

Quantitative Assessment of Urban Economic Vitality

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Abstract

In the context of globalization, the differences in urban development are increasing. Based on the macro statistical data of 26 large, medium and small cities across the country, this paper selects 22 indicators to establish an urban economic vitality evaluation system, uses factor analysis to quantify the urban economic vitality index, and divides the 22 indicators into 5 categories: residents' personal economic benefits, economic benefit of the enterprise, urban economic growth, residential residence and government expenditure. The study found that: residents' personal economic benefits and economic benefit of the enterprise have a strong correlation with urban economic vitality, and urban economic growth, residential residence and government expenditure have a weak correlation with urban economic vitality.

Keywords

urban economic vitality evaluation system; factor analysis; economic benefit; Urban Economic Vitality.

1. Introduction

With the globalization promoting the continuous development of urban economy, the differentiation of urban development will appear. How to judge whether a city has vitality and development potential, and which city college students choose as their development city, such problems need to be solved urgently. The development of a city, in the final analysis, needs to trace the people in the city, because it is people who promote the development of the city's economy. The development of the city's economy, in turn, further supports the vital functions, ecological environment, and economic society in the city. The vitality of the urban economy is an important concept that links and reflects these two processes.

To analyze and evaluate the urban economic vitality of a region, it is important to find and establish an evaluation system from the perspective of quantitative explanation. The urban economic vitality is used as a bridge to evaluate urban economic development. This article selects intermediate indicators from 8 aspects to rebuild the urban economic vitality index system. The aspects are economic growth, corporate income, residents' income, living environment, finance and social security, foreign trade and foreign investment, science, education, culture and health and living environment. To determine the future development trend of the city and the path to improve the economic vitality, thereby enhancing the competitiveness, influence and attractiveness of the city, This article adopts conventional indicators such as GDP, per capita GDP, annual per capita disposable income, government fiscal revenue, and government fiscal expenditures. At the same time, it introduces innovative indicators such as the total profits of industrial enterprises above designated size, per capita deposits of financial institutions, per capita loans of financial institutions, the number of financial industry employees, the number of doctors, the number of hospital beds, the rate of

good air quality, and etc., And then, it conduct in-depth analysis of people's livelihoods such as finance, medical care, and the environment for using by enterprises and individuals.

2. The Construction of Urban Economic Vitality System

2.1. Principles for Establishing the Evaluation System

To quantify the vitality of a city, it is first necessary to construct a scientific urban economic vitality evaluation system. The construction of the evaluation system needs to follow the following principles:

2.1.1. Scientificity and Completeness

The principle of scientificity is the basic principle for constructing the index system and the basis for ensuring the accuracy and reasonableness of the evaluation results. The economic vitality of a city is a complex and diverse system. Therefore, the selected indicators should be reflected as much as possible from multiple levels, multiple perspectives, and multiple dimensions. The development status and trends of the economic vitality of each city.

2.1.2. Practicality and Operability

The construction of the evaluation index system is mainly based on theoretical analysis, but it is often greatly restricted by factors such as data sources and data availability in practical applications. Therefore, the index system to be constructed should be as easy to understand as possible, and the calculation method should be combined with the old and the new as much as possible. At the same time, the selected indicators should be able to ensure the availability and reliability of data sources.

2.1.3. Relevance and Flexibility

Economic vitality is an abstract economic phenomenon. When selecting indicators, attention should be paid to whether there is an inevitable connection with it. Based on the research of other scholars, the indicator system constructed for different regions and different periods is not exactly the same. The actual situation of the research objects in this paper should be selected flexibly on the basis of not violating the above principles.

2.2. Establishment of Evaluation System and Selection of Indicators

Urban economic vitality reflects the interaction between urban economic development and urban residents. Urban economic vitality is not only related to macroeconomic data, but also affected by factors such as population and society. Therefore, this article examines the urban economic vitality from eight aspects: economic growth, corporate income, residents' income, living environment, finance and social security, foreign trade and foreign investment, science, education, culture and health, and living environment. As shown in Table 1, this article selects 22 indicators from the above 8 aspects into the indicator system to measure the level of urban economic vitality.

3. The Quantification of Urban Economic Vitality Evaluation System

3.1. Data Acquisition and Standardization

The data in this article is derived from 2017 statistical data, and the research is conducted through data collection through major databases such as the National Research Network database, Wind database, National Ministry of Ecology and Environment database and the 2018 Statistical Yearbook. Due to the different statistical methods of some data, unified standards are used for data processing.

Table 1. Urban economic vitality evaluation index system

Evaluation factor	indicator	unit
economic growth	GDP per capita	CNY
	Real GDP growth rate	%
corporate income	The total profit	10000CNY
	Number of industrial enterprises	factory
residents' income	Annual per capita disposable income of residents	CNY
	Annual residents' per capita disposable income growth rate	%
Financial development	Per capita deposits of financial institutions	CNY
	Per capita loan amount of financial institutions	CNY
	Financial industry practitioners	10000 persons
Fiscal revenue and expenditure	General budget expenditure as a proportion of GDP	%
	Per capita fiscal revenue	CNY
Open to the outside world	Export value	10000USD
	Imported goods	10000USD
	Amount of foreign capital actually used in the year	10000USD
Science, Education, Culture and Health	Education expenditure per capita	CNY
	Number of invention patents granted	piece
	Number of beds in hospitals and health centers	bed
	Number of doctors	person
	Number of hospitals and health centers	hospital
living environment	Green area per capita	square meter
	Air quality good rate	%
	Housing area per capita	square meter

Because of the different units between the indicators, there are dimensional differences, so they need to be standardized first. There are two commonly used data standardization methods: deviation standardization and standard deviation standardization. Deviation standardization linearly transforms the original data so that it falls between 0 and 1, while standard deviation standardization often reflects the degree of outlier data. The evaluation of urban economic vitality is not to explain the outlier degree of indicator data, but to reflect the economic vitality of the city linearly through indicator data. Therefore, this article uses deviation standardization to unify the dimensions and score indicators. The conversion function is:

$$x_{ij}^* = \frac{x_{ij} - \min(x_i)}{\max(x_i) - \min(x_i)}$$

3.2. Factor Analysis

The factor analysis method analyzes the correlation between the indicators, classifies the data with a higher degree of correlation into one category, named it a main factor, and conducts a combined analysis. According to the rotated component matrix, 22 indicators are divided into 5 main factors.

Main factor 1 includes: per capita GDP, annual per capita disposable income of residents, per capita deposits of financial institutions, per capita loans of financial institutions, per capita fiscal revenue, exports of goods, imports of goods, per capita education expenditures, number of invention patents and per capita Green area. Reflecting residents' income deposit status and comprehensive indicators of education, innovation, and environment, the main factor is named as residents' personal economic benefits.

Main factor 2 includes: total profit, number of industrial enterprises, employees in the financial industry, the amount of foreign capital actually used in the year, the number of beds in hospitals, the number of doctors, the number of hospitals, and the rate of good air quality. Reflecting the development status of the enterprise and the scale of development of public institutions, the main factor is named the economic benefit of the enterprise.

Main factor 3 includes: actual GDP growth rate and annual per capita disposable income growth rate. Reflecting the growth rate of urban economy and residents' income, the main factor is named urban economic growth.

Main factor 4 includes: housing area per capita. Reflect the living conditions of urban residents, and name the main factor as residents' residence.

Main factor 5 includes: the proportion of the general budget expenditure of the local government in GDP. Reflecting the impact of government expenditure on output, the main factor is named government expenditure.

4. Empirical Analysis and Discussion

From the index score and the weight of each index, the urban economic vitality of each city can be calculated. Based on the quantitative results, it can be analyzed from two perspectives: the urban economic vitality index of each city and the relationship between the main factor and the urban economic vitality of each city.

4.1. City Economic Vitality Index

After determining the 5 main factors and 22 index classifications, calculate the index score coefficient matrix to obtain the influence of the index on each factor, calculate the weight of each index and the weight of the main component, comprehensively consider the scores of each index and The corresponding weights are weighted to calculate the principal component scores of each city. The results are shown in Table 2.

$$Q_j = \sum_{i=1}^{22} x_{ij}^* \times \omega_i \times 100$$

It can be seen from Table 2 that Shenzhen and Shanghai, as the frontier cities of reform and opening up, have always maintained a medium-to-high-speed economic development trend. As an international economic center, an international financial center, an international trade center, and an international shipping center, Shanghai has a comprehensive development, overall coordination and orderly, and has always had advantages in enterprise production. Therefore, it has a good performance in the urban economic vitality and still has Good potential. Shenzhen has benefited from the reform and opening up and the vigorous development of high-tech industries, making it more popular with innovative talents, and high-tech often brings faster development and more residents' income, so it ranks first in the city's economic vitality. . Cities such as Chongqing, Chengdu, Wuhan, and Ningbo have benefited from the development of the Silk Road Economic Belt and the Maritime Silk Road and have achieved good results in the past decade. Among them, Chongqing and Chengdu have benefited the most. Because they are located in the blocked Sichuan Basin, their development has not been smooth. The

construction of the Silk Road Economic Belt and the opening of the China-Europe Railway Express have greatly increased their enthusiasm for foreign trade and production, opening up The door to expand the demand, which drives the production of enterprises, so that the benefits of enterprises increase rapidly, so the city's economic vitality is in the forefront.

Table 2. City Economic Vitality Index Score Table

total rank	city	Resident individual economic benefit score	Business economic benefit score	City economic growth score	Resident residence score	Government expenditure score	Comprehensive score of urban economic vitality
1	Shenzhen	93.16	51.27	61.30	4.90	69.40	66.70
2	Shanghai	64.51	84.42	45.71	26.23	85.86	63.08
3	Chongqing	10.75	77.77	77.12	42.43	76.71	43.62
4	Chengdu	16.89	64.68	83.94	25.93	38.47	42.56
5	Guangzhou	41.42	48.83	48.00	0.00	28.66	41.28
6	Wuhan	22.66	41.23	68.00	34.24	39.42	35.17
7	Ningbo	26.83	40.69	37.65	43.53	45.10	32.03
8	Qingdao	21.86	39.35	50.06	17.99	38.72	30.82
9	Changsha	18.32	33.60	62.06	55.25	32.85	30.45
10	Tianjin	26.40	46.92	20.82	9.80	58.39	30.19
11	Zhengzhou	18.76	36.40	48.65	15.42	54.06	28.33
12	Xiamen	31.08	16.96	44.94	11.89	60.88	26.76
13	Hefei	13.60	22.51	74.39	28.14	41.38	26.27
14	Xi'an	15.55	27.68	49.65	33.95	43.78	24.82
15	Fuzhou	13.74	22.54	56.88	61.52	40.72	24.34
16	Quanzhou	10.22	28.94	47.69	100.00	21.88	24.29
17	Nanchang	10.12	18.56	66.24	48.95	40.08	22.74
18	Zhoushan	20.17	6.12	60.41	36.79	100.00	22.12
19	Yantai	12.62	25.03	42.41	27.75	26.62	21.26
20	Xining	6.23	8.27	88.24	15.93	77.18	20.77
21	Dalian	15.38	22.38	26.77	7.62	37.85	18.52
22	Haikou	14.49	10.63	48.88	10.20	44.85	18.18
23	Shantou	2.15	14.31	64.24	15.44	44.24	16.77
24	Zhanjiang	1.82	13.35	62.18	36.27	52.89	16.60
25	Lanzhou	10.97	10.11	42.21	22.25	55.73	15.80
26	Sanya	11.61	4.81	53.29	11.10	0.00	15.62

4.2. Analysis about Main Factors

According to the scores of the main factors of each city, the correlation between the urban economic vitality and the main components is analyzed, and the results are shown in Table 3.

Table 3. Correlation between urban economic vitality and main components

Main factor	Weight	Correlation coefficient	Relevance
Resident personal economic benefits	42.68%	0.8568	Very strong correlation
economic benefit of the enterprise	31.72%	0.8577	Very strong correlation
Urban economic growth	16.58%	0.1193	Weak correlation
Resident residence	2.72%	-0.1146	Weak negative correlation
Government expenditure	0.56%	0.3573	Weak correlation

It can be seen from Table 3 that the individual economic benefits of residents and the economic benefits of enterprises are important factors to measure the economic vitality of the city, and their weights add up to more than 70%, and they have a strong correlation with the economic vitality of the city. Urban economic growth, residential housing, and government expenditures have a low correlation with urban economic vitality, and even residential housing is negatively correlated. This situation will be analyzed one by one below.

4.2.1. Resident Personal Economic Benefits

Residents' personal economic benefits are the main components that comprehensively include residents' income status, residents' deposit status, education, innovation and environment. The increase in residents' income has a positive impact on consumption, and the status of residents' deposits has a positive impact on investment, thereby increasing the GDP and urban economic vitality. Education, innovation, and environmental development will all promote the sustainable development of the economy and ensure sustainable urban development. Therefore, the personal economic benefits of residents have a strong correlation with the urban economic vitality.

4.2.2. Economic Benefit of the Enterprise

The economic effect of an enterprise comprehensively reflects the status of enterprise development and the scale of development of public institutions. Enterprise development is the source of economic development. If the economy continues to develop, enterprises must continue to produce innovations to support economic development. The expansion of the scale of public institutions has expanded the basic services of the city, which provides residents with more convenient services, provides the labor force with a sense of belonging, and enables the city to have more high-quality labor and bringing good economic vitality. Therefore, the economic benefits of enterprises have a strong correlation with the economic vitality of cities.

4.2.3. Urban Economic Growth

Urban economic growth directly reflects the state of urban economic development and is a direct indicator of urban development. The current state of urban economic vitality cannot be determined by urban economic growth, but it is the result of urban economic vitality in the previous periods. The urban economic vitality between different periods does not have a strong correlation, resulting in a weak correlation between urban economic growth and urban economic vitality.

4.2.4. Resident Residence

The increase in the number of residents has enabled people to live and work in peace and contentment and achieve a stable and comfortable state. However, when residents' living conditions reach a certain limit, people feel satisfied. This will increase leisure time and reduce

human labor time. The impact is a small reduction in the scale of innovation and a small decline in production. Therefore, residents' residence has a weak negative correlation with urban economic vitality.

4.2.5. Government Expenditure

Changes in government expenditure have a direct effect on the current GDP situation, and because of the multiplier effect, they have played a multiple-fold role in expanding the current economic growth. The effects of government expenditures often act in the short-term, making people actively engage in production for a period of time. If the time is extended, the effects of government expenditures are often no longer obvious. For example, short-term economic stimulus policies such as government expenditures rarely become the driving force of sustainable development, which led to a weak correlation between government expenditures and long-term economic growth and urban economic vitality.

4.2.6. Discussion about Main Factors

In the main factors of urban economic vitality, it is necessary to focus on the extremely relevant main factors, such as resident personal economic benefits and economic benefit of the enterprise. They play a decisive role in the economic vitality of cities. Governments need to focus on these two main factors, strengthen the continuous expansion of resident personal economic benefits and economic benefit of the enterprise, improve the economic vitality of the city, and provide impetus for the sustainable development of the economy.

Of course, not all principal components are strongly positively correlated, such as urban economic growth, resident residence and government expenditures. But these main factors are also the purpose of economic development or a means of regulating economic development. Failure to correctly understand the relationship between them will also have a negative impact on the economic vitality of the city.

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