Research on Evaluation and Countermeasure of Urban-Rural Integration in Jiangsu Province

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Abstract: Due to unbalanced development among its cities, urban-rural integration situation is quite differentiated in Jiangsu province. To further assess integration level for 13 cities in Jiangsu province, this paper selected 12 indicators from five aspects, namely economy, public service, environment, infrastructure and social security. Then Principal Component Analysis (PCA) was utilized to arrive at cities' scores respectively. Finally, advises on policies were given out based on analysis results and current development landscape.

1. Introduction

Integrated development is an important method in achieving town-country integration, and the remarkable progresses made by China in this aspect since reform and opening up are the best examples. They not only accelerated modernization process, but are also precious lessons for other countries. As the economically most active province, Jiangsu has no parallel in economic competitiveness, but it still faces challenges from unbalanced development. Among Jiangsu cities, 13 were selected as samples for research in this case. 12 indexes were picked out from five subsystems including economy, public service, environment, infrastructure as well as social security. Finally, the paper associated results with empirical studies and stated relevant advises.

2. Urban-Rural Integration Evaluation Based on Pca

Many scholars have conducted in-depth researches into urban-rural integration evaluation. To name a few, Qi Lili (2007) combined PCA and Analytic Hierarchy Process (AHP) to observe relations between urban and rural integration; Jiang Songfang (2011) built index system through frequency analysis and theoretical analysis, and determined indexes' weight through AHP, finally arrived at the evaluation of town-country integration;and Ding Fan (2019) accomplished assessments through the combination of Factor Analysis and Entropy Method. This paper focused on the urban-rural integration within Jiangsu province, utilized PCA to calculate comprehensive scores at the first place for analysis, then based on scores in different principle components and correlation factors, presented corresponding advises on policies, aiming to promote progress in integration within Jiangsu.

2.1 Establishing Index System

Indexes were chosen from five subsystems, economy, public service, environment, infrastructure and social security, following the principles of being systematic, comparable and objective. From economy aspect service sector's GDP and disposable income per ca pita were selected. It's natural reasoning that development in service sector would contribute to bridging income gap between urban and rural areas, that is to say, economic indexes can to some extent explain the effects economic development extracted on urban-rural integration. This paper also identified two public service indexes, the number of medical and health institutions, and the number of doctors per ten thousand population, to reflect residents living standards. When it comes to environmental indexes, sewage disposal rate, collection and transported volume of domestic waste, green coverage in

constructed areas, as well as daily disposal capacity of innocuous disposal plants were picked for they represent the ability residents possess to live in harmony with nature in certain areas. In infrastructure per ca pita floor area of residential buildings and paved road area total by the year end, and in social security enrollment in ordinary middle schools and proportion of urban residents were chosen for they deliver messages in integration potential and life quality respectively. Data source of this paper is *Jiangsu Statistical Yearbook (2018).*

Table 1 Indexes System

	Index	Serial Number
economy	GDP of service sector	X1
	per ca pita disposable income of residents	X2
public service	the number of medical and health institutions	X3
	the number of physicians per ten thousand population	X4
environment	sewage disposal rate	X5
	collection and transported volume of domestic waste	X6
	green coverage in constructed areas	X7
	daily disposal capacity of innocuous disposal plants	X8
infrastructure	per ca pita floor area of residential buildings	X9
	paved road area total by the year end	X10
social security	enrollment in ordinary middle schools	X11
	proportion of urban residents	X12

2.2 Analysis Procedure

One major function of PCA is reducing dimensions. Through substitution of multiple factors by integrated components, we would arrive at a much more simplified model composed of independent comprehensive components without loss of original information.

2.2.1 Standardizing Indexes

Differences in calculation units would influence evaluation result and impair its practical significance. In this case exist both aggregate indicators such as GDP of service sector and ratio ones like sewage disposal rate, so that it's necessary to standardize indexes before PCA process to eliminate possible interference.

2.2.2 Extracting Principal Components

After loading collected data into SPSS 22 and software calculation followed, 3 principal components whose eigenvalues exceed 1 were extracted with the assistance of correlation coefficient matrix. Their accumulated contribution mounted to 87.503%, nearly all the information contained in original data, thus could be used to conduct evaluation process.

2.2.3 Calculating and Ranking the Scores and Comprehensive Scores

On unrotated component matrix, apply:

$$e_{ij} = a_{ij} / \sqrt{\lambda_i}$$

Table 2 Scores of Principal Components

	1	2	3
Zx1	.35	-.02	.17
Zx2	.32	.26	.23
Zx3	.31	-.26	-.07
Zx4	.35	-.05	-.07
Zx5	.18	.53	-.16
Zx6	.37	-.10	.01
Zx7	.11	.26	-.73
Zx8	.33	-.10	.21
Zx9	-.09	.39	.54
Zx10	.36	-.09	-.06
Zx11	.07	-.54	.02
Zx12	.35	.21	.05

Then we would at standardized eigenvectors, or the scores of principal components, revealing linear relations between principal principal components and indexes. See Table 2.

Scores of principal components were calculated through multiplication of standardized data vectors by standardized eigenvectors. Set Y1, Y2, Y3 to identify the first, second and third principal component, then score function could be expressed as follows:

Y1=0.35Zx1+0.32Zx2+0.31Zx3+0.35Zx4+0.18Zx5+⋯+0.35Zx12

Y2=-0.02Zx1+0.26Zx2-0.26Zx3-0.05Zx4+0.53Zx5+⋯+0.21Zx12

Y3=0.17Zx1+0.23Zx2-0.07Zx3-0.07Zx4-0.16Zx5+⋯+0.05Zx12

Comprehensive scores were reached by introducing variance proportion as weights.

Y=0.59691Y1+0.17045Y2+0.10767Y3

Table 3 Ranking of Comprehensive Scores

City	Y1	Y2	Y3	Y	Ranking
Nanjing	6.2895162	-0.4184801	-1.8590278	3.482783659	1
Wuxi	2.4912231	1.1347519	0.2506744	1.707444555	3
Xuzhou	-0.1750632	-1.7190255	-0.6135781	-0.463568825	6
Changzhou	0.7589034	1.9200439	0.942522	0.881749855	4
Suzhou	3.856812	-1.1045396	2.292721	2.360758146	2
Nantong	-0.6944681	0.9022962	-0.3674385	-0.30030067	5
Lianyungang	-2.1578799	-2.1724377	1.2203708	-1.526954773	12
Huai’an	-1.5135566	-0.9228196	0.0069144	-1.060007197	10
Yancheng	-1.6698791	-1.6133836	-0.5397757	-1.329886418	11
Yangzhou	-1.1353343	0.819654	-0.9143873	-0.636434453	8
Zhenjiang	-1.4372001	1.9335523	-0.0018621	-0.528505614	7
Taizhou	-1.8627091	1.3656586	0.911147	-0.780989983	9
Suqian	-2.7503708	-0.1252549	-1.328294	-1.806090947	13

Table 3 reflects 13 analyzed Jiangsu cities’ scores in three principal components, their comprehensive scores and rankings in integration level. Obviously, rankings in terms of each principal component are not identical with rankings of comprehensive scores.

2.3 Analysis Results

Nanjing, the capital of Jiangsu province,took the lead in urban-rural integration, and its first principal component was the most significant contributor to its top ranking. Besides, relative high proportions of economy and public services in the first principal component as presented in the table of comprehensive scores, demonstrate their significance in urban-rural integration.

It can be observed that the top four cities with highest integration level, Nanjing, Suzhou, Wuxi and Changzhou, are all located in southern Jiangsu province, the most developed and modernized region in Jiangsu and China, of which the accordance with reality further stresses the importance of economy in integration process.

What's more, as sewage disposal rate was a major part constituting the second principal factor, we can draw indirectly from it a conclusion that environment is another crucial aspect worth improvement.

3. Advice on Policies

3.1 Facilitate the Leading Effect of Major Cities

The southern part of Jiangsu is a vital economic region of Jiangsu province. It enjoys advantageous location that attract abundant human resources, providing foundation for labor-extensive industries to establish factories. Besides, its convenient transportation network injects strong momentum in growth, pulling the region surpass others far ahead.

Learning from its experience we can conclude that government should increase investment in transportation construction in central and northern Jiangsu, to relieve the burden of inaccessibility that hinders economic development. Meanwhile, promotion should be conducted to encourage industrial sectors in southern Jiangsu to drive agricultural growth, thus boosting integrated

development model with the aim of common prosperity, and laying solid material foundation for urban-rural integration.

3.2 Promote Ecological Construction

Action must be taken to strengthen ecological evaluation and assessment mechanisms in all aspect, build up harmonious and green environment for both urban and rural regions, and improve environment quality for residents. Publicity should also be taken into consideration to promote awareness of environment protection and energy conservation, with cleaning work in both regions advanced. Particularly, constructions of disposal systems should be sped up for urban and rural areas to better deal with sewage and domestic garbage. Only in this way can we manage ecological problems from their very origins.

Seen from its comprehensive scores, Lianyungang disappointingly came to the last in terms of the second principal component. And according to original data it had the lowest sewage disposal rate compared to its peers, of only 91%. That suggests Lianyungang should pay more attention to constructing sewage disposal systems, with the hope of strengthening ecological protection and improving ecological integration between urban and rural areas.

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