

Article

The Differences in the Impact of Economic Structure Adjustment on the Ecological Carrying Capacity of County Education—A Case Study of Chongqing, China

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Abstract: Basic education is a foundation-laying project of national quality education. Improving the ecological carrying level of basic education is of great practical significance to the coordinated and sustainable development of regional society and economy. Based on the panel data of Chongqing from 2011 to 2017, combined with the DPSIR theoretical model, a comprehensive evaluation index system was conducted, and the spatial and temporal evolution characteristics of ecological carrying capacity of county education in Chongqing was explored by using statistical analysis and spatial analysis methods. The multiple linear regression model was used to analyze differences in the impact of economic structure adjustment on the ecological carrying capacity of county education. It was found that the level of ecological carrying capacity of county education in Chongqing showed a steady upward trend in terms of time sequence, and all the five subsystems showed the characteristics of steady development, but the influence of each subsystem on the overall carrying capacity was different. From the formation mechanism, Chongqing's educational ecological carrying capacity is the result of a multi-factor complex system, and there are obvious differences in the influencing factors at different development stages. Therefore, it is necessary to narrow the regional differences of education ecological carrying capacity, promote the coordinated development of education among regions, and take multiple measures to effectively ensure the high quality and sustainable development of county education in Chongqing.

Keywords: county education; ecological carrying capacity of education; DPSIR model; spatial and temporal differentiation; influence difference



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1. Introduction

Since the middle and late 1990s, China's urbanization has entered a period of rapid development, which not only directly drives rapid economic growth, but also drives large-scale population flow to cities and towns rare in human history [1–3]. At the end of 2021, the urbanization rate of permanent residents in China had reached 64.72%. In the process of deepening urbanization, the pressure of urbanization accumulated over a long time is also increasing. Taking education as an example, a large number of school-age children move into cities and towns with their parents, which brings huge pressure on local education supply [4], resulting in the problems of limited ecological carrying capacity of education, mainly including the enrollment of children who move with the scale, the limited carrying capacity of public education resources and the shortage of educational land resources [5–7]. In the “14th Five-Year Plan” of China, the government proposed to “speed up the expansion and increment of urban schools”, “promote the urbanization with county as an important carrier, and enhance the comprehensive carrying capacity and governance capacity”. Most of the rural areas of China are within the jurisdiction of a county, which is the frontier of rural revitalization, urbanization and urban-rural integrated development [8–10]. Based

on the perspective of the ecological carrying capacity of education, how to give full play to the advantages of urbanization with a county as the carrier, promote the rational flow and efficient aggregation of educational resources, and form a new pattern of educational development with obvious main functions, complementary advantages and high quality development has become a hot research topic.

Activities concerning human environment (ecology), social relations and norms (society), and resource allocation (economy) are interrelated in different ranges and places [11–13]. Educational activities exist in a certain social system and environment, and the improvement of education quality needs to be supported by diversified resources to meet their own educational goals and maintain the existence and development of the education system [14,15]. Research on the ecological carrying capacity of education first appeared in the field of higher education [16]. The ecological carrying capacity of education itself is a comprehensive feedback regulation system, and it is open to the time and space [17], which is of great significance to the high-quality development of education. On the one hand, the ecological carrying capacity of education is not only an important index to measure the speed and scale of educational development, but also a quantitative evaluation index to determine the scale of educational development planning in a certain stage. On the other hand, the ecological carrying capacity of education can be based on the reality of educational resources and educational environment, and involves analyzing the systematic influencing factors of educational development, accurately describing the supporting dimension of high-quality and balanced development of education, changing the allocation mode of educational resources, breaking the restriction of improving the ecological carrying capacity of education to the maximum extent, and building an ideal ecological circle of educational development [18]. Ecological carrying capacity of education is the ability to self-maintain and adjust education in the region, which can be reflected in three aspects: resource carrying capacity, environmental carrying capacity and ecological elasticity. Other researchers have explored the carrying capacity of efficient physical education resources and environment from the perspective of educational system balance, and strived to find its dynamic equilibrium value and steady structure from the fluctuation threshold [19]. In addition, from the perspective of high-quality education development, some researchers define the ecological carrying capacity of education as the supporting capacity of “the regional composite system generated around education” for all kinds of education, which has a three-dimensional spiral structure consisting of situational supporting force, resource-based force and management elasticity. By constructing the regulation model of ecological carrying capacity of higher education, the judgment model and concrete expression model are given from three aspects: carrying index, pressure index and carrying pressure degree [20].

From the relevant research of carrying capacity of educational resources, at first, the concept, index system construction and evaluation method of carrying capacity of educational resources were discussed piecemeal, focusing on the investment of educational funds, conditions for running schools and teachers’ strengths. After that, due to the joint action of new urbanization and new development concepts, a discussion on the sustainable carrying capacity of compulsory education resources under the background of new urbanization was started [21], and academic concepts such as the carrying capacity of compulsory education resources and the carrying capacity of compulsory education resources in big cities were put forward. At the same time, with the increasing scale of the floating population brought about by the new urbanization, the relevant research began to use the principal component analysis method to build a model of regional educational resource carrying capacity for quantitative analysis [22–24]. In recent years, the research on the carrying capacity of education resources has gradually deepened, and it has begun to comprehensively understand and scientifically analyze the causes of the problem of carrying capacity of compulsory education resources cities from a practical point of view [25]. Based on the PERS analysis framework of education system in the perspective of system theory, the index system of carrying capacity of compulsory education resources in big

cities has been conducted, and policy suggestions have been put forward to realize the “spatial matching” between the education population and resources. On the other hand, research methods are increasing, and research fields are expanding. In related research, the entropy method and geographical detector technique were used to analyze the spatial and temporal differentiation and influencing factors of basic education resources in China from 2003 to 2019 [26]; based on an AHP-cloud model, the index system of provincial postgraduate-education resource carrying capacity is constructed [27], and based on the entropy TOPSIS model, the model and evaluation index of higher education resource carrying capacity were constructed [28,29].

On the whole, existing research has carried out a more in-depth study on the ecological carrying capacity of education and provided beneficial enlightenment and suggestions for promoting the high-quality development of basic education, but there are still some shortcomings. The research on educational carrying capacity is usually considered as a single factor, such as resource carrying capacity and environmental capacity, but the integration effect of the educational ecosystem is ignored. The contribution rate of various educational resources and environments to the ecological carrying capacity of education needs to be discussed. The ecological carrying capacity of education takes the whole educational ecosystem as the research object, pays attention to the supporting strength of the whole educational ecological environment, and coordinates the development of internal educational resources and external environmental conditions. The external conditions here include the whole social and economic development level, the training demand for talents and the introduction of national education policies [30–32]. In view of this, this paper builds a comprehensive evaluation system based on the DPSIR model to measure the level of ecological carrying capacity of county education in Chongqing, and tries to answer the following questions by means of statistical analysis and spatial analysis: (1) What is the time-sequence dynamic change law of ecological carrying capacity of county education in Chongqing as a whole? (2) What are the spatial distribution characteristics of the ecological carrying capacity of education in Chongqing? (3) What role does the adjustment of economic structure play in the evolution of the spatial and temporal pattern of ecological carrying capacity of county basic education? Answering the above questions has two research values. From the macro perspective, based on the realistic consideration of the county, we can comprehensively examine the spatial differences of carrying capacity of county education, analyze its formation mechanism, and formulate matching educational policies. From the micro perspective, combining the development needs of county education and social and economic environment, an in-depth analysis of the carrying scale of educational resources and environments within the region can lay a foundation for speeding up the allocation of educational resources to complement shortcomings and balance strengths and weaknesses within the region and enhance the carrying capacity and governance capacity of education.

2. Materials and Methods

2.1. Study Area and Data Sources

Chongqing is located in the southwest of inland China. Chongqing is a provincial administrative region (Figure 1), a municipality directly under the central government and megacity in China. It is one of the important central cities in China, the economic center of the upper reaches of the Yangtze River, an important national advanced manufacturing center, western financial center, western international comprehensive transportation hub and international gateway hub [33]. By the end of 2021, it had jurisdiction over 26 districts, 8 counties and 4 autonomous counties, with a total area of 82,400 square kilometers and a permanent resident population of 32.12443 million. Chongqing has complete educational and cultural facilities, including 111 museums, 41 cultural centers, 43 public libraries and 20 public art-performance groups. The comprehensive population coverage rate of radio is 99.49 percent, and that of television is 99.56 percent. There are 69 general schools of higher education, 3 adult colleges and universities, 129 secondary vocational

schools (excluding technical schools), 2717 regular primary schools, 5684 kindergartens and 39 special education schools. The gross enrollment rate of higher education is 58.03 percent, the enrollment rate of primary school is 99.93 percent, the gross enrollment rate of preschool in three years is 91.01 percent, and the consideration rate of nine-year compulsory education is 95.67 percent. However, Chongqing's urban and rural dual economic and social structure has obvious characteristics, and large urban and rural differences and regional differences have been formed in the process of education development.

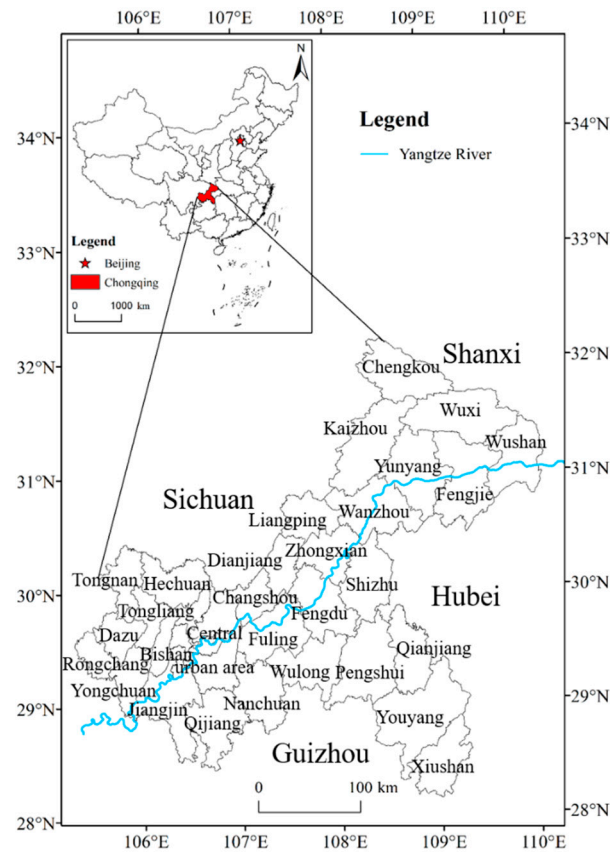


Figure 1. Location of Chongqing, China. Note: Based on the standard map (scale 1: 48 million) with the approval number of GS (2019) 1823 on the standard map service website, the base map has not been modified.

This paper takes 38 districts and counties in Chongqing as the analysis unit and takes the basic education stage as the specific research object, including primary school, junior high school and senior high school education. The development data mainly comes from the Chongqing Education Statistical Yearbook, which was obtained from the Chongqing Education Commission. However, since the data statistics are only updated to 2017, and the data statistical caliber was different before 2011, and the relevant index data lacks statistics, this paper conducts an empirical study by collecting data from 2011 to 2017. Among them, the standards of school building area, campus land area, and the number of books for school construction needs are taken as the average or the minimum standard value by referring to primary and secondary school construction standard documents in Chongqing, and the demand for the number of teaching staff is taken as the average value by referring to the Opinions on Formulating Standards for Teaching Staff in Primary and Secondary Schools and other relevant documents. The economic and social data mainly come from the Chongqing Statistical Yearbook of the corresponding year and the statistical yearbooks of each district and county, and the statistical bulletin of national economic and social development, and some missing data are handled smoothly.

2.2. Methods

2.2.1. Bearing Capacity Index System and Comprehensive Evaluation Model

The DPSIR model is a framework based on causal structure information and related index. It is widely used in the mechanism analysis of evaluation index systems of complex things [34]. With the help of this model, the dynamic evolution path of county education ecological carrying capacity can be centrally displayed, and education bearing capacity and sustainable development can be systematically analyzed. DPSIR represents five subsystems, namely: driving force and pressure, respectively; state; impact; and response [35,36]. This paper makes a comprehensive evaluation of the ecological carrying capacity level of county education in Chongqing based on the above five subsystems. Among them, the driving force subsystem, and the pressure subsystem are the potential factors and direct reasons that lead to the change of tourism environmental carrying capacity. The state subsystem is the current situation of tourism environmental carrying capacity under the joint influence of driving force and pressure, while the influence subsystem represents the potential result of the change of tourism environmental carrying capacity, and the response subsystem is the measure taken against the above changes. In the selection of indicators, following the scientific, representative, purpose, availability principle, and taking into account the economic, social, resource and educational factors of Chongqing as a whole, after preliminary selecting 36 indicators through theoretical and systematic analysis, and combining the interview and consultation results of 8 experts in related fields such as educational resource management, an evaluation index system of tourism environmental carrying capacity composed of 12 dimensions and 30 specific indicators was finally constructed (Table 1).

Table 1. Evaluation index system of educational ecological carrying capacity.

	Dimension Layer	Indicator Layer	Index Definition	Attribute
Driving force	Economic drive (D1)	GDP (D11)	Represent the driving force of economic aggregate on carrying capacity	+
		Per capita disposable income of residents (D12)	Represent the driving force of economic development on carrying capacity	+
	Social driven (D2)	Population (D21)	Represent the driving force of population base on carrying capacity	+
Pressure	Land resource pressure (P1)	School building area demand (P11)	Represent the pressure of students' accommodation demand on carrying capacity	−
		Campus floor space requirements (P12)	Represent the pressure of students' activity space on carrying capacity	−
	Teacher pressure (P2)	Faculty needs (P21)	Represent the pressure of students' teacher demand on carrying capacity	−
	Financial pressure (P3)	Educational expenditure demand (P31)	Represent the pressure of education expenditure demand on carrying capacity	−
State	Education status (S1)	Number of students at school (S11)	Represent the amount of education carried	+
		Number of full-time teachers (S12)	Representing the quality of education	+
		Number of graduates (S13)	Represent the amount of education carried	+
		Number of students enrolled (S14)	Represent the amount of education carried	+
	Status of education provision (S2)	Number of schools (S21)	Represent the capacity of education carrying space	+
		Sports field area (S22)	Represent the capacity of education carrying space	+
		Value of fixed assets of the school (S23)	Represent the quality of education	+

Table 1. Cont.

Dimension Layer	Indicator Layer	Index Definition	Attribute	
Status of education funds (S3)	Number of school books (S24)	Represent the quality of education	+	
	Number of teaching computers (S25)	Represent the quality of education	+	
	Education cost within the budget per student (S31)	Represent the quality of education	+	
Impact	economic impact (I1)	Represent the impact of education on the level of economic development	+	
	social influence (I2)	Urbanization rate (I21)	Represent the impact of Education on Social Innovation Ability	+
		Number of employees (I22)	Represent the Impact of Education on Social Employment Stability	+
	Average annual salary of employees (I23)	Represent the impact of education on income level	+	
	Birth rate (I24)	Represent the impact of education on social fertility concept	+	
	Industrial labor productivity (I25)	Represent the impact of Education on Social Production Efficiency	+	
Response	Economic response (R1)	Total value of import and export (R11)	Represent the response of regional opening to carrying capacity	+
		Proportion of tertiary industry in GDP (D12)	Represent the response of economic and industrial structure to carrying capacity	+
	Social response (R2)	Road mileage per 10,000 people (R21)	Represent the response of infrastructure to bearing capacity	+
		Book collection of public library (R22)	Represent the level of public cultural facilities	+
		Investment in fixed assets of the whole society (R23)	Represent the response of infrastructure to bearing capacity	+
	Number of beds in health institutions per 10,000 people (R24)	Represent the response of service facilities to bearing capacity	+	
	Number of colleges and universities (R25)	Represent the response of higher education to carrying capacity	+	

The evaluation of educational ecological carrying capacity at the county level is the result of the comprehensive action of multiple factors. This paper fully refers to the existing relevant research, and on the basis of selecting the entropy method to determine the objective weight of indicators, the current multi-objective weighted function method was adopted to establish the comprehensive evaluation model of educational ecological carrying capacity. The specific steps are as follows:

(1) Standardized treatment. Before determining the weight, the raw data of indicators are processed dimensionless, so as to eliminate the difference between indicators. The specific process and formula are as follows:

$$\text{Positive : } Z_{ij} = \frac{x_{ij} - \min\{x_{ij}\}}{\max\{x_{ij}\} - \min\{x_{ij}\}}, \quad (1)$$

and

$$\text{Negative : } Z_{ij} = \frac{\max\{x_{ij}\} - x_{ij}}{\max\{x_{ij}\} - \min\{x_{ij}\}}. \quad (2)$$

In Formulas (1) and (2): x_{ij} is the original value of the item j index in i -th year; Z_{ij} is the normalized index values; and $\max\{x_{ij}\}$ and $\min\{x_{ij}\}$ are the maximum and minimum values, respectively.

Formula (2) Quantization of the same degree. Calculate the proportion P_{ij} of the index value Z_{ij} in the i -th year in all statistical years. And the calculation formula is:

$$P_{ij} = \frac{Z_{ij}}{\sum_{i=1}^n Z_{ij}}. \quad (3)$$

Formula (3) The entropy method confirms the right. Calculate the first j entropy value of index e_j , the utility value d_j and the weight w_j , in which the lower the entropy value, the higher the utility value, that is, the greater the impact on the comprehensive evaluation results. The calculation formulae is as follows:

$$e_j = -k \sum_{i=1}^n P_{ij} \ln P_{ij}, \quad k = \frac{1}{\ln n}, \quad (4)$$

$$d_j = 1 - e_j, \quad \text{and} \quad (5)$$

$$w_j = \frac{d_j}{\sum_{j=1}^m d_j} \quad j (1 \leq j \leq m). \quad (6)$$

In Formula (4): when $P_{ij} = 0$, make $P_{ij} \cdot \ln P_{ij} = 0$.

Formula (4) Comprehensive evaluation. Index weight w_j is combined with standardization value Z_{ij} of each index, and the comprehensive evaluation index $EECC_i$ of ecological carrying capacity level of the county education is obtained. The calculation formula is:

$$EECC_i = \sum_{j=1}^m w_j Z_{ij} \quad (7)$$

2.2.2. Analysis of the Influencing Factors

The ecological carrying capacity of education is an important support for the high-quality development of regional education, and also an important backing for the sustained and stable operation of the economy and society [37]. Exploring the influencing factors of the ecological carrying capacity of county education and identifying its formation mechanism can provide theoretical support for promoting the sustainable development and spatial control of county education. The ecological carrying system of county education is a typical dynamic composite system, which is influenced by economy, society, population, industry, science and technology, resources and other factors [38–40]. In the process of rapid urbanization, the population and resource elements gradually flow into and migrate to the urban spatial areas as a whole, and the moving population will inevitably put forward a persistent rigid demand for basic education in the inflow areas. The larger the urban scale, the more severe the challenge of carrying capacity of educational resources it will face. The internal institutional factors, the investment level and allocation mode of educational resources, and the constraints of the educational resources will directly determine the carrying capacity of the local education. In this paper, the following factors are mainly considered in the study of the influence of economic structure adjustment on the ecological carrying capacity of county education: (1) Industrial structure refers to the composition of various industries and the proportional relationship between industries. Industrial structure adjustment will often bring about the transfer of labor force and the change of talent-demand structure, while the development of educational structure can guarantee the transformation and upgrading of industrial structure; (2) Education investment is one of the forms of redistribution and reuse of national income. It is also the material basis that determines the development of education. The investment of assets provides the necessary teaching elements and teaching environment for the development of education.

The improvement of education investment level will directly improve the quality of existing human capital, thus improving the labor production efficiency; (3) Financial structure refers to the scale increase, proportion change and interaction mode of various types of financial components. Its impact on social and economic development is mainly realized through financial intermediaries, financial markets and financial services; (4) There is a big gap between urban and rural income distribution and consumption structure in Chongqing. Urban areas have greater economic radiation capacity and a higher level of public infrastructure; the distribution of educational resources is unbalanced, and the advantages of educational resources in urban areas are obvious. After comprehensively considering the availability of indicators and their correlation with the ecological carrying capacity of education, this paper selects 10 indicators to analyze differences in their influence on the ecological carrying capacity of county education (Table 2).

Table 2. Variables index system of multiple linear regression model.

Variables	Symbols	Definitions
Carrying capacity index	Eecc	Educational ecological carrying capacity
Industrial structure	Indst	Tertiary industry output/other industry output
Investment structure	Invest	Total social fixed asset investment/GDP
Financial structure	Finst	Year-end balance of savings deposits of urban and rural residents/GDP
Urban and rural income distribution structure	Incst	Urban per capita annual income/Rural per capita annual income
Consumption structure of urban and rural residents	Const	Urban per capita consumption expenditure/Rural per capita consumption expenditure
Social consumption structure	Socst	Total retail sales of consumer goods/GDP
Employment structure	Empst	Number of non-private sector workers/total population
Share of education expenditure	Eduex	Education expenditure/total local financial expenditure
Share of expenditure on culture, sports and media	Culex	Expenditure on culture, sports and media/Total local financial expenditure
Population urbanization rate	Urbrat	Urban population/total population

Differences in the influence of economic structure adjustment on the ecological carrying capacity of county education are identified by the multiple linear regression method, and the linear relationship between the dependent variables and independent variables can be revealed by regression analysis through the given values of several explanatory variables [41]. The general form of this model is as follows:

$$Y_i = b_0 + b_1X_{1i} + \dots + b_{ji}X_{ji} + U_i. \quad (8)$$

In Formula (8): i is the sample size, that is, the number of districts and counties; b_{ji} is the variable coefficient of the equation, $j = 1, 2, \dots, i$; U_i is the residual term.

3. Results

3.1. The Temporal Evolution Law of County Education Ecological Carrying Capacity

It can be seen that from 2011 to 2015, the ecological carrying capacity of county education in Chongqing showed a steady upward trend, rising from 0.263 in 2011 to 0.423 in 2017, with a high growth rate, with an average annual growth rate of 8.7% (Figure 2). Among them, the growth rate from 2011 to 2015 was significantly higher than that after 2015, which shows that the development level of county education in Chongqing had entered a gentle high-quality development stage from a high-speed growth stage after 2015. On the whole, the basic economic foundation level of Chongqing municipality was steadily enhanced during the research period, the social security system continuously

improved, the concept and consciousness of high-quality education development became more advanced, the investment in education infrastructure continuously increased, and the ecological carrying capacity of county education continuously and steadily improved.

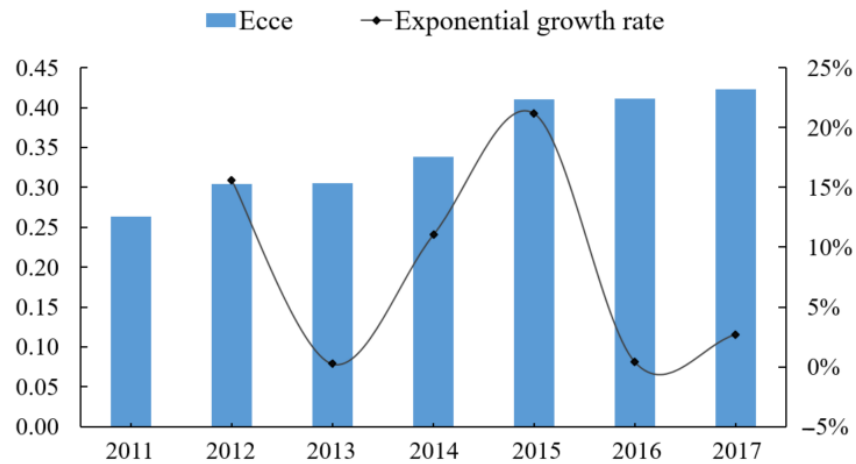


Figure 2. Time sequence change of the comprehensive evaluation index of education ecological carrying capacity in Chongqing county from 2011 to 2017.

During the research period, the five subsystems of Chongqing's county education ecological carrying capacity system, namely driving force, pressure, state, influence and response, showed characteristics of steady development (Figure 3). Among them, the pressure subsystem index had the smallest impact on the overall carrying capacity, and its growth rate was the lowest, increasing by 0.003, which indicated that the supply of various educational resources such as manpower, material resources and land needed for the development of Chongqing's county education was sufficient during the research period. The driving force subsystem index had a relatively high impact on the overall carrying capacity, but the growth rate was relatively small, which indicates that Chongqing had good economic and social security in the development process of educational ecological carrying capacity. The state subsystem index had the biggest impact on the overall carrying capacity with the highest growth rate, rising by 0.074 from 2011 to 2017, which indicates that the situation of educational resources and carrying status in Chongqing county is considerable. The influence subsystem index showed a slow growth trend, with an increase of 0.017 in the past seven years, which indicates that although the improvement of the education carrying capacity in Chongqing's county has significant economic and social benefits, its benefit potential has not been fully played. The influence of the response subsystem index on the overall bearing capacity was in a secondary position, with a large increase of 0.057 in seven years, which indicates that Chongqing has taken positive measures in aspects of economy, society and resources in the development of the ecological carrying capacity of education.

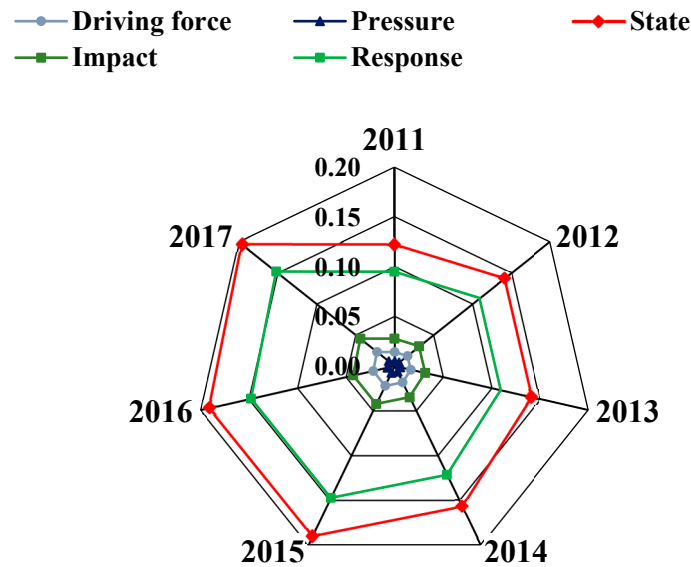


Figure 3. Comparison of the score of ecological carrying capacity standard layer of county-level basic education in Chongqing from 2011 to 2017.

3.2. Law of Spatial Differentiation of Ecological Carrying Capacity of County Education

There are great differences in the economic development conditions, industrial policy environment, endowment of educational resource, and infrastructure of public facilities in different regions, which leads to obvious regional differences in educational ecological carrying capacity. Based on two time-sections in 2011 and 2017, this paper makes a comparative analysis using spatial visualization, and uses the natural fracture method to grade the ecological carrying capacity of county education (Figure 4).

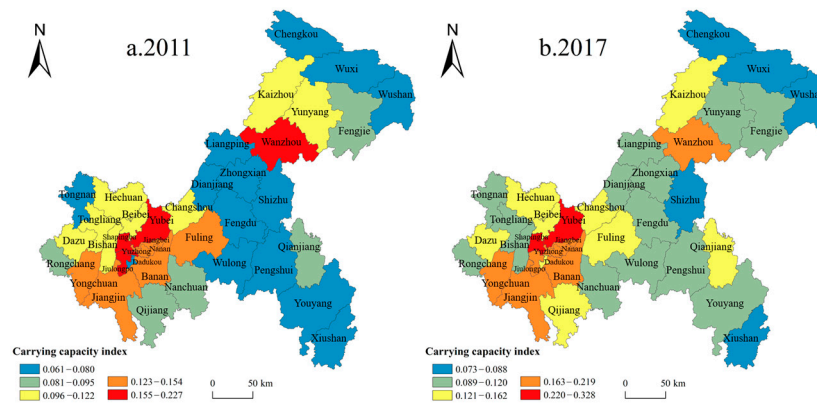


Figure 4. Spatial differentiation pattern of ecological carrying capacity of county education in Chongqing in 2011 to 2017. Note: Based on the standard map (scale 1:48 million) with the approval number of GS (2019) 1823 on the standard map service website, the base map has not been modified.

In 2011, the ecological carrying capacity of education in most districts and counties in Chongqing was relatively low and there was obvious regional imbalance. Among them, the educational ecological carrying capacity of 50% of the districts and counties was less than 0.1, and the regions with the highest educational ecological carrying capacity were Shapingba, Yubei and Wanzhou, and the educational ecological carrying capacity of Chengkou was the lowest. The areas with high carrying capacity in addition to Wanzhou, were mainly concentrated in the metropolitan area of Chongqing, with more obvious agglomeration characteristics. The northeast area of Chongqing was slightly better than the southeast area of Chongqing. The common characteristics of the areas with high carrying

capacity are a high level of economic development and a good endowment of education resources, social services and public facilities, which have played a vital role.

In 2017, the level of ecological carrying capacity of county education in Chongqing had improved overall, and the proportion of cities with a carrying capacity lower than 0.1 had decreased to 31.6%. Cities with faster growth rates were concentrated in the metropolitan areas of Chongqing, especially Yubei and Shapingba, which have been continuously improved. The overall growth rate of county education ecological carrying capacity in southeast Chongqing and northeast Chongqing was slow. In this stage, Chongqing municipal government had taken measures to improve school conditions, strengthen the standardization of schools, and provide educational technology and equipment in southeast and northeast Chongqing, which were relatively backward in economic and social development, and achieved remarkable results.

3.3. The Trend of Spatial Expansion of Ecological Carrying Capacity of Basic Education at the County Level

In order to further explore the spatial pattern and formation mechanism of ecological carrying capacity of county education, the development process of ecological carrying capacity of county education in Chongqing was revealed from the perspective of regional spatial gradient evolution. In this paper, the trend lines of transects in 2011 and 2017 were drawn and compared by using the spatial analysis method of the trend surface (Figure 5). In 2011 and 2017, the trend of ecological carrying capacity in Chongqing county had not changed much. On the whole, it was high in the west and low in the east, with an inverted U-shaped structure from north to south. The high value points were concentrated in the west and central areas of Chongqing, and the spatial directivity was more prominent. The metropolitan areas with developed urbanization had obvious educational advantages. Compared with 2011, the curve in 2017 was smoother, indicating that the gap of educational ecological carrying capacity had a trend to narrow.

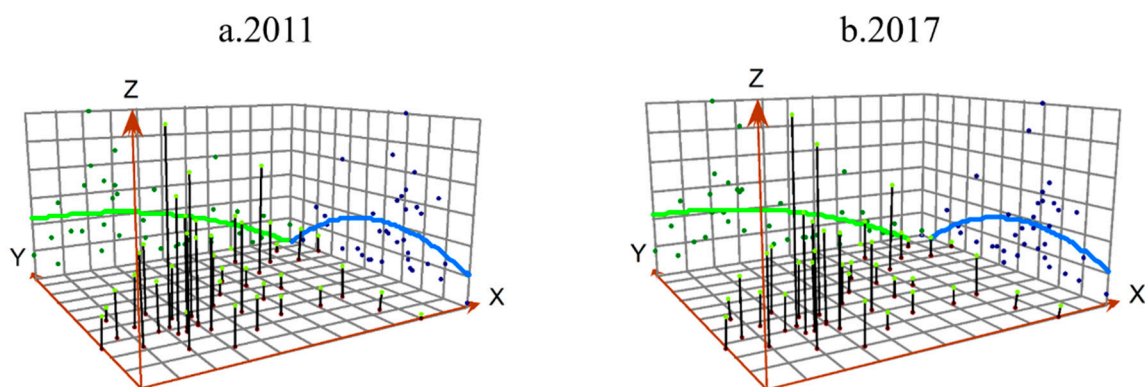


Figure 5. Trend of ecological carrying capacity of county education in 2011–2017.

3.4. Influence of Economic Restructuring on the Ecological Carrying Capacity of County Education

In the process of multiple linear regression analysis, the R^2 of the models in 2011 and 2017 were 0.606 and 0.617, respectively, and the degree of linear regression fitting became higher year by year, which indicates that the explanatory ability of explanatory variable to dependent variable was constantly enhanced. In 2011, the industrial structure, the consumption structure of urban and rural residents, the employment structure and the share of education expenditure had a significant impact on the ecological carrying capacity of county education (Table 3). All variables had positive effects, among which the investment in education funds had the greatest impact, with the standardization coefficient of 0.15. During this period, the overall level of ecological carrying capacity of county education in Chongqing was relatively low. Affected by historical factors of regional development and location advantages, the central city and western Chongqing, which developed earlier,

had a good foundation of factors such as population, economy, industry, resources and services elements, and was able to invest more educational resources. Moreover, all kinds of factors were still transferring and gathering continuously, and the educational ecological carrying capacity of these areas was relatively higher than other regions at this stage. In 2017, the urban and rural income distribution structure, employment structure, and cultural and media expenditure share had a significant impact on the ecological carrying capacity of county education, among which the share of cultural and media expenditure had the highest degree of impact, with a standardized coefficient of 0.326. With the continuous advancement in the construction of beautiful countryside in China and the successive proposals of strategies such as poverty alleviation and rural revitalization, the investment in education funds and resources in northeast and southeast Chongqing, which are mainly rural areas, has been increased, the infrastructure has gradually improved, the ecological carrying capacity of education in these two areas has gradually improved, and the imbalance of regional education development has been alleviated.

Table 3. Results of the multiple linear regression equations.

Year	Variable	B	Std.	β	t	Sig.
2011	(Constant)	0.104	0.061		1.715	0.098
	Invest	0.04	0.019	0.288	2.111	0.044
	Const	0.053	0.02	0.558	2.682	0.012
	Empst	0.299	0.146	0.764	2.049	0.05
	Eduex	0.37	0.15	0.298	2.475	0.02
2017	(Constant)	0.312	0.114		2.742	0.011
	Incst	0.091	0.039	0.658	2.358	0.026
	Empst	0.385	0.139	0.912	2.777	0.01
	Culex	0.769	0.326	0.343	2.91	0.007

4. Discussion

4.1. The Complexity and Differences of the Factors Affecting the Educational Ecological Carrying Capacity

Since 2011, the ecological carrying capacity of county education in Chongqing has continuously improved. With the help of DPSIR, we can objectively understand the development and evolution of the ecological carrying capacity in Chongqing (Figure 6). In the process, “driving force” was the fundamental driving force and potential factor that led to the change in ecological carrying capacity of education, and it was also the key to promoting and restricting development of county education. In the process of urbanization, social and economic development will inevitably bring about the migration and growth of the population, which will lead to an increased demand for education in the region, and will also lead to problems such as tension between supply and demand in the field of education, imbalance of educational allocation, and so on. Improvement of educational infrastructure and improvement of the carrying capacity of educational resources requires the support of economic and social development. “Pressure” is the direct factor that exerts itself on the educational ecosystem and makes it change, and it is the burden on educational activities on resources and environment under the direct or indirect effect of “driving force”. In the education ecosystem, in order to alleviate the continuously expanding educational demand and ensure educational equity, it is necessary to expand investment in national educational resources, rationally allocate educational resources including land, funds, teachers and environment, and constantly build new educational infrastructure. Whether the allocation of educational resources is reasonable, whether the demand for educational land can be met, and whether the supply capacity of facilities and equipment is sufficient are the main sources of “pressure”, which will not only restrain the driving force, but also burden the “State”. “State” is the direct reflection and representation of the “driving force”, and is the current situation of education ecological carrying capacity under the effect of pressure, marking the current level of education ecological carrying capacity and

the future development trend, and can be directly reflected through the implementation situation of education, the current situation of educational teachers and the supply level of educational resources. “Impact” describes the potential consequences caused by change in the ecological carrying capacity of basic education, and is the impact and feedback of the current situation of the educational ecological carrying capacity on the society and economy under the combined action of the first three subsystems. “Response” refers to the measures taken by the whole society in response to the changes that have taken place. It is mainly the policies and regulations formulated or specific measures taken by relevant government administrative departments in the process of urban construction. It aims to improve the ecological carrying capacity of education by increasing investment in science and technology, improving urban public service facilities, improving the living ecological environment, and improving the quality of personnel [42].

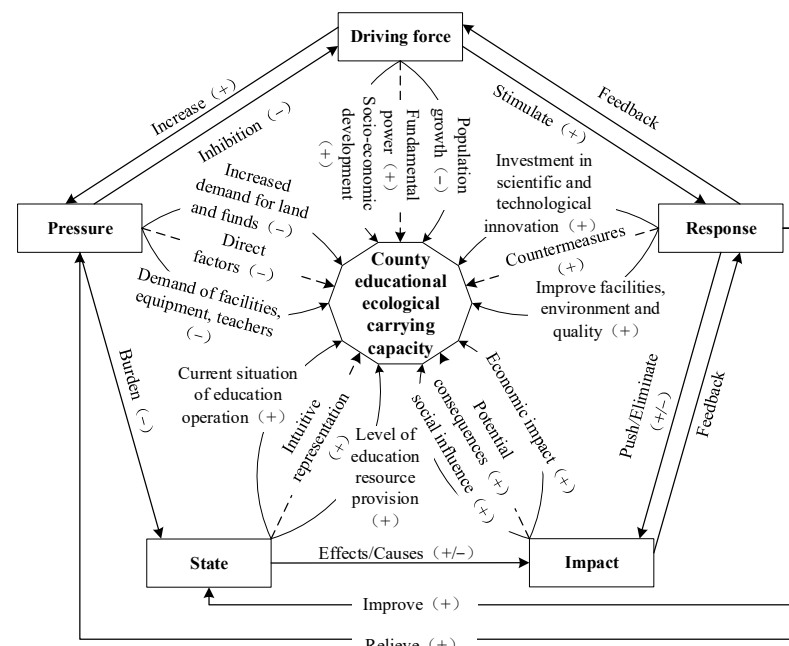


Figure 6. Analysis of the mechanism of the ecological carrying capacity of county education under the DPSIR concept.

Through multiple linear regression analysis, it was found that industrial structure, consumption structure of urban and rural residents, employment structure, share of education expenditure, income distribution structure of urban and rural areas, and share of cultural and media expenditure had a significant impact on education carrying capacity in different periods, and the impact strength was obviously different. The development and transformation of society profoundly affects the nature, purpose, content, structure and management system of education. The development of productive forces affects and restricts the scale and speed of educational development, the selection and development of teaching methods and teaching organization forms, and the training specification and structure of talents. The change of technology will change the concept of educators and educational objects and provide the necessary ideological elements and technical conditions for the renewal and development of educational materials. At the same time, the size of the population will determine the scale of education, the quality of the population will affect the quality of education, and the population structure will affect the education structure. Differences in economic and social development between regions will inevitably lead to differences in the development of education, which verifies the complexity of the spatial differentiation law of educational carrying capacity, and also increases the difficulty of analyzing its driving mechanism.

4.2. Possible Problems of the Education Ecological Carrying Capacity Improvement and Resource Co-Construction and Sharing Paths

Since Chongqing became a municipality directly under the central government, the rapid development of urban economic construction has also led to the rapid rise in the urban education level. However, the education level of rural areas with a high proportion of the population lags far behind that of cities, especially the development of basic education, which shows a serious unbalanced state. The first reason is that the input of education funds is insufficient and unbalanced. The main body of basic education funds in rural areas is the limited financial ability of local government, the shortage of funds, and the conditions for running schools, which are far lower than those in urban areas. Secondly, there are many high-quality schools and teacher resources in the central cities with the city as the main body, and the excellent teachers in southeast and northeast Chongqing with the countryside as the main body are seriously lost. Excellent teachers and students tend to choose schools with rich educational resources, resulting in continuous polarization of educational development between urban and rural areas and regions. In addition, in the process of rapid urbanization, along with the transfer of the rural labor force to cities, there has been large-scale population mobility, and the educational needs of children who move with them have brought great challenges to cities. The objective resource constraints of the city itself and the internal institutional factors of the supervisor can easily lead to an imbalance between supply and demand of educational resources, resulting in limited capacity expansion of urban educational resources, and the rational spatial allocation of educational resource elements urgently needs to be improved.

Under the background of the new era, in order to solve the imbalance of educational resources between urban and rural areas, it is necessary to continuously improve the adaptability and flexibility of the supply structure of educational resources to changes in educational needs and realize the spatial matching between educational population and resources. Fair and inclusive, timely supplement of educational resources for the school-age population, active educational financial investment and scientific and reasonable educational land planning determine the improvement quality of regional educational resources carrying capacity. Based on this, it is necessary to coordinate the supply and demand relationship between the education-age population and resources in the county from a practical level, adjust the education management mechanism in time according to the management range, and explore the information exchange mechanism, resource mutual construction mechanism, talent mutual education mechanism, achievement mutual sharing mechanism, focus on the improvement of the educational ecological environment in the region, strengthen the timely supplement of educational resources and the sustainable driving force of endogenous development. Most parts of the world are facing the same problem of unbalanced and insufficient education development as Chongqing. Based on the DPISR model, this paper studies the evolution of the development of Chongqing's educational ecological carrying capacity and finds that Chongqing has effectively improved the level of education development in the region through a series of measures, narrowed the gap in the development of education within the region, and provided experience cases for the development and management of education in the vast underdeveloped regions.

4.3. Research Limitations

This study also has some limitations. Due to the limitation of statistics and acquisition of basic data, the time series of data in this paper is short, which cannot be compared with a longer period, and cannot completely reveal the temporal and spatial evolution law of educational ecological carrying capacity. At present, the research on educational carrying capacity is mainly qualitative research, and there are few research results for reference. The construction of the index system needs to be further improved and optimized. For example, education development is closely related to political and economic systems, local culture, science and technology, and so on, but these factors are difficult to quantify, and there is a lack of relevant indicators in the construction of a carrying capacity and influencing factors

index system. At the same time, the level of educational carrying capacity is also affected by micro factors such as school management level, teachers' personal abilities, and so on. Further field investigation and visits are needed for more micro research.

5. Conclusions

(1) The level of ecological carrying capacity of county education in Chongqing is rising steadily from the time sequence, and all the five subsystems show the characteristics of stable development, but the influence of each subsystem on the overall carrying capacity is different. The steady growth of county economic development level in Chongqing, the perfection of the social security system, the continuous innovation of educational concepts and the continuous investment in educational infrastructure have promoted the steady improvement of county educational ecological carrying capacity, with an average annual growth rate of 8.7%. Among them, the state subsystem has the strongest effect on carrying capacity improvement, followed by the response subsystem. On the whole, in the process of improving the ecological carrying capacity of education in Chongqing, effective measures have been implemented in five levels: internal driving force, pressure, state, influence and response.

(2) There is obvious regional imbalance in the ecological carrying capacity of county education in Chongqing. The districts and counties with high carrying capacity are mainly distributed in the central and western regions, which are mainly cities and towns. From 2011 to 2017, the regional differences of ecological carrying capacity of county education showed a narrowing trend, and the regional balance continued to improve, but the reduction rate was slow.

(3) The ecological carrying capacity of county education in Chongqing is the result of a multi-factor compound system, and there are obvious differences in the influencing factors in different development stages. On the whole, industrial structure, urban and rural residents' consumption structure, employment structure, share of education expenditure, urban and rural income distribution structure, and share of culture and media expenditure have a positive relationship with the promotion of educational ecological carrying capacity in different periods, and the influence is obvious.

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