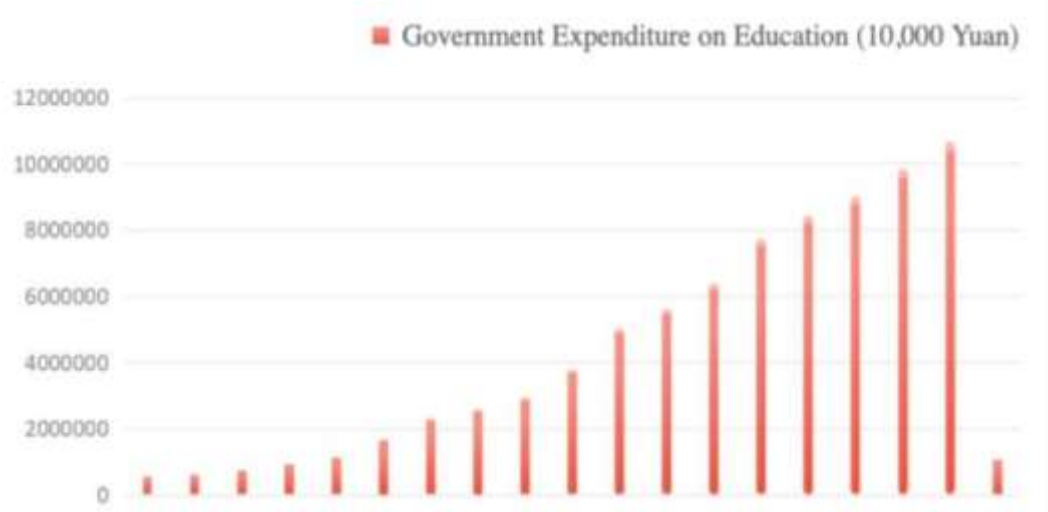

Figure 2-3 Fiscal Expenditure on Education in Guizhou Province

Figure 2-3 shows the trend of fiscal expenditure on education in Guizhou Province. The

value, calculated after deflation using the consumer price index, indicates a continuous rise in fiscal expenditure on education from 2002 to 2020, with a more moderate increase between 2006 and 2010.

(2) Average Years of Education

The average years of education per person in Guizhou Province from 2002 to 2020 can be obtained from the "China Statistical Yearbook." Based on the data, this study considers 0 years for those who have never attended school, 6 for primary school, 9 for junior high school, 12 for high school, and 16 for college and above, in "years." The average number of educational years, Edut, in Guizhou Province is calculated as follows:

$$\overline{Edu_t} = \frac{\sum_{j=1}^{5} Edu_j * p_{tj}}{\sum_{j=1}^{5} p_{tj}} \qquad \text{(Equation 2-6)}$$

Where represents the average number of years of education in Guizhou Province in year t; j represents different educational levels; represents the average number of years of education for the population in category j; Ptj represents the total number of people in category j in Guizhou Province in year t.

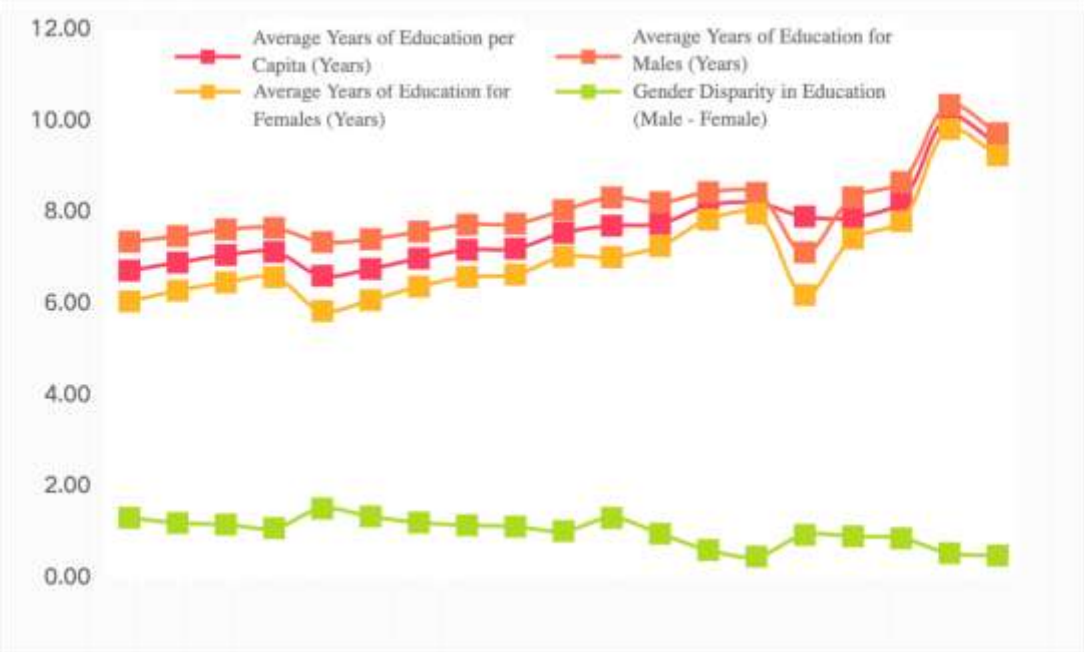

Figure 2-4 Average Years of Education in Guizhou Province

Initially, the trend of average years of education from 2002 to 2020 in Guizhou Province was analyzed. Figure 2-4 shows the gap between men and women in average years of education in Guizhou Province, indicating an overall increase from 2002 to 2020 in both average years of education and gender disparities in education. This suggests a continual improvement in educational universalization and equity in Guizhou Province. According to statistics, the data on gender disparities in education are calculated by subtracting the average years of education for women from that of men. The analysis results not only indicate Guizhou Province's increasing emphasis on women's education but also the rising status of women in society.

(3) Construction and Calculation of Education Gini Coefficient

The average years of education refer to the average of the total years of education for a certain age group, which is a weighted average of the proportion of various educated populations in the total population. The "Compulsory Education Law" stipulates 9 years of compulsory education, which this study uses as a reference. The calculation is performed using formula 2-7:

$$H = \sum_{i=1}^{5} h_i t_i \qquad \text{(Equation 2-7)}$$

In Equation (2-7), H represents the total human capital stock of 5 educational levels, i indicates educational level, hi represents the proportion of the educated population at each educational level to the total population; ti represents the years of education at each educational level. The educational levels here are the same as those used in calculating the average years of education, comprising 5 levels.

According to the data, the formula for calculating the education Gini coefficient is as shown in Equation 2-8:

$$G = 1 - \sum_{i=1}^{5} (x_i - x_{i-1})(y_i + y_{i-1}) \qquad \text{(Equation 2-8)}$$

$$(x_0 = 0, y_0 = 0, x_n = 1, y_n = 1)$$

In Equation (2-8), G represents the education Gini coefficient, i indicates the educational level, identical to the categories in the above educational level classification. xi represents the cumulative proportion of the educated population at each level to the total population, and yi represents the cumulative proportion of the total years of education of the population at each level to the total years of education.

The measurement of the education Gini coefficient is derived from the principle of calculating the Gini coefficient. According to international organizations, a Gini coefficient below 0.2 indicates absolute fairness; 0.2 to 0.3 indicates relative fairness; 0.3 to 0.4 indicates a reasonably fair distribution; 0.4 to 0.5 indicates a significant disparity; and above 0.5 indicates a substantial gap, with 0.4 often used as the "warning line" for the Gini coefficient. This standard also applies to the education Gini coefficient, where a higher coefficient indicates lower educational equity, and a lower coefficient indicates higher educational equity.

Table 2-1 Education Gini Coefficients in Guizhou Province from 2002 to 2020

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Gini Coefficients	0.2755	0.2663	0.2826	0.2605	0.2805	0.2586	0.2494	0.2403	0.2324	0.2379
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	

Gini Coefficients	0.2523	0.2477	0.2447	0.2538	0.2584	0.2479	0.2472	0.2224	0.2152

As seen from Table 2-1, the education Gini coefficient in Guizhou Province fluctuates between 0.21 and 0.28, showing a trend of decreasing, then increasing, and decreasing again. From 2002 to 2010, the education Gini coefficient decreased, signifying a gradual increase in educational equity in Guizhou, mainly due to the nationwide promotion of compulsory education from the mid-1990s. According to government reports, by the end of 2011, China had almost eradicated illiteracy among young and middle-aged adults, and the average years of education had increased. Studies have shown that countries with higher education levels tend to have higher levels of educational equity. Therefore, during this period, Guizhou's education Gini coefficient dropped from 0.2755 in 2002 to 0.2324 in 2010, a decrease of approximately 15.64%. In contrast, from 2010 to 2016, the education Gini coefficient in Guizhou Province showed a reverse trend, indicating a decline in educational equity and an increase in inequality. This is due to its inherent development pattern, and as education develops, the increase in the Gini coefficient will become smaller, and the difficulty of improvement will also increase. Another reason might be the shift in focus from basic and secondary education to higher education. Overall, the education Gini coefficient dropped from 0.2755 in 2002 to 0.2152 in 2020, a reduction of 21.89%.

2.2.3 Descriptive Statistics of Variables

Due to inter-provincial population mobility among provinces, changes in educational investment within a province do not fully and effectively promote economic development. Therefore, this study improves the model by adding a variable that measures the level of net population outflow between provinces, namely the net population outflow rate. Its data can be obtained by calculating the difference between the registered population and the resident population divided by the registered population. Descriptive statistics of each variable are shown in Table 2-2.

Table 2-2 Descriptive Statistics of Variables

	Unit	Min	Max	Average	Std. Deviation	Variance
GDP	Billion	1185.04	8302.67	4023.61	2380.99	5669149.63
GDP (per capita)	Billion	3153.00	46433.00	20234.85	15063.82	226918751.50
Education Gini Coefficient	—	0.22	0.28	0.25	0.017	0.00
Capital Stock	Billion	2984.20	8531.65	5994.42	1728.40	2987379.30
Resident Population	Ten Thousands	3479.00	3904.00	3710.42	129.46	16760.14

Average Years of Education	year	6.60	10.09	7.66	0.91	0.84
Net Population Outflow Rate	—	-0.02	0.17	0.11	0.06	0.00
Gender Education Gap Years	year	0.46	1.51	1.00	0.30	0.09

2.3 Analysis of Regression Model Results

2.3.1 Trends in Per Capita Fiscal Education Expenditure and Education Gini Coefficient

As previously analyzed, fiscal education funding in Guizhou Province has been increasing year by year from 2002 to 2020. The growth rate was relatively modest between 2006 and 2010. The education Gini coefficient in Guizhou Province fluctuated between 0.21 and 0.28, generally showing a trend of rising and then falling. Overall, the Gini index decreased from 0.2755 in 2002 to 0.2152 in 2020, a reduction of 21.89%, indicating some improvement in educational equity in Guizhou Province.

2.3.2 Analysis of OLS Regression Results for Educational Equity and Economic Growth

Based on the existing model, an OLS regression was conducted with LnGDP as the dependent variable, and Ln Resident Population, Ln Average Years of Education, Ln Capital Stock, lagged Education Gini Coefficient, and squared lagged Education Gini Coefficient as independent variables. Descriptive statistics for each variable are shown in Table 2-3:

Table 2-3 Descriptive Statistics of Variables

	Average	Std. Deviation
LnGDP	8.2309	0.5779
Ln Resident Population	8.2138	0.0342
Ln Average Years of Education	2.0421	0.1126
Ln Capital Stock	8.7235	0.2530
Lagged Education Gini Coefficient	0.2551	0.0144
Squared Lagged Education Gini Coefficient	0.0653	0.0074

Pearson correlation tests and multicollinearity tests were conducted for these five variables, with the results presented in Table 2-4:

Table 2-4. Correlation Test for Variables

	LnGDP	Ln Resident Population	Ln Average Years of Education	Ln Capital Stock	Lagged Education Gini Coefficient	Squared Lagged Education Gini Coefficient
LnGDP	1.000	0.323	0.865	0.992	-0.646	-0.653
Ln Resident Population	0.323	1.000	0.500	0.206	0.189	0.181
Ln Average Years of Education	0.865	0.500	1.000	0.831	-0.537	-0.545
Ln Capital Stock	0.992	0.206	0.831	1.000	-0.681	-0.687
Lagged Education Gini Coefficient	-0.646	0.189	-0.537	-0.681	1.000	1.000
Squared Lagged Education Gini Coefficient	-0.653	0.181	-0.545	-0.687	1.000	1.000

Table 2-5. Model Summary

Model	R	R^2	Adjusted R^2	Standard Error of Estimate	Change Statistics					Durbin-Watson
					Change in R^2	F-Change	df	df	Sig. F Change	
1	1.000[a]	0.999	0.999	0.01916	0.999	2909.446	5	11	0.000	1.919

a. Predictors: (Constant), Squared Lagged Education Gini Coefficient, Ln Resident Population, Ln Capital Stock, Ln Average Years of Education, Lagged Education Gini Coefficient

b.

b. Dependent Variable: LnGDP

Analysis from Table 2-5 indicates that the model R^2 is 0.999, meaning that the logarithm of resident population, the logarithm of average years of education, the logarithm of capital stock, the lagged education Gini coefficient, and the squared lagged education Gini coefficient can explain 99.9% of the variation in the logarithm of GDP. Table 2-6 indicates that with a P-value < 0.05, the established regression model passes the F-test, suggesting that at least one variable impacts the dependent variable.

Table 2-6 ANOVA

Model		Sum of Squares	df	MSE	F	Sig.
1	Regression	5.341	5	1.068	2909.446	0.000[b]
	Residual	0.004	11	0.000		
	Total	5.345	16			

a. Dependent Variable: LnGDP
b. Predictors: (Constant), Squared Lagged Education Gini Coefficient, Ln Resident Population, Ln Capital Stock, Ln Average Years of Education, Lagged Education Gini Coefficient

Based on Table 2-7, the model equation is obtained as follows:

$$lnGDP = -30.724 + 2.303lnL + 0.61lnH + 2.174lnK + 10.524G_{t-2} - 22.642G_{t-2}^2$$

(Equation 2-9)

Table 2-7 Model Coefficients

model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity	
	B	Std. Error	Beta			lower limit	upper limit	Tolerance	VIF
1 (Intercept)	-30.724	2.105		-14.597	0.000	-35.359	-26.090		
LnGDP	2.303	0.212	0.1362	10.868	0.000	1.837	2.768	0.438	2.286
Ln Resident Population	0.061	0.101	0.0121	-.608	0.554	-0.160	0.170	5.600	

Ln Average Years of Education	2.174	0.040	0.9520	54.05	0.000	2.085	2.265	0.222	4.511
Ln Capital Stock	10.524	11.800	0.2630	0.892	0.392	-12.155	36.449	0.009	1268.375
Lagged Education Gini Coefficient	-22.642	22.906	-0.2930	-0.988	0.340	-27.773	27.074	0.007	1282.809

a. Dependent Variable: LnGDP

The regression analysis indicates that the model is well-fitted, and the independent variables adequately explain the dependent variable. At the t-2 stage, the education Gini coefficient significantly impacts regional total output. When not considering the quadratic term, an increase of 0.1 in the Gini coefficient results in a 0.0263% increase in regional total output. Conversely, at the t-2 stage, the squared term of the education Gini coefficient is negative, indicating that an increase of 0.1 in the Gini coefficient leads to a 0.0293% decrease in regional total output. The coefficients for capital input, labor input, and human capital input are 0.040, 0.212, and 0.101, respectively. This means that for each percentage point increase in labor input, Guizhou Province's regional GDP rises by 0.212 percentage points; similarly, a percentage point increase in human capital input leads to a 0.101 percentage point increase in regional GDP. Labor input contributes the most to the province's economy, followed by human capital input, while capital input has a smaller impact on regional economic growth.

It appears that there is an inverted U-shaped relationship between educational inequality across regions and regional economic development. Initially, as educational inequality increases, its impact on regional economic development is positive; however, beyond a certain point, this impact becomes negative. Both extremely low and high levels of educational inequality can hinder economic development. Therefore, the optimal education Gini coefficient is calculated as follows:

Optimal Education Gini Coefficient = - Coefficient of the Linear Term of Education Gini / (2 * Coefficient of the Quadratic Term of Education Gini)

This calculation finds that an education Gini coefficient of 0.232 is most beneficial for regional economic growth. According to Table 2-7, some variables have a VIF greater than 5, indicating multicollinearity. Hence, Lasso regression is used to mitigate the impact of multicollinearity.

2.3.3 Multicollinearity: Lasso Regression Analysis

Multicollinearity in the independent variables often occurs in linear regression analysis. According to theory, a VIF greater than 10 indicates severe multicollinearity, while a VIF greater than 5 suggests the presence of multicollinearity. The consequences of multicollinearity can be severe, potentially leading to regression coefficients that are opposite to the actual situation, or causing variables that should be significant to appear insignificant, and vice versa. To avoid or mitigate the impact of multicollinearity, Lasso regression is employed. Lasso regression introduces a penalty term, leading to a more reliable estimation despite the loss involved.

The first step before conducting Lasso regression is to determine the value of k based on the trajectory graph.

The second step is to select the smallest value of k where the standardized regression coefficients of the variables stabilize. A lower value of k means smaller error; at k = 0, it equates to standard OLS regression.

The third step involves inputting the determined value of k to obtain the Lasso regression model.

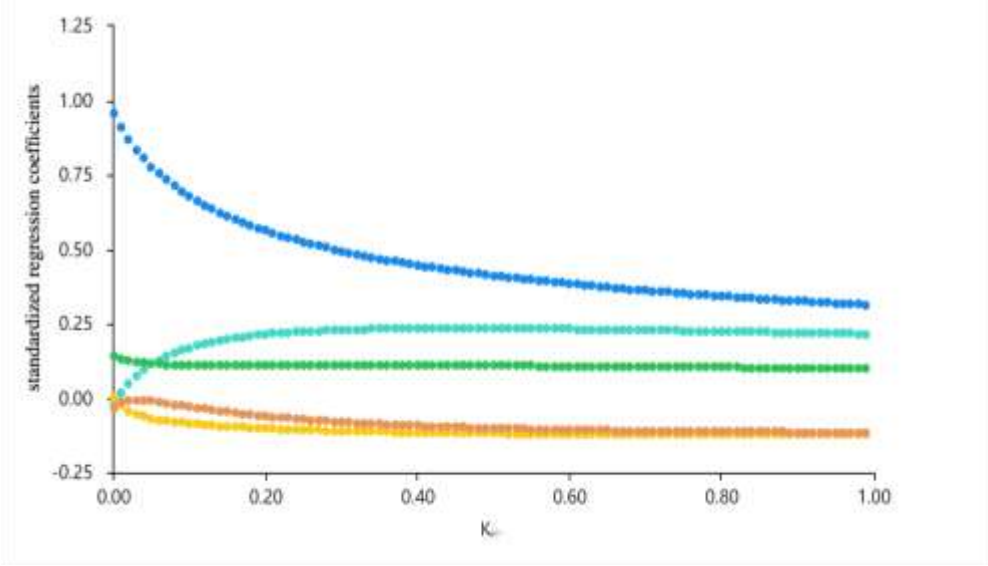

Figure 2-5 Trajectory graph

Figure 2-5 shows the trajectory graph, which provides a clear visualization of the Lasso regression analysis on LnGDP using LnK, LnH, LnL, Gt-2, and G2t-2 as independent variables. The graph suggests that when the value of k is set at 0.01, the standardized regression coefficients of the variables tend to stabilize, recommending 0.01 as the optimal value of k. Entering this value yields the following analysis results.

Table 2-8 ANOVA

	Sum of Squares	df	MSE	F	p -value
regression	5.285	5	1.057	201.349	0.000

	Sum of Squares	df	MSE	F	p -value
residual	0.058	11	0.005		
total	5.343	16			

Table 2-9 Lasso Model Summary

Sample Size	R^2	Adjusted R^2	RMSE
17	0.989	0.984	0.058

The ANOVA test for Lasso regression, also known as the F-test, is used to analyze and determine the significance of the model. A p-value less than 0.05 (or 0.1) indicates that the model is meaningful and can be used.

The model passes the F-test (F=201.349, p=0.000<0.05), suggesting that at least one of the variables (LnK, LnH, LnL, Gt-2, G2t-2) influences LnGDP.

Table 2-10 Lasso Regression Analysis Results

	Unstandardized Coefficients		Standardized Coefficients	t	p	R^2	Adjusted R^2	F
	B	Std. Error	Beta					
Intercept	-16.881	5.962	-	-2.832	0.016*			
LnK	2.006	0.151	0.909	13.261	0.000**	0.98	0.984	F (5，11)=201.349，p =0.000
LnH	0.184	0.367	0.019	0.501	0.627			
LnL	0.882	0.764	0.133	1.153	0.273			
G_{t-2}	0.000	3.727	-0.026	0.000	1.000			
G^2_{t-2}	0.000	6.447	-0.013	0.000	1.000			

Dependent Variable: LnGDP
* p<0.05** p<0.01

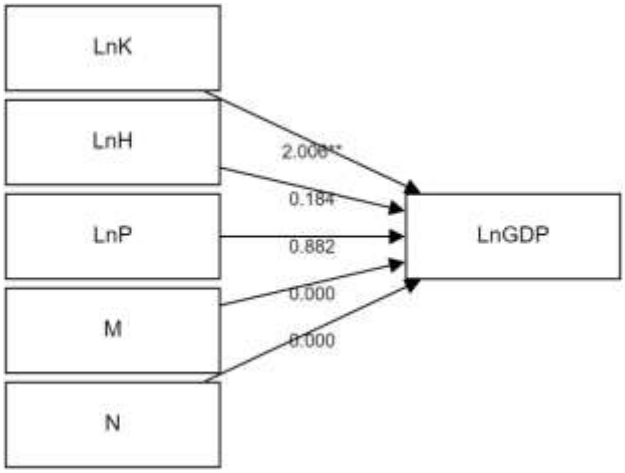

Figure 2-6 Model Coefficients

From Table 2-10, it is evident that using LnK, LnH, LnL, Gt-2, G2t-2 as independent variables and LnGDP as the dependent variable in Lasso regression (with k=0.010), the model's R-squared value is 0.989. This means that these variables explain 98.92% of the variation in LnGDP. The model passes the F-test (F=201.349, p=0.000<0.05), indicating that at least one of the variables significantly influences LnGDP. The model equation is:

$$lnGDP = -16.881 + 2.006 * lnK + 0.184 * lnH + 0.882 * lnL + -0.000 * G_{t-2} + -0.000 G_{t-2}^2$$

(Equation 2-10)

Table 2-11 Lasso Regression Analysis Results

	Regression Coefficients
Intercept	-16.881* (-2.832)
LnK	2.006** (13.261)
LnH	0.184 (0.501)
LnL	0.882 (1.153)
G_{t-2}	0.000 (0.000)
G^2_{t-2}	0.000 (0.000)
样本量	17
R^2	0.989
调整 R^2	0.984
F 值□	F (5，11)=201.349，p =0.000

Dependent Variable: LnGDP
* p<0.05** p<0.01 (t-values in parentheses)

The regression coefficient for LnK is 2.006 (t=13.261, p<0.01), indicating a significant positive effect on LnGDP. LnH's coefficient of 0.184 (t=0.501, p>0.05) implies no significant impact on LnGDP. LnL's coefficient of 0.882 (t=1.153, p>0.05) also shows no significant effect on LnGDP. The coefficients for Gt-2 and G2t-2 are both 0.000 (t=-0.000, p=1.000), suggesting no impact on LnGDP. Therefore, LnK significantly and positively

affects LnGDP, while LnH, LnL, Gt-2, and G2t-2 do not significantly influence LnGDP.

2.3.4 Robustness Test: Robust Regression Analysis

If outliers are present in the data, standard linear regression may be affected, necessitating the use of robust regression. Robust regression (or robust regression) is typically used in two scenarios: for regression analysis with outliers and for verifying the stability of regression results. Robust regression typically does not analyze R-squared or F-test values, as their original meanings are lost in this context.

Table 2-12 Robust Regression Analysis Results (n=17)

	Regression Coefficients	Standard Error	t	p	95%CI	R^2	Adjusted R^2	F
Constant	-31.650	2.073	-15.265	0.000**	-35.713~-27.586	0.99	0.998	F (5，11)=1433.442，p=0.000
LnL	2.592	0.262	9.893	0.000**	2.078~3.105			
LnH	-0.118	0.136	-0.868	0.385	-0.383~0.148			
LnK	2.187	0.055	40.035	0.000**	2.080~2.294			
G_{t-2}	-0.783	1.591	-0.492	0.623	-3.902~2.336			
G^2_{t-2}	-0.731	2.753	-0.266	0.791	-6.128~4.665			

Dependent Variable: LnGDP
* p<0.05** p<0.01

From the table above, using LnL, LnH, LnK, Gt-2, and G2t-2 as independent variables, and LnGDP as the dependent variable for Robust Regression analysis (M-estimation method), the regression coefficient for LnL is 2.592 (t=9.893, p<0.01). This implies that LnL has a significant positive impact on LnGDP.

The coefficient for LnH is -0.118 (t=-0.868, p>0.05), indicating that LnH does not significantly affect LnGDP. The coefficient for LnK is approximately 2.187 (t=40.035, p<0.01), suggesting that LnK significantly and positively influences LnGDP. The coefficient for Gt-2 is -0.783 (t=-0.492, p>0.05), meaning that Gt-2 does not affect LnGDP. Similarly, the coefficient for G2t-2 is -0.731 (t=-0.266, p>0.05), showing no significant impact on LnGDP.

In summary, LnL and LnK have a significant positive relationship with LnGDP. However, LnH, Gt-2, and G2t-2 do not exhibit any significant influence on LnGDP.

Table 2-13 Simplified Format of Robust Regression Analysis Results

	Regression Coefficients
Constant	-31.650** (-15.265)
LnL	2.592** -9.893

LnH	-0.118 (-0.868)
LnK	2.187** -40.035
G_{t-2}	-0.783 (-0.492)
G^2_{t-2}	-0.731 (-0.266)
Sample Size	17
R^2	0.998
Adjusted R^2	0.998
F - value□	F (5，11)=1433.442，p=0.000

3 Estimation of VAR Model Results on Educational Equity and Economic Development

Based on the analysis above, there is a significant positive correlation between Guizhou Province's Gross Domestic Product (GDP), total fixed asset investment (K), total labor force (L), and average years of education (H). The correlation of over 90% among these variables implies a close and mutually positive relationship between regional economic growth and inputs in material capital, labor capital, and education investment.

Moreover, the calculated education Gini coefficient of Guizhou Province shows a significant negative correlation with the region's economic development level, fixed asset investment, labor force capital, and average years of education, all above 90%. This suggests that a higher education Gini coefficient corresponds to lower educational equity, negatively impacting economic growth, fixed asset investment, labor participation, and education investment. Conversely, a lower education Gini coefficient in Guizhou Province indicates higher educational equity, promoting local economic growth, fixed asset investment, labor participation, and education investment.

3.1 ADF Test for Proxy Variable Data

Following the methods of Dickey and Fuller (1979 & 1981) on unit roots, ADF unit root tests will be conducted for the logarithm of GDP (LnGDP), the logarithm of the labor force (LnL), the logarithm of average years of education (LnH), and the total amount of fixed asset investment (LnK). The results, presented from Tables 3-1 to 3-4, indicate whether these series are stationary.

Table 3-1 ADF Test for LnGDP

差分阶数	t	p	临界值		
			1%	5%	10%
0	-2.110	0.240	-3.859	-3.042	-2.661
1	1.580	0.998	-4.332	-3.233	-2.749
2	-4.547	0.000	-3.924	-3.068	-2.674

The ADF test checks for stationarity in a time series. The null hypothesis assumes the series is non-stationary. LnGDP's ADF test results in a t-statistic of -2.110 and a p-value of 0.240. Since p=0.240>0.1, the null hypothesis of non-stationarity cannot be rejected. Hence, first and second-order differencing and retesting are required. The second-order differenced data shows p=0.000<0.01, indicating stationarity.

Table 3-2 LnL ADF Test Table

Differencing Ordert		p	Critical Value		
			1%	5%	10%
0	-2.415	0.138	-4.223	-3.189	-2.730
1	-2.172	0.217	-3.924	-3.068	-2.674
2	0.007	0.959	-4.332	-3.233	-2.749

Table 3-3 LnH ADF Test Table

Differencing Ordert		p	Critical Value		
			1%	5%	10%
0	0.853	0.992	-3.964	-3.085	-2.682
1	-2.300	0.172	-4.012	-3.104	-2.691
2	-4.272	0.000	-4.012	-3.104	-2.691

Table 3-4 LnK ADF Test Table

Differencing Order	t	p	Critical Value		
			1%	5%	10%
0	-16.407	0.000	-3.859	-3.042	-2.661

Tables 3-2, 3-3, and 3-4 follow similar procedures for LnL, LnH, and LnK, respectively. The findings suggest that the series for LnGDP, LnL, and LnH are not stationary at 1% significance level but become stationary after second-order differencing.

3.2 Johansen Cointegration Test for Proxy Variables

(1) Cointegration Test (Eigenvalue Test):

Table 3-5 reports the test statistics and critical values for the eigenvalue test. When the null hypothesis r<=3, the statistic value of 12.24 is significant at 10%, implying the rank is 3, and there is a cointegration relationship among the variables.

Table 3-5 Cointegration Test - Eigenvalue Test

H0：rank=r				
r=0	r≤1	r≤2	r≤3	Sample Interval
42.83***	25.58***	25.17***	12.24***	2002-2020

Note: *** indicates rejection of the null hypothesis at the 1% significance level

(2) Cointegration Test (Trace Test):

Table 3-6 presents a similar analysis, concluding that there is a cointegration relationship among the variables.

Table 3-6 Cointegration Test - Trace Test

H0：rank=r				
r=0	r≤1	r≤2	r≤3	Sample Interval
105.82***	62.99***	37.41***	12.24***	2002-2020

Note: *** indicates rejection of the null hypothesis at the 1% significance level

These tests under Johansen's framework suggest at least three cointegrating relations at a 5% significance level for the sample.

3.3 Vector Error Correction Model (VECM)

Given the established cointegration relationship among LnGDP, LnK, LnL, and LnH, VECM is estimated (Table 3-7). The error correction term (ect1) coefficient of -0.0177 indicates that a unit deviation from long-term equilibrium leads to a 0.0177 unit decrease in the total in the short term. The negative sign of the error correction term confirms the negative feedback mechanism for adjustments from long-term equilibrium.

Table 3-7 Vector Error Correction Model Results

Coefficients				
	LnGDP.d	LnH.d	LnP.d	LnK.d
ect1	-0.017687	0.042395	0.030838	-0.019736
constant	0.046727	0.036104	0.004403	-0.001649
LnGDP.d11	0.272883	0.298102	0.408510	0.034856
LnH.d11	-0.171372	-0.296068	-0.052055	0.022502
LnP.d11	-0.087643	0.763259	0.012998	-0.152124
LnK.d11	-0.195988	1.250424	0.614466	-0.106119

Table 3-8 Vector Error Correction Model Beta Coefficients

$beta	
	ect1
LnGDP.12	1.0000000
LnH.12	2.6164946
LnP.12	-2.6701158
LnK.12	0.6870922

3.4 VAR Model for Educational Equity and Economic Growth

The study employs a VAR model to analyze the relationship between educational equity and economic growth in Guizhou Province. LnGDP is used as a proxy for economic growth, and the education Gini coefficient as a proxy for educational equity. Granger causality test is applied to analyze the relationship between these endogenous variables.

3.4.1 Optimal Lag Selection for VAR Model

According to the AIC criterion, the best lag length for the model is determined to be 4 (Table 3-9).

Table 3-9 VAR Model Optimal Lag Order Selection

AIC(n)	HQ(n)	SC(n)	FPE(n)
4	4	4	5

3.4.2 Analysis of VAR Model Fitting Results

The economic growth is influenced negatively by the education Gini coefficient of the previous two periods and positively by the first-order and negatively by the second-order economic growth (Table 3-10).

Table 3-10 VAR Model Fitting Results (Dependent Variable: LnGDP)

	Unstandardized Coefficients		t	p	R^2	Adjusted R^2	F
	B	Standard Error					
Constant	0.6054	0.2478	2.444	0.031*	0.9994	0.9992	

	Unstandardized Coefficients		t	p	R^2	Adjusted R^2	F
	B	Standard Error					
LnGDP.11	1.2622	0.2795	4.516	0.000**			
G.11	0.1201	0.3661	0.328	0.748			F (4, 12)=4791, p =0.000
LnGDP.12	-0.2993	0.2710	-1.104	0.291			
G.12	-1.0127	0.4543	-2.229	0.046*			

Dependent Variable: LnGDP
* p<0.05 ** p<0.01

The results from the table lead to the formulation of Equation 3-1 as follows:

$$LnGDP = 0.6054 + 1.2622LnGDP.11 + 0.1201G.11 - 0.2993LnGDP.12 - 1.0127G.12$$

(Equation 3-1)

Table 3-11 VAR Model Fitting Results (Dependent Variable: G)

	Unstandardized Coefficients		t	p	R^2	Adjusted R^2	F
	B	Standard Error					
Constant	0.1802	0.2008	0.897	0.387			
LnGDP.11	0.0342	0.2266	0.151	0.883			
G.11	0.4518	0.2968	1.522	0.154	0.5196	0.3595	F (4, 12)=3.245, p =0.05
LnGDP.12	-0.0429	0.2197	-0.195	0.848			
G.12	0.0828	0.3683	0.225	0.826			

Dependent Variable: LnGDP
* p<0.05 ** p<0.01

Regarding the education Gini coefficient, economic growth lagged by one period has a positive effect on the education Gini coefficient. However, a lag of two periods exhibits a negative effect. This indicates that economic growth can both promote the stable development of educational equity and hinder it.

The results from the table lead to the formulation of Equation 3-2 as follows:

$$LnG = 0.1802 + 0.0342LnGDP.11 + 0.4518G.11 - 0.0429LnGDP.12 + 0.0828G.12$$

(Equation 3-2)

3.5 Granger Causality Test between Educational Equity and Economic Growth

The Granger causality test results suggest that at a significance level close to 10%, educational equity is a Granger cause of economic growth, rejecting the null hypothesis that "educational equity is not a Granger cause of economic growth" (Table 3-12). However, economic growth is not a Granger cause of educational equity. This indicates a one-way causal relationship between educational equity and economic growth. Economic growth impacts educational equity in various ways, as educational equity promotes social mobility, leading to stable economic development. However, rapid economic growth accompanied by imperfections in the market economy, corruption, rent-seeking, and unequal competition can widen income disparities, hindering social and economic development.

Table 3-12 Granger Causality Test Results

H_0	G do not Granger-cause LnGDP	LnGDP do not Granger-cause G
F-test	2.4902	0.8077
df1	2	2
df2	24	24
P-value	0.1041	0.4576

4 Conclusions and Recommendations

4.1 Research Conclusions

This paper uses the education Gini coefficient as an indicator of the average distribution of educational resources between regions and GDP as a proxy variable to study the relationship between regional economic development levels and the degree of educational equity in Guizhou Province. OLS and LASSO models are used for regression, and the results are tested for stability. The findings indicate:

(1) There is an inverted U-shaped relationship between educational inequality and the level of economic development in Guizhou Province. With the increase in the degree of educational inequality, there is initially a positive effect on the economic development of Guizhou Province, followed by negative effects.

(2) Robustness tests found that the effect of educational inequality on Guizhou's economic development exhibits an inverted U-shaped function, and this effect has a certain lag. Within Guizhou Province, due to significant imbalances in the distribution of local educational resources, achieving this goal requires the optimization of educational resources at the provincial level. To this end, transfer payments should be adopted to increase support for local education investment, reduce imbalances in local education investment, and promote long-term regional economic development.

In the long run, educational equity has a significant impact on economic growth, mainly reflected in:

(1) The output elasticity coefficient of educational equity is negative, indicating that in the short term, a decrease in the degree of educational equity will hinder the economic growth of Guizhou Province.

(2) We believe that the impact relationship between educational equity and economic development is unidirectional. In the long run, there is a significant Granger causal relationship between the degree of educational equity in Guizhou Province and economic growth, but not vice versa; that is, economic growth is not the Granger cause of educational equity.

4.2 Policy Recommendations

Therefore, this paper discusses the development of education in China from the following aspects:

(1) Optimize the distribution of educational resources.

(2) Promote balanced development of education.

(3) Establish and improve the financial transfer payment system.

(4) Increase educational subsidies for underdeveloped areas.

(5) Meet the educational resource needs of financially constrained regions.

(6) Further improve the distribution method of education funds, incorporating performance into investment efficiency evaluation, enhancing the transparency, scientificity, efficiency, and fairness of funding, and ensuring optimal use of limited funds.

(7) Improve the education subsidy system, ensuring upward social mobility for disadvantaged groups. On the one hand, the government should increase support for impoverished students, expand the scope of assistance, and raise the standard of

assistance, establishing an economic compensation mechanism for impoverished students and providing policy and institutional support. Encourage various forms of assistance, coordinate funds from the government, businesses, and other social sectors, and provide assistance to impoverished students in various forms such as awards, aids, work-study, reductions, and supplements. Develop preschool education, special education, ensure equal educational opportunities, clarify government responsibilities, improve the preschool education system, explore policies and systems for government-run and socially operated preschools, reform the investment and management system of rural preschool education, explore ways to develop preschool education in poor areas, and improve bilingual education models in ethnic areas, promoting the development of ethnic education.

(8) The overall education level of children with disabilities is low, with education for disabled children being the weakest link in primary education and educational equity. Therefore, relevant departments should strengthen support for children with disabilities, promoting their education, vocational education for people with disabilities, and the development of higher education for people with disabilities.

5 Limitations and Prospects

This study has the following two areas for improvement:

(1) The impact mechanism of educational equity on regional economic growth is quite complex, and the impact pathways are varied and intertwined, warranting more in-depth and systematic exploration and research. However, due to the limitations of existing data and article length, this paper only summarizes the impact mechanisms of educational equity on regional economic growth based on some existing literature, without systematically and comprehensively testing the impact mechanisms through a series of scientific and feasible empirical methods.

(2) A single indicator often cannot fully reflect all aspects and the entire content of the degree of educational equity in a region. Due to limitations in available statistical data, this paper only explores the relationship between horizontal educational equity and regional economic growth from the perspective of the education Gini coefficient. If future research can use multiple indicators to analyze and measure the educational equity of various regions from multiple perspectives, or synthesize a comprehensive index that fully reflects the degree of educational equity, it will more scientifically, comprehensively, and reasonably reflect the relationship between educational equity and regional economic growth.

Reference

Andrs R, Tselios V. Inequalities in income and education and regional economic growth in Western Europe [J]. The Annals of Regional Science, 2010, 44(2): 349-375.

Bi Bo. Study on spatial fairness evaluation and planning path of basic urban education in Beijing [D]. Tsinghua University, 2018. DOI: 10.27266/d.cnki.gqhau.2018.000195.

Chen Yuetang, Lei Zhixiang. Differences and trends in the development of educational equity in China — Mainly based on regional comparisons of the education Gini coefficient [J]. Journal of Hunan Agricultural University (Social Science Edition), 2019, 20(03): 90-96.

Chu Hongqi. What kind of educational fairness is needed in the new era: research problem domains and policy toolboxes [J]. Educational Research, 2020, 41(02): 4-16.

Cui Youbo. Research on the impact of the Internet on the construction of a learning society [D]. Party School of the Central Committee of the Communist Party of China, 2019. DOI: 10.27479/d.cnki.gzgcd.2019.000121.

Gu Xiaoqing, Li Shijin, Li Rui. International perspective on innovative applications of artificial intelligence — Prospects and future education outlook of NSF AI research institutes in the USA [J]. China Distance Education, 2021(12): 1-9+76. DOI: 10.13541/j.cnki.chinade.2021.12.001.

Han Shimei. Policy evolution, problem analysis, and development suggestions for promoting educa tional equity through educational informatization in China [J]. China Distance Education, 202

1(12): 10-20+76. DOI: 10.13541/j.cnki.chinade.2021.12.002.
Jin Lu. Study on the impact of urban-rural educational inequality on the income gap of urban and r ural residents in China [D]. Northeast Normal University, 2019. DOI:
Jing Xueqing. Estimation of provincial material capital stock in China: 1952-2010 [J]. Guangdong Social Sciences, 2013, (02): 46-55.
Jin Yuying, Ye Guangyu. Analysis of the coupling and coordinated development of educational equity and regional economic growth in China — Based on inter-provincial panel data from 2003-2016 [J]. Hunan Social Sciences, 2019(04): 115-122.
10.27011/d.cnki.gdbsu.2019.000196.
Knowles S, Lorgelly PK, Owen PD. Are educational gender gaps a brake on economic development? Some cross-country empirical evidence [J]. Oxford Economic Papers, 2002, 54(1): 118-149.
Liao Yi'er. Fiscal education precision poverty alleviation: Performance targets and empirical tests [D]. South China University of Technology, 2019. DOI: 10.27151/d.cnki.ghnlu.2019.000346.
Liu Dawei. Does education help to bridge the 'two meridians' of poverty governance? — Path and effect of educational poverty alleviation from the perspective of urban-rural differences [J]. Education and Economy, 2020, 36(06): 12-21.
Liu Lihua, Sun Zao. The impact of income inequality on economic growth: mechanisms, effects, and responses — An empirical study based on the perspective of intergenerational income transmission [J]. Fiscal Studies, 2020(07): 79-92. DOI: 10.19477/j.cnki.11-1077/f.2020.07.007.
Lopez R, Thomas V, Wang Y. Addressing the education puzzle: the distribution of education and economic reform [R]. World Bank working paper, 1998.
Sauer P, Zagler M. (In)equality in education and economic development [J]. Review of Income & Wealth, 2014, 60: s353-s379.
Stephan K. Low schooling for girls, slower growth for all? Cross-country evidence on the effect of gender inequality in education on economic development [J]. World Bank Economic Review, 2002(3): 345-373.
Wang Chengduan. Current situation and prospects of higher education research in Western China [J]. Chongqing Higher Education Research, 2019, 7(05): 23-34. DOI: 10.15998/j.cnki.issn1673-8012.2019.05.003.
Wang Dongxue. Research on education poverty alleviation by Chinese social organizations since the reform and opening up [D]. Jilin University, 2020. DOI: 10.27162/d.cnki.gjlin.2020.000366.
Wang Jiaqi, Min Weifang. Study on the impact of educational equity on provincial economic growth [J]. Education and Economy, 2021, 37(01): 19-28.
Xu Changqing, Mei Guoshuai. Review of the relationship between educational equity, social mobil ity, and economic growth [J]. Hebei Normal University Journal (Education Science Edition), 2 020, 22(06): 102-111. DOI: 10.13763/j.cnki.jhebnu.ese.2020.06.013.
Xu Changqing, Zhou Liping. Research on the relationship between educational equity and economic growth — Based on empirical analysis of China's data from 1978-2014 [J]. Exploration of Economic Issues, 2017, (10): 28-40.
Yu Xuan. Study on the dilemmas and governance paths of ordinary high school education development in poverty-stricken areas in central and western China [D]. East China Normal University, 2019.
Zhang Ruijing. Study on the spillover effect of higher education investment efficiency on economic growth in China [D]. Chongqing University of Business and Commerce, 2019.