Study on coupling of new urbanization and environmental quality in Qinghai Province

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Abstract. This paper selects the index data of population, economy and space from 2000 to 2019, establishes an evaluation index system for the level of new urbanization and environmental quality in Qinghai Province, studies the coordination between new urbanization and environmental quality in Qinghai Province by establishing a coupling coordination model, and puts forward countermeasures and suggestions for the coordinated development of new urbanization and environmental quality in Qinghai Province.

Keywords: New urbanization; Environmental quality; Coupling coordination.

1 Introduction

China has a population of nearly 1.4 billion, with a large proportion of rural population, large gap between urban and rural areas and regions, irrational economic development structure, and urbanization is an inevitable choice.Grossman and Kruger (1995) used econometric methods to conduct empirical research and put forward the famous Environmental Kuznets Curve Hypothesis (EKC) [1]. Liu Yaobin et al. (2005) quantitatively revealed the main factors of the coupling between urbanization and ecological environment system in various provinces of China [2]. There is little research on the relationship between new urbanization and environment in Northwest China, especially Qinghai Province, which is also the significance and innovation of this paper.Urbanization has many rich connotations. New urbanization is people-oriented, establishing modern civilization and realizing the goal of common prosperity [3].

2 Overview of new urbanization level and environmental quality in Qinghai Province

2.1 Development status of new urbanization in Qinghai Province

Population urbanization change: The urbanization level of Qinghai Province has an obvious upward trend from 1996 to 2019. Economic urbanization changes: In 2019, the per capita GDP of Qinghai Province increased to 48,981 yuan. Spatial urbanization change: the

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construction land area of Qinghai Province is 202.43 square kilometers in 2019.

2.2 Dynamic changes of environmental quality in Qinghai Province

Environmental pollution control: In the past 19 years, the sewage treatment rate in Qinghai Province has increased by 11.51 times and the utilization rate of industrial solid waste has increased by 3.66 times. Energy consumption: From 2000 to 2019, the total energy consumption in Qinghai Province increased as a whole.

3 Coupling analysis of new urbanization construction and environmental quality in Qinghai Province

3.1 Regression analysis

It is of economic significance to use Eviews software to regress the new urbanization and environmental quality in Qinghai Province. Taking the comprehensive score of new urbanization as independent variable and the comprehensive score of environmental quality as dependent variable (Table 1), it is found that there is a cubic functional relationship between them, and a regression model is established:

Table 1. Comprehensive score of urbanization level and environmental quality in each year.

age	Comprehensive score of urbanization level	Comprehensive score of environmental quality
2000	-0.038	0.146
2001	-0.001	0.329
2002	0.027	0.171
2003	0.068	-0.047
2004	0.097	-0.089
2005	0.127	-0.03
2006	0.19	0.057
2007	0.227	0.159
2008	0.301	0.253
2009	0.354	0.441
2010	0.418	0.451
2011	0.507	0.644
2012	0.554	0.606
2013	0.577	0.637
2014	0.63	0.675
2015	0.601	0.606
2016	0.623	0.624
2017	0.645	0.657
2018	0.657	0.693
2019	0.681	0.635

Data source: Qinghai Statistics Bureau

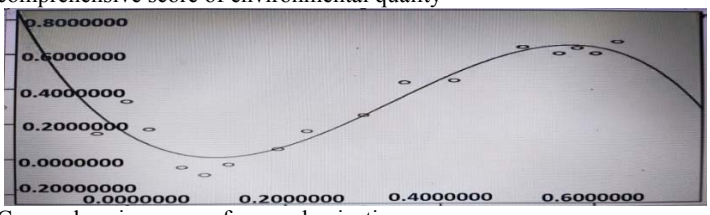
$$Y=\beta 0+\beta 1X3+\beta 2X2+\beta 3X \quad (1)$$

Y=0.143712-13.58813+13.83677X2-2.57712X (0.043566) (3.396949) (3.044518) (0.708266)

The adjusted determinable coefficient R2=0.898485 has high goodness of fit, which proves that there is a high correlation between them,The T values of constants C, X3, X2 and X are 3.298755, -4.000092, 4.544817 and -3.638626, respectively, which have passed the test, and F=45.25845 is larger than the critical value. Through fitting diagram, it is

found that there is an inverted "N" relationship between urbanization and environmental quality in Qinghai Province, which shows that environmental quality in Qinghai Province has been affected in the implementation of new urbanization(Figure1).

comprehensive score of environmental quality



Comprehensive score of new urbanization

Fig. 1. Regression curve fitting diagram of urbanization and environmental quality in Qinghai Province.

3.2 Coupling function

The coupling function in physics is

Cn=n{[UA(u1) UA(u2)*……Ua (un)]/(π ua (ui)+ua (uj))} 1/n*, which can be simplified as

$$C=2*\{[F(x)*E(y)]/[(F(x)+E(y))*(F(x)+E(y))]\}1/2 \quad (2)$$

In which c represents coupling degree, and F(x) and E(y) respectively represent comprehensive index of urbanization level and comprehensive index of environmental quality. The coupling degree is between [0,1].There are negative values in the comprehensive scores of urbanization and environmental quality in Qinghai province through factor analysis, so here we deal with the five negative values, which are as follows: M=F(x)+g(3), where m represents the positive comprehensive score, F(x) is the negative value in the comprehensive scores of new urbanization or environmental quality, and g represents a positive number as small as possible to make F(x) positive.

Table 2. Comprehensive score and coupling degree after processing.

age	Comprehensive score of urbanization	Comprehensive environmental score	Coupling degree c
2000	0.002	0.146	0.217
2001	0	0.329	0.015
2002	0.027	0.171	0.686
2003	0.068	0.003	0.414
2004	0.097	0.001	0.146
2005	0.127	0.001	0.127
2006	0.19	0.057	0.844
2007	0.227	0.159	0.984
2008	0.301	0.253	0.996
2009	0.354	0.441	0.994
2010	0.418	0.451	0.999
2011	0.507	0.644	0.993
2012	0.554	0.606	0.999
2013	0.577	0.637	0.999
2014	0.63	0.675	0.999
2015	0.601	0.606	1
2016	0.595	0.587	0.995
2017	0.657	0.637	0.993
2018	0.684	0.662	0.999
2019	0.713	0.702	0.999

The coupling degree calculated according to formula (2) is shown in Table 2, and it is

found that it can not accurately reflect the coordination degree of coupling between new urbanization and environmental quality in Qinghai Province, so the coupling coordination model is introduced:

$$D=(C*T)(1/2) \tag{4}$$

$$T=\alpha F(x)+\beta E(y) \tag{5}$$

In the formula, D stands for coupling coordination degree, which ranges from [0,1], T stands for comprehensive evaluation index of urbanization and environmental quality reflecting the overall contribution of urbanization and environmental quality, and α and β respectively represent the weights of urbanization and environmental quality representatives,In Qinghai Province, urbanization and environmental quality are equally important, so α and β each take 0.5, and the division scope of coupling coordination degree is divided by scholars as follows [4]:

Table 3. Classification standard of coupling coordination degree.

Coupling coordination degree (D)	Degree of coordination
0—0.09	Extreme imbalance
0.10—0.19	Serious maladjustment
0.20—0.29	Moderate maladjustment
0.30—0.39	Mild maladjustment
0.40—0.49	On the verge of disorder
0.50—0.59	Reluctantly coordinate
0.60—0.69	Primary coordination
0.70—0.79	Intermediate coordination
0.80—0.89	Good coordination
0.90—1.00	Quality coordination

3.3 Research conclusion of coupling between new urbanization and environmental quality in Qinghai Province

According to the coupling degree model and coupling coordination degree model, the following table is obtained:

Table 4. Coupling coordination degree and grade of urbanization and environmental quality in Qinghai Province.

year	Comprehensive index t	Coupling coordination degree d	Coupling coordination level
2000	0.074	0.127	Serious maladjustment
2001	0.164	0.05	Extreme imbalance
2002	0.099	0.26	Moderate aladjustment
2003	0.036	0.122	Serious maladjustment
2004	0.049	0.084	Extreme imbalance
2005	0.064	0.09	Extreme imbalance
2006	0.124	0.323	Mild maladjustment
2007	0.193	0.436	On the verge of disorder
2008	0.277	0.525	Reluctantly coordinate
2009	0.397	0.628	Primary coordination
2010	0.435	0.659	Primary coordination
2011	0.575	0.756	Intermediate ordination
2012	0.58	0.761	Intermediate ordination
2013	0.607	0.779	Intermediate ordination
2014	0.652	0.808	Good coordination
2015	0.604	0.777	Intermediate ordination
2016	0.643	0.813	Good coordination
2017	0.675	0.834	Good coordination
2018	0.712	0.857	Good coordination
2019	0.671	0.783	Intermediate ordination

It can be seen from Table 4 that from 2000 to 2019, the coupling coordination between new urbanization and environmental quality in Qinghai Province fluctuated horizontally. Generally speaking, there is still much room for improvement in urbanization and environmental system in Qinghai Province.

4. Countermeasures and suggestions on coordinated development of new urbanization and environmental Quality in Qinghai Province

1.Optimize industrial structure 2. Increase investment in science and technology 3. Increase investment in environmental protection. This paper analyzes the environmental quality and urbanization in Qinghai Province in detail, which plays an important role in the development of economy, society and environmental quality in Qinghai Province.

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