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Study on Integrated Economic Strength Evaluation of Coastal Counties: Taking Liaoning Province as an Example

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Abstract. The integrated economic strength evaluation of coastal counties is an important area of study on regional competitiveness, and the research results may help government to make strategic adjustments in the distribution and structure. Based on a brief description of literature review, a method based on stakeholders' perspective is proposed to solve the integrated economic strength evaluation problem. In addition, the effectiveness of the proposed method is illustrated by the example as Liaoning province. Finally, some development proposals are proposed to promote coastal counties economy according to the evaluation result and characteristics.

Introduction

Coastal counties can get prosperity for trading with the world and will be easy to form manufacturing bases for processing trade, because they have convenient transportation conditions for international trade. Many scholars are attracted to the research of integrated economic strength evaluation for its widely application background. He (2014) designed evaluation index system based on the perspective of economy development demand in county level, and analyzed the supporting ability of science and technology in Anhui by means of analytic hierarchy process(AHP) [2]. Luo et al. proposed a method to evaluate the level of economic development of counties in Liaoning province based on entropy TOPSIS method. They took 44 counties of Liaoning province as research objects, and the evaluation index system was established from three aspects: economic development, people's living and investment consumption. Above mentioned methods have each advantage, but evaluation results rely too much on experts' preference. Evaluation objects are considered as passive objects in the above evaluation problems, but evaluation objects always have more complete evaluation information in fact. In order to highlight the democracy of evaluation process and make full use of evaluation information of the object itself, many scholars proposed new methods [3,4,5,6]. Li et al. (2012) proposed an objective self-determining evaluation method based on collaborative perspective, which can be used to solve interval number comprehensive evaluation problem [7]. Based on the models above, a method based on stakeholders' perspective is proposed to solve the integrated economic strength evaluation problem of Liaoning province.

Evaluation model

Let evaluation objects as $\boldsymbol{O}=(o_1, o_2,\ldots, o_n)$, and let evaluation indices as $\boldsymbol{X}=(x_1, x_2,\ldots, x_m)$. Then, the index observed value $x_{ij} = x_j\ (o_i)$ ($i= 1, 2,\ldots, n$; $j = 1, 2,\ldots, m$) is objective existence, and an $n\times m$ observed value matrix $\boldsymbol{A}$ can be constructed as follows: $\boldsymbol{A}=[x_{ij}]_{n\times m}=\begin{bmatrix} x_{11} & x_{12} & \mathrm{L} & x_{1m} \\ x_{21} & x_{22} & \mathrm{L} & x_{2m} \\ \mathrm{M} & \mathrm{M} & \mathrm{M} & \mathrm{M} \\ x_{n1} & x_{n2} & \mathrm{L} & x_{nm} \end{bmatrix}$. Let y_i be evaluation value of o_i.

We know that if one row vector is closely to another one in evaluation matrix $\boldsymbol{A}$, then the two evaluated objects might have more common interests. Based on the above analysis and literature [8], we give definition of benefit correlation coefficient from the view of proximity of vector.

Definition 1: Let $r_{ii'}$ be benefit correlation coefficient between evaluated object o_i and evaluated object $o_{i'}$, and benefit correlation coefficient is given by

$$r_{ii'} = x_i \cdot x_{i'} / \|x_i\| \cdot \|x_{i'}\|, \ i,i'=1,2,\ldots,n \tag{1}$$

where $\boldsymbol{x}_i=(x_{i1},x_{i2},\ldots,x_{im})$ is the row vector of matrix $\boldsymbol{A}$, and $\|x_i\|$ is the norm of $\boldsymbol{x}_i$. If the data of matrix $\boldsymbol{A}$ has been normalized, then $r_{ii'}\in[0,1]$. By definition 1, we know that the bigger the $r_{ii'}$ is, the more benefits evaluated objects get from the cooperation.

Definition 2: Let $c_{ii'}$ be net benefit coefficient between evaluated object o_i and evaluated object $o_{i'}$, and net benefit coefficient is given by

$$c_{ii}=r_{ii'}-(1-r_{ii'})=2r_{ii'}-1 \tag{2}$$

The formula (2) represents net benefit between evaluated object o_i and evaluated object $o_{i'}$ if they cooperate with each other. Obviously, $c_{ii'}\in[0,1]$. When $c_{ii'}>0$, cooperation between evaluated object o_i and evaluated object $o_{i'}$ does not more harm than good. When $c_{ii}=0$, cooperation brings same pros and cons. When $c_{ii'}<0$, cooperation does more harm than good, and evaluated object o_i is a competitor for evaluated object $o_{i'}$.

According to the assumption that we can obtain calculation model of index bargaining weight by

$$\max \sum_{i'=1}^{n} c_{ii'} \sum_{j=1}^{m} x_{ij} w_j^{(i)} \tag{3}$$

where $w_j^{(i)}$ is index weight value from the perspective of evaluated object o_i.

By literature [8], the index weight and evaluation value can be determined.

Application of the evaluation model

We determine the evaluation indices and evaluation objects by literatures [9], and the evaluation index value can be obtained by literatures [10]. In this case, there are six evaluation indices: gross regional domestic product (x_1), total income of public Finance & Budgeting (x_2), total retail sales of consumer goods (x_3), total export (x_4), incoming overseas capital in place (x_5), and gross fixed asset formation (x_6). The date unit of x_1, x_2, x_3, x_6 are ten thousand yuan, and the date unit of x_4, x_5 are ten thousand dollar. There are 32 coastal counties in Liaoning province, but there is no data of Changhai, Nanpiao, Suizhong and Jianchang about index x_5 in the literatures [10]. In order to guarantee the consistency of data statistics caliber, we choice the other twenty-eight coastal counties as evaluation objects. The twenty-eight coastal counties are Ganjingzi (o_1), Lvshunkou (o_2), Jinzhou (o_3), Wafangdian (o_4), Pulandian (o_5), Zhuanghe (o_6), Yuanbao (o_7), Zhenxing (o_8), Zhenan (o_9), Kuandian (o_{10}), Donggang (o_{11}), Fengcheng (o_{12}), Taihe (o_{13}), Heishan (o_{14}), Yixian (o_{15}), Linghai (o_{16}), Beizhen (o_{17}), Bayuquan (o_{18}), Laobian (o_{19}), Gaizhou (o_{20}), Dashiqiao (o_{21}), Shuangtaizi (o_{22}), Xinglongtai (o_{23}), Dawa (o_{24}), Panshan (o_{25}), Lianshan (o_{26}), Longgang (o_{27}), Xingcheng (o_{28}). The index data is shown in Table 1.

Table 1 Related economic data of coastal counties in Liaoning province

	x_1	x_2	x_3	x_4	x_5	x_6
o_1	9840379	337337	5060165	241733	19002	4972875
o_2	2884515	190077	755540	108539	4682	3121204
o_3	16112659	815939	4120294	849103	28978	13124345
o_4	9620162	376450	2040812	73843	13857	6285094
o_5	6872701	224795	1928713	147921	4977	5952733
…	…	…	…	…	…	…
o_{28}	1239447	119665	774771	10900	575	549721

According to the evaluation model, the comprehensive evaluation result can be obtained, and the comprehensive evaluation value and rank are shown in Table 2.

Table 2 Comprehensive evaluation value and rank of coastal counties

coastal counties	value	rank	*rank*	coastal counties	*rank*
o_1	0.7105	2	o_{15}	0.0588	26
o_2	0.1528	12	o_{16}	0.1402	13
o_3	0.9289	1	o_{17}	0.0648	24
o_4	0.4496	3	o_{18}	0.1920	9
o_5	0.3277	4	o_{19}	0.0506	27
o_6	0.3232	5	o_{20}	0.0808	18
o_7	0.0726	20	o_{21}	0.1663	11
o_8	0.2027	8	o_{22}	0.1306	15
o_9	0.0190	28	o_{23}	0.2393	6
o_{10}	0.0689	22	o_{24}	0.2251	7
o_{11}	0.1874	10	o_{25}	0.0595	25
o_{12}	0.1066	16	o_{26}	0.1318	14
o_{13}	0.1008	17	o_{27}	0.0789	19
o_{14}	0.0687	23	o_{28}	0.0708	21

Conclusion

The ideas of self-determining evaluation is introduced to solve integrated economic strength evaluation problem, and the method can reflect subject status of each coastal county. According to the evaluation result, Jinzhou, Ganjingzi and Wafangdian developed better, but the other coastal counties still have resistance to enhance economic power, and they urgently need operational countermeasures to improve integrated economic strength.

First, the garden economy in the county is the innovation of the intra-county economic development model, and we should pay great attention to the system innovation that involved in it.

Second, it is a necessary choice of economy thoughts to accelerate the industry structure adjustment of agriculture and promote the development of region economy.

Third, we should balance and coordinate the hard and soft environment, so as to promote the continuous, rapid and health development for coastal counties.

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