Research on the Sheepskin Effect in China: Factors Influencing Educational Returns and Heterogeneity Analysis

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Abstract: Using sample data from the China General Social Survey (CGSS2021), this study employs econometric methods based on the basic cost-benefit economics perspective. It investigates the relationship between educational investment and labor income in China in recent years, utilizing the Mincer earnings model as well as an extended model incorporating additional control variables. An Ologit model is constructed to analyze the impact of gender, ethnicity, family economic status, and regional registration on educational attainment among the sample population. Furthermore, the study compares educational returns across different genders, regions, workplaces, and job positions. Finally, based on empirical analysis, suggestions are proposed to enhance individual income levels and optimize the allocation of social educational resources from both individual and environmental perspectives.

Keywords: Education market, Mincer earnings equation, Sheepskin effect, Education returns.

1.   Introduction

According to statistics from the National Bureau of Statistics, as of June 2023, the unemployment rate for youth aged 16-24 in China reached 21.3%, an increase of 2% year-on-year, marking the highest point since the data was first published in 2018. Additionally, the supply of university graduates in 2024 is expected to reach 11.79 million, resulting in a severe labor surplus. Therefore, it is necessary to conduct an in-depth study on the impact of education on income in the new era.

Michael Spence introduced the concept of information asymmetry into the education market, suggesting that employers use employees' educational levels to differentiate their skill levels and offer wages accordingly. This model is vividly referred to as the sheepskin effect [1]. In contrast, human capital theory posits that education enhances employees' capabilities, enabling them to earn higher incomes in the labor market.

Scholars both domestically and internationally have validated these two theories by controlling for variables such as region, gender, and family background. Layard and Psacharopoulous, based on the Mincer earnings model with additional dummy variables, empirically analyzed and found that the educational returns for workers with different educational backgrounds in the United States were similar, thus negating the sheepskin effect [2]. Reiley pointed out that this theory failed to account for factors such as years of education and reasons for dropping out, thus introducing errors into the results [3]. Olneck found that the signaling effect of diplomas diminished after controlling for variables like family background and personal ability [4]. Crespo and Reis, by studying data from

Brazil between 1982 and 2004, concluded that the sheepskin effect decreased year by year [5]. Bauer and Haisken's research on Japanese companies revealed that, due to different recruitment channels, the sheepskin effect was more significant in small and medium-sized enterprises compared to large enterprises [6]. Chinese scholar Li Fengliang analyzed the 2010 CFPS data and, using an improved Spline model based on the LP model, concluded that junior high and bachelor's degrees positively impacted income, while high school diplomas had the opposite effect, and the sheepskin effect was greater for females than for males [7]. Shen Hong et al., based on the 2008 China General Social Survey data, conducted a comparative analysis and found that the sheepskin effect gradually increased with higher educational levels [8].

This paper examines the cost-benefit situation of education from an economic perspective, with specific research contents as follows: On one hand, it applies knowledge and theories from educational economics and real survey data to empirically study the relationship between educational investment and income in China, analyzing the sheepskin effect across different education levels for various groups to help individuals make rational decisions based on their circumstances. On the other hand, it analyzes the objective reasons behind educational disparities and proposes measures to improve the current situation.

2. Data and Econometric Model

(1) Data Sources and Statistics

The data for this paper comes from the China General Social Survey (CGSS2021), using random sampling to represent a sample size of 8,148 people, covering a wide range of areas. The survey includes extensive education and employment information of the respondents, such as years of education, highest level of education attained, income, years of work experience, and information about the employing unit, making it suitable for exploring the educational returns under China's educational background and employment system. During data screening, this paper strictly excludes other sources of income and selects "total occupational income" as the dependent variable.

(2) Variable Description

According to the needs of this paper, the following core variables are set. From Table 1, it can be seen that the average years of education in China is 11.82 years. Among adults, 90.30% have completed nine years of compulsory education, 62.90% have completed high school education, 25.00% have obtained a bachelor's degree, and 2.76% have obtained a master's degree. Since this paper has excluded agricultural workers and samples with income below the minimum wage standard (1500 yuan), the overall educational level is relatively high. Overall, the basic education penetration rate in China is quite high, but there are significant imbalances in educational resources across different regions and schools, which cannot be simply reflected by the data. The individual sample ages selected in this paper are between 18 and 60 for males, and between 18 and 55 for females, with an average working experience of 22.61 years. Additionally, gender, ethnicity, household registration location, and family economic status are selected as control variables to refine the model analysis.

Table 1: Descriptive Statistics of Core Variables

Variable	Variable Definition	mean	sd
Income	Annual Occupational Income (Yuan)	82,811	143,257
Age	Age (Years)	40.44	10.36
edu	Years of Education	11.82	3.589
DJHS	0 = No Junior High Diploma, 1 = Has Junior High Diploma	0.903	0.296

Table 1: (continued).

DHS	0 = No High School Diploma, 1 = Has High School Diploma	0.629	0.483
DUNI	0 = No University Degree, 1 = Has University Degree	0.25	0.433
DGRA	0 = No Master's Degree, 1 = Has Master's Degree	0.0276	0.164
E	Years of Work Experience	22.61	12.13
Female	0 = Male, 1 = Female	0.452	0.498
Nation	0 = Han Ethnicity, 1 = Minority Ethnicity	0.0529	0.224
Hukou	0 = Non-rural Household Registration, 1 = Rural Household Registration	0.477	0.5
Family	0 = Family Economic Status Average or Below, 1 = Family Economic Status Above Average	0.107	0.309
Sample Size	2,175		

(3) Econometric Model

The rate of return on education measures the net economic benefits, both personal and social, that are obtained from increased investment in education over a period of time. These returns can be classified into market returns and non-market returns. Since the latter are difficult to measure, this paper focuses solely on the market returns on education.

This study employs three models to analyze the relationship between education and income. Model 1 is the basic Mincer earnings model, where the main factors affecting personal income are the years of education and work experience. With the inclusion of other control variables, the standard Mincer earnings equation can be represented by the following formula:

$$\ln(\text{Income}) = \alpha + \beta_1 \cdot edu + \beta_2 \cdot E + \beta_3 \cdot E2 + u \tag{1}$$

where α is the intercept, β_1 is the Mincer return rate, representing the return from an additional year of education, β_2 is the marginal return from an additional year of work, and u is the random error term.

Breton pointed out that the average years of education is an inaccurate measure of a country's human capital unless the interaction effects with experience are considered [9]. Based on this, we add control variables to construct the following equation:

$$\ln(\text{Income}) = \alpha + \beta_1 \cdot edu + \beta_2 \cdot (edu*E) + \beta_3 \cdot (edu*E2) + \delta \cdot X + u \tag{2}$$

Model 2 can be transformed into the following form:

$$\ln(\text{Income}) = \alpha + \beta_1 \cdot edu \cdot [1 + (\beta_2/\beta_1)E + (\beta_3/\beta_1)E2] + \delta \cdot X + u \tag{3}$$

Based on Breton's method, the study constructs the Chinese Education Effectiveness Measure (SE) and the standardized Education Effectiveness Index (SEI):

$$SE = 1 + (\beta_2/\beta_1)E + (\beta_3/\beta_1)E2$$

$$SEI = SE/\overline{SE}$$

According to the SEI chart below, school education for Chinese workers has a time effect, peaking at the age of 35, after which the rate of return on education declines with age.
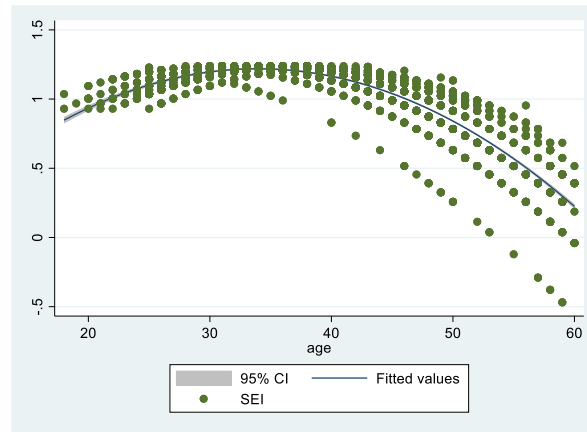
Figure 1: Relationship between SEI and Age

Model 3 adds dummy variables for whether the individual has obtained a junior high school diploma, high school diploma, university degree, or graduate degree on the basis of Model 2. This model can be written as the following formula:

$$\ln(\text{Income}) = \alpha + \beta1 \cdot edu + \lambda1 \cdot DJHS + \lambda2 \cdot DHS + \lambda3 \cdot DUNI + \lambda4 \cdot DGRA + \beta1 \cdot edu + \beta2 \cdot (edu*E) + \beta3 \cdot (edu*E2) + \delta \cdot X + u \tag{4}$$

where λi (i=1,2,3,4) represents the sheepskin effect of different levels of diplomas after controlling for other variables, and X represents the control variables.

3.   Empirical Analysis

As shown in the first column of the table below, after controlling for the variable of work experience, an additional year of education increases individual income by 9.11%. Observing the data in the third column, after strictly controlling for various variables, the return on education for each additional year of schooling is 3.86%. Specifically, a junior high school diploma has a negative effect on individual income, while high school diplomas, bachelor's degrees, and master's degrees all bring significant and increasing positive returns, at 2.94%, 18.8%, and 58.4% respectively. This indicates that in a modern society where education is widespread, higher education indeed plays an important role in increasing income.

Table 2：Empirical Results of the Three Models (Full Sample)

VARIABLES	(1) ln_Income	(2) ln_Income	(3) ln_Income
edu	0.0911	0.0656	0.0386
	(0.00691)	(0.00605)	(0.0172)
DJHS			-0.116
			(0.0928)
DHS			0.0294
			(0.0781)
DUNI			0.188
			(0.0681)
DGRA			0.584
			(0.119)
eduE		0.00275	0.00349

Table 2: (continued).

		(0.000445)	(0.000457)
eduE^2		-0.000087	-9.89e-05
		(1.04e-05)	(1.06e-05)
E	0.0191		
	(0.00657)		
E_2	-0.000572		
	(0.000137)		
Female		-0.382	-0.372
		(0.0331)	(0.0330)
Nation		-0.204	-0.194
		(0.0732)	(0.0729)
family		0.423	0.431
		(0.0537)	(0.0536)
Hukou		-0.121	-0.126
		(0.0361)	(0.0366)
Constant	9.765	10.21	10.46
	(0.126)	(0.0806)	(0.107)
Observations	2,175	2,175	2,175

The level of education affects income levels; however, the differences among the samples themselves also influence their educational attainment. Table 3 uses the Ologit model to analyze the factors influencing the attainment of different education levels from four perspectives. Firstly, regarding gender: in primary and secondary education, males are 0.7% and 0.9% more likely than females to receive education, respectively. However, in undergraduate and graduate education, females are 4.5% and 0.5% more likely than males to receive education, indicating that gender differences in educational opportunities are not significant. Secondly, regarding ethnicity: ethnic minorities are more likely than Han Chinese to enter undergraduate education, but Han Chinese have a higher proportion in graduate and above education. Those with a family economic status above the average are more likely to receive education, and this characteristic is more evident in high school and undergraduate education. Regarding household registration, individuals with non-agricultural household registrations are more likely to obtain educational diplomas. This is partly due to the uneven distribution of educational resources and partly because rural residents are more likely to engage in agricultural work, which has a lower educational return rate, in the future. Scholars have analyzed the potential reasons for the lower educational return rate in the agricultural sector. Chen Yuyu suggests that the educational return rate in the agricultural sector is low, and the way to improve the educational return rate in rural areas is through the flow of labor from the agricultural sector to the non-agricultural sector. However, the professional division of labor in the non-agricultural sector in rural areas is not as detailed as in urban areas, resulting in lower educational return rates [10].

Table 3: Ologit Model Regression Analysis of Factors Influencing Diploma Attainment

	dy/dx	std. err.	z	P>z	[95% conf. interval]	
Female						
1	0.007	0.012	0.57	0.569	-0.017	0.031
2	-0.007	0.012	-0.57	0.569	-0.031	0.017
3	-0.009	0.019	-0.48	0.633	-0.047	0.028

Table 3: (continued).

4	0.045	0.017	2.59	0.010	0.011	0.079
5	0.005	0.007	0.71	0.476	-0.009	0.019
Nation						
1	0.009	0.027	0.34	0.734	-0.044	0.062
2	-0.009	0.027	-0.34	0.734	-0.062	0.044
3	0.028	0.044	0.63	0.528	-0.058	0.113
4	0.032	0.038	0.84	0.403	-0.042	0.106
5	-0.014	0.019	-0.72	0.473	-0.051	0.024
Family						
1	-0.072	0.030	-2.44	0.015	-0.131	-0.014
2	0.072	0.030	2.44	0.015	0.014	0.131
3	0.181	0.036	5.01	0.000	0.110	0.251
4	0.144	0.024	5.89	0.000	0.096	0.192
5	0.006	0.010	0.62	0.537	0.013	0.025
Hukou						
1	0.123	0.015	8.11	0.000	0.093	0.153
2	-0.123	0.015	-8.11	0.000	-0.153	-0.093
3	-0.318	0.014	-22.06	0.000	-0.346	-0.290
4	-0.268	0.017	-15.64	0.000	-0.302	-0.235
5	-0.048	0.012	-4.14	0.000	-0.070	-0.025

Note: For the ordinal variables, 1 = No junior high school diploma, 2 = Junior high school diploma, 3 = High school diploma, 4 = Bachelor's degree, 5 = Master's degree.

Table 4 reflects the sheepskin effect of different levels of education under various conditions such as gender, region, nature of the workplace, and job position in Model 3. The data show that at all education levels, the sheepskin effect for females is significantly higher than for males. Higher education in central and western China yields a higher rate of return. A master's degree brings positive effects in state-owned, collective, and private enterprises, whereas in foreign-funded enterprises, positive returns are only observed at the bachelor's degree level. For general employees and family business workers, a bachelor's degree and above have a significant sheepskin effect.

Table 4: Sheepskin Effect of Different Education Levels on Various Groups

	Junior High School Diploma	High School Diploma	Bachelor's Degree	Master's Degree	Sample Size
Full Sample	-0.116	0.0294	0.188	0.584	2,175
Gender					
Male	-0.375	-0.213	-0.0216	0.320	1,191
Female	0.151	0.248	0.394	0.862	984
Region					
Eastern Region	-0.319	-0.138	0.150	0.192	962
Central Region	0.208	0.371	0.354	1.401	678
Western Region	0.0642	0.158	0.157	1.035	404
Northeastern Region	-0.386	0.166	0.0777	0.230	131

Table 4: (continued).

Nature of Workplace					
State-Owned Enterprise	-0.461	-0.318	-0.0281	0.187	422
Collective Enterprise	-0.383	-0.554	0.588	0.948	110
Private Enterprise	-0.274	0.000190	0.176	0.735	752
Foreign Enterprise	-0.273	-2.491	0.630	-1.971	16
Job Position					
Owner/Partner	-0.337	0.392	0.249	0.815	129
Self-Employed	0.461	0.144	0.161	-	311
General Employee	-0.140	0.00885	0.229	0.576	1,391
Laborer	1.062	1.190	0.692	-	52
Temporary Employee	0.0727	-0.110	-	-	148
Family Business Worker	1.404	1.979	1.180	1.737	19
Freelancer	-1.089	-0.178	0.220	-	51

4. Conclusion

Using data from CGSS2021, this study conducted an empirical analysis of the sheepskin effect of different educational levels in China. After controlling for variables such as years of work experience, gender, ethnicity, family background, and household registration, it was found that high school, bachelor's, and master's degrees all positively impact income levels, with the sheepskin effect of a master's degree being higher than that of a bachelor's degree. Conversely, a junior high school diploma has a negative impact on income. The study concluded that males are more likely to receive basic education, while females slightly surpass males in higher education attainment. Minorities are more likely to receive undergraduate education compared to Han Chinese, but the overall difference is not significant. Family economic status significantly influences children's education levels, and the rural living environment is the biggest obstacle to continued education due to scarce educational resources and low education return rates. Furthermore, based on the extended Mincer income model, the study analyzed the sheepskin effect across different education levels for various demographic groups. The results showed that females exhibit a higher sheepskin effect at all education levels compared to males. The education return rates in the central and western regions are generally higher than in other regions, though the degree varies across different education levels. Collective enterprises have the highest education return rates among different work units, followed by private enterprises, with state-owned enterprises having the lowest. The sample size for foreign enterprises was too small to draw definitive conclusions. There are also significant differences in education return rates across different job positions. Temporary and freelance workers have lower educational needs, while general employees show high education return rates at high school, bachelor's, and master's levels, with the most significant returns at the master's level.

Based on the above conclusions, the following recommendations are made: Firstly, for those living in rural areas who are likely to engage in agricultural work in the future, and do not have a strong desire for further education or higher academic aspirations, it is advisable to shorten their education duration and invest more time in work. China should promote educational equity and equal

opportunities, providing more educational resources and preferential policies to students in impoverished areas to ensure their right to education. For groups with low returns on formal education, vocational skills training should be emphasized to avoid a disconnect between theoretical knowledge and practical work. Enterprises should lower educational thresholds for new hires and evaluate job seekers' abilities from multiple dimensions. Secondly, relevant departments should deeply analyze the development status of higher education and the distribution of employment opportunities in the central regions to narrow the gap with the eastern regions. Thirdly, workers should consider their educational attainment when choosing employers.

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