

An Inspection on the Educational Gini Coefficient for the Balanced Development of China's Compulsory Education

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Abstract—This paper uses the Gini coefficient from 1991 to 2016 as the measure of equity in China's compulsory education. The findings are that basically, the Gini coefficient of educational expenditure per student for compulsory education is becoming lower year by year. However, there are huge gaps between different categories of economic development in terms of education Gini coefficient, as well as different parts of China in terms of expenditure per student for compulsory education. The balanced development level of compulsory education is different among the four economic zones. By applying the multiple linear regressions to official national data from 1991 to 2016, the paper shows the relationship between educational expenditure and the economic development at the provincial level. The financial situation and the responsibility of state government and local government on the development of basic education are critical to the fairness of the allocation of educational resources. The amount of educational expenditure for compulsory education decreases with the increasing level of fiscal decentralization at the provincial level. Based on the analysis of the findings, the suggestions for future improvement are shown as follow: first, government at all levels should clarify their financial responsibility for the balanced development in China's compulsory education; second, it is necessary to enhance the legislation on the implementation of compulsory education expenditure in local government; third, the central government should increase the financial transfer payment for compulsory education in remote and poverty-stricken areas and ethnic minority areas.

Keywords—*educational Gini coefficient; balanced development; compulsory education; educational expenditure; China*

I. INTRODUCTION

Gini coefficient is an important index that many researchers apply the measurement to comprehensively investigate the variance in income distribution among countries (Ren Y & Liang F, 2013). It is a useful index that can fairly reflect the difference in income distribution with the usage of all the sample data, making the sensitivity to inflation not significant. Meanwhile, the Gini coefficient also makes a great contribution in terms of equity in population, income, property and education.

The balanced development of China's compulsory education has an essential impact on the country's sustainable development. China's government, therefore, made legislation for compulsory education — Compulsory Education Law in 2006, which attracted relevant researchers to focus on the field of compulsory education. This paper analyzes the trend of Gini coefficient from 1991-2016 through the Statistical Yearbook of China's Education funds and the Yearbook of China's Education Statistic, measuring the balanced development in China's compulsory education. To further discuss the factors that impact on the educational expenditure, the multiple linear regressions are used to examine the relationship between educational expenditure and economic development levels. Suggestions for China's policy-makers are shown in the final part of the paper.

II. LITERATURE REVIEW

A. Educational Gini Coefficient

Research on educational Gini coefficient started in the 1970s. Jackson (1975) calculated and evaluated the educational Gini coefficient in East Africa based on educational fund data. Vinod Thomas (2000) used educational Gini coefficient in 11 countries based on the educational years. Thomas (2005) calculated the educational Gini coefficient of people over 15-year old in 140 countries from 1960 to 2000. He found that educational inequity decreased year by year. The degree of educational inequity is negatively correlated with the level of educational development. Lin (2007) measured the educational inequity in Taiwan, China through educational Gini coefficient. It was found that between 1976 and 2003, the educational expansion in higher education positively affected education equity. Based on the panel data of 102 regions in EU member countries from 1995 to 2000, Andres & Vassilis (2009) considered the error factors in the empirical model. It is found that the probability of residents' accessing to education was closely related to the income distribution gap. K Digidowiseiso (2010) used the educational Gini coefficient to analyze educational inequity in third world countries. There was a negative correlation between the average educational years and the Gini coefficient. The

higher the educational years implies the higher probability of educational accomplishment, which leads to the achievement the education fairness. Also, studies showed that gender differences could also have an impact on education equity, and these factors would become stronger over time. Haim & Shavit (2013) used the educational Gini coefficient to investigate educational equity in China. With the expansion of education, the level of educational inequality has declined. M Hojo (2015) studied the increase in high school enrolment and the number of years of education per capita since the 1950s. Using Japan's multi-year educational Gini coefficient to measure educational inequality in Japan, it studied the inclusion of gender in Japan's high school enrolment rate, as well as in the number of years of education per capita in Japan. The results show that the unfair distribution of education in Japan decreases; the distribution of education in women is more equitable than that in men; the relationship between the educational Gini coefficient and educational years was shown as an inverted U-shaped.

B. Gini Coefficient and China's Educational Development

In the middle and late 1990s, domestic scholars began to use the Lorenz curve and educational Gini coefficient to study education fairness, especially in the stage of compulsory education. Yuhong and Shanmai (1998) used the Lorenz curve of the average cost of education to depict the annual change of the students' average cost in each province. Minghe (1999) used the data of 1753 counties to analyze the educational investment and average education expenditure between urban and rural areas with the Gini coefficient. Zhang Changzheng et al. (2006) calculated educational Gini coefficient to measure the educational equity in China from 1978 to 2004. The results show that there are still significant problems among local education, and the gap of urban-rural education was getting larger in China. Based on the empirical analysis of the average budget of students, Zhou (2007) measured the educational equity in different counties using the Gini coefficient. Xiaomin et al. (2007) used the Gini coefficient of the budget educational expenditure per student to measure the equity of the allocation of national education funds in the field of compulsory education, using provincial data and urban and rural data from 1995 to 2004. It is found that from 1995 to 2004, although the expenditure of career funds in the average student budget tends to increase, there is still a big gap in the level of education funds per student between regions. Yanjun et al. (2011) used the educational Gini coefficient of the year of education to select the relevant provincial panel data and used the fixed effect variable intercept model to study the relationship between educational inequality and the widening income distribution gap in China. The study found that educational inequality has a growing impact on the income distribution gap; at the same time, the relationship between the number of years of education and the income distribution gap is negatively correlated. That is to say, with the prolongation of the average number of years of education, the gap in income distribution in China is widening. Xiaohua (2014) decomposed the Gini coefficient of education and found that

the main influencing factors of educational inequality in China are the educational investment, residents' income gap, urbanization level, educational expansion and economic development level. Through the state space model with variable parameters, the influence of urban and rural factors on educational inequality is studied.

III. HYPOTHESIS

In China, education, as a cause related to the national economy and the people's livelihood, has been paid a lot of attention among policy-makers and researchers all the time. Since 2001, China's basic education began to implement the policy that "under the leadership of the State Council, the responsibility should be taken by the local government and county government". The county-level government has become the main body of the financial expenditure of basic education.

After fiscal decentralization in 1994, the local government did not increase its investment in compulsory education with the increase of financial rights. To promote the development of local economy, and to speed up the attraction of investment and to improve political performance, the investment in public infrastructure has been accelerated. The fiscal decentralization has weakened the driving force for local governments to invest in compulsory education. However, the new edition compulsory education law has been proposed since 2006, which force the local governments to increase the investment of compulsory education.

China is a wide and broad country, which the economic development levels among regions are different. There are also great differences in the degree of development not only between provinces but also between counties within the province. The differences among schools, urban and rural areas and regions have always been the drawbacks of the balanced development of basic education in China [2]. Therefore, many scholars put forward the reform of the existing fiscal decentralization system after studying from different angles.

Hypothesis 1: There is a positive correlation between the level of economic development and the level of educational equity. The higher the level of economic development in the region is, the better the situation of the development of compulsory education is.

Hypothesis 2: The stronger the degree of fiscal decentralization is at the provincial level, the lower the amount of educational expenditure is.

IV. EMPIRICAL ANALYSIS OF EDUCATIONAL GINI COEFFICIENT FOR CHINA'S COMPULSORY EDUCATION

A. Data Sources

Based on the research of index for public funds in the budget of expenditure per student for compulsory education in China, this paper applies data from the Statistical Yearbook of Education funds published by the National Bureau of Statistics and the Ministry of Education to the

multiple linear regressions. Since the expenditure on education mainly consists of two parts: public expenditure and business expenditure, Business expenditure, which includes basic salaries of teaching staff, grants, social security benefits, welfare expenses, etc., is a fixed expenditure allocated following regulations of China's compulsory education. Therefore, expenditure per student for compulsory education is particularly critical to the measurement of the educational Gini coefficient.

All the data comes from a series of Statistical Yearbooks of China. The data on the expenditure per student for primary education and expenditure per student for junior high school student comes from the Statistical Yearbook of China Education funds and the Statistical Bulletin of the implementation of National Education funds in each year (1991-2016). Both the number of students in ordinary primary schools and the number of students in junior middle schools come from the Statistical Yearbook of China Education Statistics. Other important data such as GDP, financial expenditure comes from the Statistical Yearbook of China.

Based on the research of Taoyuan (2018), the paper divides the provinces into four economic zones, according to the economic development levels, structural characteristics, which is more reasonable and comprehensive to recap the contemporary economic environment. The first category is the most productive economic zones which contain Tianjin, Shanghai and Beijing. The second category is the rich economic zones which contain Fujian, Inner Mongolia, Guangdong, Jiangsu, Liaoning, Zhejiang, and Shandong. Ningxia, Shanxi, Xinjiang, Jilin, Chongqing, Hebei, Heilongjiang, Hubei belongs to the next economic zones. The provinces with the lowest level of economic development include Guizhou, Xizang, Yunnan, Gansu, Guangxi, Anhui, Jiangxi, Sichuan, Shanxi, Hainan, Henan, Hunan and Qinghai. The paper does not take Sichuan and Chongqing into consideration because of the lack of data.

B. Variable and Model

The dependent variable in the model is educational Gini coefficient. The Gini coefficient can be most intuitively understood by illustration. The horizontal and vertical axes in "Fig. 1" show the cumulative percentage of the population sorted by income from high to low and the corresponding cumulative percentage of income, respectively. The diagonal line represents the absolute average line, and the Gini coefficient is expressed as the ratio of the area of region A to region B in the graph. The calculation process is shown as follow:

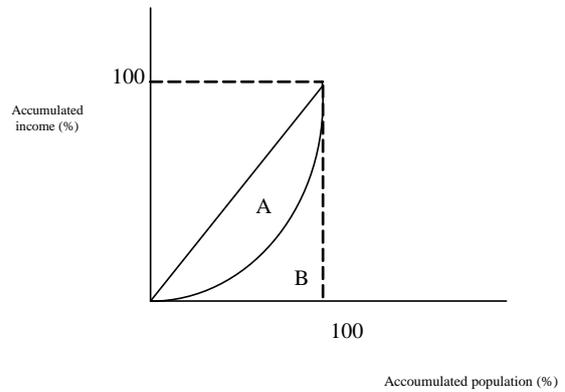


Fig. 1. Gini coefficient diagram.

G represents Gini coefficient; P represents the set of the population of a country; x_i represents the set of income in a country; represents the income of a person, in which $i \in P$; the number of elements of the indicator set P is N ;

Therefore, $\sum_{i=1}^N x_i$ is the sum of the income of the people R ; the elements in the collection will be shown in order: $x_i \leq x_j \leq \dots \leq x_k \leq x_l$, in which $i, j, k, l \in P$.

Therefore, $x_1 \leq x_2 \leq \dots \leq x_{N-1} \leq x_N$. The percent of accumulation population can be shown as $Y_i, i \in P$. The formulation of the Gini coefficient can be represented as follow:

$$G = 1 - 2S_B = 1 - \frac{1}{N} \left(\frac{2 \sum_{i=1}^{N-1} \sum_{n=i+1}^N x_n}{R} + 1 \right) \tag{1}$$

The formulation above is the original Gini coefficient which is a little bit different from the educational Gini coefficient. For example, to calculate the Gini coefficient of compulsory education in 1991, firstly, it is necessary to arrange the 29 provinces of compulsory education expenditure per student in descending order. The next step is to calculate the proportion and cumulative proportion of education expenditure per student in one province to the total education expenditure per student all around the country (E_i). After that, it needs to calculate the proportion and cumulative proportion of the number of student of compulsory education in one province to the total number of student of compulsory education all around the country (S_i). Finally, it is easy to get the Gini coefficient which is:

$$G_e = \sum_{i=1}^{n-1} E_i S_{i+1} - \sum_{i=1}^{n-1} E_{i+1} S_i \tag{2}$$

The dependent variable is a continuous variable. EE represents the educational expenditure. In this paper, the educational expenditure means the educational expenditure for compulsory education. Therefore, the multivariate linear regression model can be used in the paper. The model is expressed as the following expression:

$$EE = \beta_{0k} + \beta_{1k} X_{1k} + \beta_{2k} X_{2k} + \beta_{3k} X_{3k} + v_i + \varepsilon$$

k represents the year, β_{0k} represents the intercept of year k , X_{1k} represents the GDP of year k , β_1 is the coefficient of X_{1k} , X_{2k} represents the fiscal decentralization index of year k , β_2 is the coefficient of X_{2k} . Fiscal decentralization can be expressed as the ratio of local financial expenditure and national financial expenditure. X_{3k} represents the control variables of year k , β_3 is the coefficient of X_{3k} . ν_t is the fixed effect of time, ε is the stochastic disturbance.

Independent variables include GDP, financial expense and several control variables. Although the number of the observation is limited, the paper is also inspired by the relevant research that it is possible to get the coefficient to analysis the relationship between the economic development levels and educational expenditure.

C. Empirical Analysis

The descriptive analysis is shown in "Table I". It is known that the maximum of educational Gini coefficient from 1991 to 2016 is 0.52, and the minimum of educational Gini coefficient in the same period is 0.23. The average of educational Gini coefficient is 0.34. The difference between GDP is 722345.7. Total financial expenditures are composed of central financial expenditure and local financial expenditure. Because of the inflation, the data from the Yearbook is the normative values. It is necessary to use deflator to gain the real GDP, real central and local financial expenditure. The descriptive statistics of real values are shown in "Table II".

TABLE I. DESCRIPTIVE STATISTICS (NORMATIVE VALUE)

Items	Minimum	Maximum	Mean
Educational Gini coefficient	0.23	0.52	0.34
GDP(Million Yuan)	2178.15	23067.68	95492.29
Central Financial Expenditure (Million Yuan)	105.262	2740.385	995.0934
Local Financial Expenditure (Million Yuan)	229.581	16035.14	4463.584

^a The data is sourced from the Yearbook of China statistic, the Yearbook of the Statistical Yearbook of China's Education funds and the Yearbook of China's Education Statistic (1991-2016).

TABLE II. DESCRIPTIVE STATISTICS (REAL VALUE)

Items	Minimum	Maximum	Mean
Educational Gini coefficient	0.23	0.52	0.34
GDP(Million Yuan)	2178.15	74412.72	25016.38
Central Financial Expenditure (Million Yuan)	105.26	849.51	388.04
Local Financial Expenditure (Million Yuan)	229.581	4970.83	1610.8

As is shown in "Fig. 2", the trend of the Gini coefficient for compulsory education fell sharply from 1991 to 1995. Between 1978 and 1990, the Chinese government took measures to achieve universal compulsory education. Since

the promulgation of the compulsory Education Law in 1985, China has begun to popularize compulsory education on a large scale. The implementation of universal compulsory education carried out step by step, which includes school age and the number of years of study, educational expenditure, and teacher management. Based on research of the Compulsory Education Law, first large-scale priorities have been organized at the provincial and county levels to formulate a plan for universal nine-year compulsory education. The local government put the primary responsibility for the development of basic education, especially the popularization of compulsory education, into practice at the county and township levels. They actively took measures to solve the problem of difficulties in enrolling in compulsory education, raising funds from the masses to improve the conditions for the construction and operation of schools and to reform the education and teaching system. Therefore, the level of the balanced development of compulsory education continues to improve. However, since the fiscal decentralization since 1994, to maintain the development of local economic, the local government has shifted its focus to the public infrastructure construction which can rapidly improve its economic situation, which causes decreasing investment in compulsory education. With the increasing investment in public infrastructure construction, the inequality of compulsory education in provinces is becoming more and more obvious. Therefore, from 1995 to 2001, the inequality of compulsory education is becoming more and more significant, especially in 1997, when the central government appropriate funds for Tibet to develop its compulsory education. It also implies that China's government with its unique and centralized fiscal policy has a significant and important impact on the balanced development of basic education. This phenomenon has improved since 2006. The Compulsory Education Law, which was newly amended in 2006, clearly stipulates that "local government should promote the balanced development of compulsory education". In October 2007, the report of the Seventeenth National Congress of the Communist Party of China (CPC) put forward that "promoting the balanced development of compulsory education is important for the realization of educational equity". In recent years, local finance has attached importance to compulsory education, which makes the difference between each province. Local government generally paid attention to the educational expenditure and education management. The Gini coefficient of educational expenditure for compulsory education started falling generally.

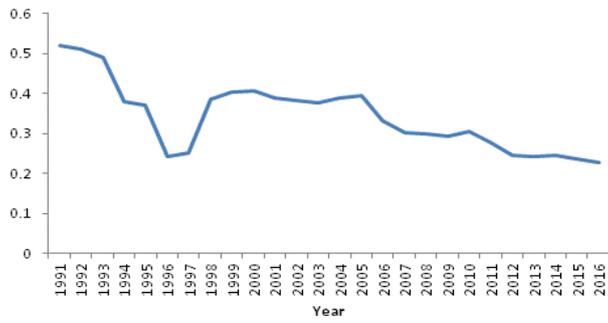


Fig. 2. The trend of Gini coefficient for national compulsory education.

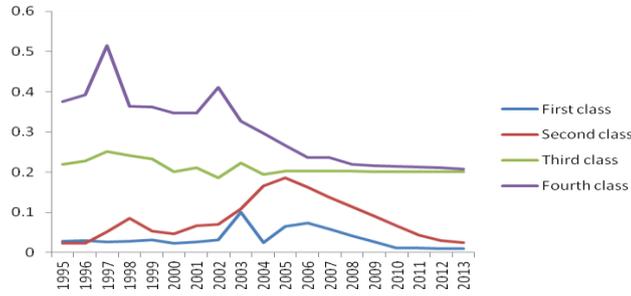


Fig. 3. The trend of Gini coefficient for local compulsory education (four categories).

In terms of the Gini coefficient in four economic zones, the balanced development level of compulsory education is significantly different from each other (as shown in “Fig. 3”). The educational Gini coefficient of the first and the second economic zone is lower than that of the third and fourth economic zone before 2000. After 2000, the Gini coefficients all go down in four economic zones. It suggests increased educational attention and opportunities for all students in both rich and poor provinces. According to the graph, the Gini coefficient had dropped twofold to 0.2 in third and four economic zones. The higher the economic development is, the higher the equity level of compulsory education is. Through the simple regression of the Gini coefficient and GDP, the result is significantly negative between the Gini coefficient and GDP. It implies that the higher the GDP is, the lower the Gini coefficient is. Therefore, the balanced development of compulsory education is better. It is necessary to know whether the estimation may have heteroskedasticity or not. Therefore, “Fig. 4” shows the relationship between the residual and the fitted values. “Fig. 5” shows the relationship between the residual and the independent variable. It seems that there is a certain relationship between the two graphs. Testing heteroskedasticity is necessary for the process of estimation. White test is shown in “Fig. 6”. The result shows that it’s necessary to consider heteroskedasticity at a significant level of 95%. Though WLS, it is easy to eliminate the effect of heteroskedasticity on the educational Gini coefficient and GDP. Then estimating again, the conclusion can be gain that GDP has a positive effect on educational Gini coefficient. The first hypothesis can be examined as the correct proposal.

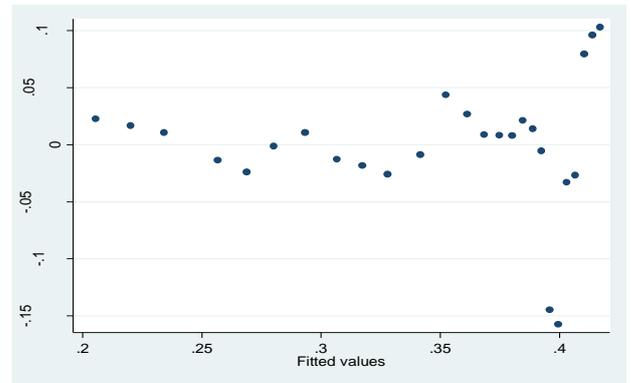


Fig. 4. The relationship between residual and the fitted values.

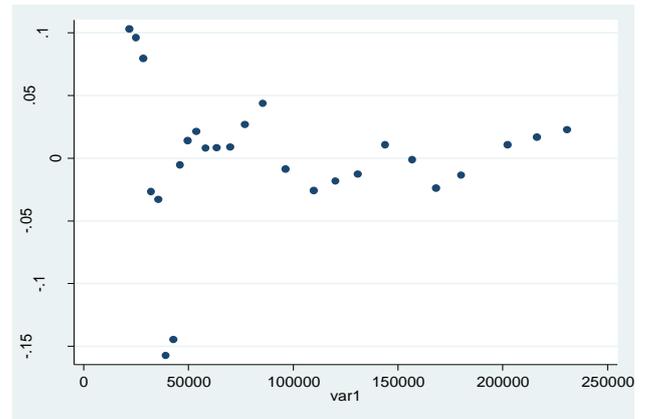


Fig. 5. The relationship between residual and GDP.

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White's test for Ho: homoskedasticity
against Ha: unrestricted heteroskedasticity

chi2(2)      =      6.97
Prob > chi2  =      0.0307
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Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	6.97	2	0.0307
Skewness	3.16	1	0.0755
Kurtosis	5.17	1	0.0229
Total	15.30	4	0.0041

Fig. 6. White examination.

The second proposal can be examined through the multiple linear regressions between the educational expenditure and fiscal decentralization. The regression results are shown in "Table III":

TABLE III. REGRESSION RESULTS

variables	model1	model2	model3	model4	model5
Capital gdp	0.197*** (0.0049)	0.226*** (0.005)	0.115*** (0.004)	0.115*** (0.004)	0.117*** (0.004)
Fiscal decentralization index		-44.021*** (4.722)	-12.613** (5.090)	-14.952*** (5.154)	-9.108*** (5.421)
Fiscal expenditure			0.544** (0.140)	0.558*** (0.014)	0.537 (0.160)
Dum94				-132.78** (52.240)	-100.548* (52.82)
Dum06					229.816** (69.98)
R ² within	0.547	0.622	0.840	0.840	0.840

As the paper tries to exam the fixed effect on the expenditure education which is not affected by the time series, fixed effect estimation has been used in the totally five models. The first model is the regression between educational expenditure and per capital GDP. The result is significantly positive. The second model added the fiscal decentralization index with a significant level of 0.001, the effect of fiscal decentralization to compulsory educational expenditure is negative, which is -44.02. Then to further exam the relationship between the educational expenditure and fiscal decentralization, the paper adds several control variables like capital fiscal expenditure and time dummy variable. 1994 is the initial year of fiscal decentralization. 2006 is the year of the proposal of the new edition of Compulsory Education Law. Therefore, time dummy variables are added in model 4 and model 5. Generally, the variables the paper adding are improving the goodness of fit in the process of estimation, which is from 0.547 to 0.840. Therefore, hypothesis 2 has been examined.

V. CONCLUSION

The paper discusses the educational Gini coefficient for the balanced development of China's compulsory education. Two hypotheses have been proposed and examined in this paper. China occupies a land area of one-fourteenth on the earth. The gap between rich and poor is growing in this area. With the different economic environment and regional conditions, the gap in the development of compulsory education is very obvious. Although the state has taken measures such as "the large-scale development of the western region," the rise of the central region, "and" revitalizing the old industrial base in Northeast China, "to regulate the balanced development of the different regions, the significant differences are still existing among regions in terms of the hardware or software of compulsory education. Fiscal decentralization with the unique intergovernmental structures, which began in 1994, plays an important role in China's economic development. However, because more attention has been paid in public infrastructure construction such as highway, subway and train, the investment in

education has not been given an appropriate amount of the total financial expenditure.

Several suggestions have been proposed in the section. Since the reform and opening up in 1978, China's compulsory education has made considerable development. However, because of the overall level of education investment is far behind the public infrastructure construction, the regional distributions of education investment are unreasonable. It remains great differences between different economic blocks of compulsory education in China. It is necessary to clarify the responsibilities of governments at all levels and increase the responsibility of provincial and local governments for school operation. According to the level of economic development and the situation of the labor force in different regions, the minimum allocation for investment in compulsory education should be established. A supportive policy for compulsory education will be adopted in relatively poor areas.

The allocation of compulsory education funds in China is not only related to the level of economic development, but also related to the imperfection of the financial system of education. Therefore, it is necessary to establish regulations and guidelines to ensure the healthy and orderly development of compulsory education.

The central government should make the financial power of governments at all levels more compatible through the reform of the financial system. Through transfer payments and the establishment of special funds for education, the differences between educational regions and schools can be reduced.

REFERENCES

- [1] Ren Y, Liang F, Yang W. A new exploration of Gink coefficient of institutions of higher learning [J]. Journal of Huazhong Normal University, 2013.
- [2] Jackson D. Economic Development and Income Distribution in Eastern Africa [J]. Journal of Modern African Studies, 1971, 9(4): 531-542.

- [3] Thomas V, Wang Y, Fan X. Measuring Education Inequality: Gini Coefficients of Education. Policy Research Working Paper [J]. Social Science Electronic Publishing, 2001, 1(100): 43-50.
- [4] Thomas V, Wang Y. Distribution of Opportunities Key to Development [M]. Inequality in Education. 2005.
- [5] Lin C H A. Education Expansion, Educational Inequality, and Income Inequality: Evidence from Taiwan, 1976-2003[J]. Social Indicators Research, 2007, 80(3): 601-615.
- [6] Rodriguez-Pose A, Tselios V. Education and Income Inequality in the Regions of the European Union[J]. Journal of Regional Science, 2009, 49(3): 411-437.
- [7] Digdowiseiso K. Education Inequality, Economic Growth, and Income Inequality: Evidence from Indonesia, 1996-2005[J]. Social Science Electronic Publishing, 2009.
- [8] Haim E B, Shavit Y. Expansion and inequality of educational opportunity: a comparative study [J]. Research in Social Stratification & Mobility, 2013, 31(1): 22-31.
- [9] Hojo M. Inequality in Japanese Education[J]. Japanese Economy, 2015, 36(3): 3-27.
- [10] Wang Shanmai, Du Yuhong, Liu Yuanxin. An empirical analysis of the imbalance of educational development in China [J]. Educational Research, 1998 (6): 19 -23.
- [11] Jiang Minghe. Developing the production of higher education and expanding the consumption of education [J]. Research on Educational Development, 1999 (7): 12 -14.
- [12] Zhang Changzheng, Xun Zhijian, Li Huaizu. An empirical study on the degree of educational equity in China: 1978-2004 measurement and analysis based on the Gini coefficient of education [J]. Educational Research of Tsinghua University, 2006, 27 (2): 10-14.
- [13] Zhou Long, Liu Chao. A study on the regional difference of budgetary funds per student in education: based on statistical method and calculation of Gini coefficient [J]. Scientific Management Research, 2007,25 (6): 81- 84.
- [14] An Xiaomin, Wu Zhihui. Research on Educational Equity: a Multidisciplinary Perspective [J]. Shanghai Education and Scientific Research, 2007 (10): 22- 25.
- [15] Wen Jiaoxiu, Wang Yanjun. A dynamic study on educational inequality and widening income distribution gap in China: an empirical study based on the Gini coefficient of education in various regions [J]. Journal of Chengdu University of Technology (Social Science Edition), 2011,19 (1): 5 - 10.
- [16] Xiaohua Zhang, An analysis of the measurement and influencing factors of educational inequality in China [D]. Zhejiang University of Industry and Commerce, 2014.
- [17] Gao Taoxuan, Chen Ming, Wang Guozhang. Division of China's Economic Zone Based on Functional Data [J]. Mathematical Statistics and Management, 2018, 37 (4).
- [18] Ren Y, Liang F, Yang W. A new exploration of Gink coefficient of institutions of higher learning[J]. Journal of Huazhong Normal University, 2013.
- [19] Jackson D. Economic Development and Income Distribution in Eastern Africa[J]. Journal of Modern African Studies, 1971, 9(4): 531-542.
- [20] I.S. Jacobs, C.P. Bean. "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.
- [21] K. Elissa. "Title of paper if known," unpublished.
- [22] R. Nicole. "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.
- [23] Y. Yorozu, M. Hirano, K. Oka, Y. Tagawa. "Electron spectroscopy studies on magneto-optical media and plastic substrate interface", IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741, August 1987 [Digests 9th Annual Conf. Magnetism Japan, p. 301, 1982].
- [24] M. Young. The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.