



A Study on the Measurement of Local Government Governance Level and Regional Differences Based on Big Data Analysis

Shan Wang

Jingdezhen Ceramic University, Jingdezhen, 333001, China

374330828@qq.com

Abstract. This paper leverages big data on local government governance to comprehensively measure the governance level of provincial-level local governments in China from 2013 to 2022, and uses the Dagum Gini coefficient method to analyze the regional differences in local government governance. The study finds that there are significant regional disparities in the governance level of local governments in China, with higher governance levels in the eastern regions and lower levels in the western and northeastern regions. The differences in local government governance levels are primarily driven by interregional disparities. The overall disparities in local government governance levels are narrowing, mainly due to reduced interregional gaps and shrinking internal differences within Chinese four major regions.

Keywords: Big Data, Local Government Governance, Regional Differences

1 Introduction

James N. Rosenau (1992), a trailblazer in modern governance theory, defined governance as “activities underpinned by a shared goal, wherein governing actors need not be the government nor rely on state coercion for their attainment”^[1]. Moore(2007) underscored the imperative of effective collaboration between the government and other governing entities, with the core tenets of the theory centered on the interaction patterns between governmental bodies and social members^[2]. However, China's governance differs from its definition in the West. China's governance emphasizes the government's regulation over all aspects of the country. As an important part of national governance, local governments bear dual obligations: on the one hand, to implement the policies and guidelines formulated by the central government; on the other, to formulate policies for economic and social development and conduct governance activities in light of local realities^[3]. In a word, high-quality local government governance is conducive to maintaining public order, regulating economic operations, and alleviating social conflicts, serving as the core guarantee for the stable development of the country and the orderly operation of

society^[4]. As an ancient Chinese saying goes, “When counties are well-governed, the whole nation will be stable.”

2 Establishing a Measurement System and Data Sources for Local Government Governance

2.1 Establishing a Measurement System

National governance consists of five aspects: political governance, economic governance, social governance, cultural governance, and ecological governance. Given that local government governance and national governance are aligned in their objectives^[5], local government governance can likewise be reflected through these five domains. The conceptual framework for establishing a local government governance index system from the “Five-in-One” perspective lays emphasis on scientific rigor, practical feasibility, measurable outcomes, and accessible data. This multi-tiered system consists of five primary indicators—political governance, economic governance, social governance, cultural governance, and ecological civilization governance—as well as 25 secondary indicators, thereby forming a holistic measurement framework. These indicators are detailed in Table 1.

Table 1. A comprehensive measurement system of local government governance level

Primary indicator	Secondary indicator	Metric Definition
Political governance	Rule of law administration level	Index of development of market intermediary organizations and legal institutional environment
	Digital Government	Digital Government Index
	Transparency of Government	Government Transparency Index
	Social participation in governance	Number of social service units per 10,000 people
	Relative size of government	Number of permanent residents/Number of trade union members in government agencies
	Economic development level	Per capita GDP
Economic governance	Degree of openness	Total imports and exports/Regional GDP
	Digital infrastructure	Average number of internet access ports per person
	Innovation and development capability	Number of invention patent applications accepted per 10,000 people
	Industrial policy guidance	Frequency of new quality productivity in government work reports
Social governance	People's living standards	Per capita disposable income
	Social Security coverage level	Number of urban basic pension insurance participants/total population

Cultural governance	Health care standards	Number of hospital beds per 10,000 people
	Social welfare level	Civil Service/Regional Population
	Employment of residents	1- (Unemployment/total population)
	Intensity of cultural expenditure	Cultural service expenditure per capita
	Cultural organization development	Number of performing arts groups per 10,000 people
	Human resource level	The proportion of employed people with college degree or above
	Education expenditure intensity	Education expenditure/Number of students in schools at all levels
	Research expenditure intensity	R&D expenditure/Regional GDP
	Environmental regulation intensity	Frequency of environmental regulation text in government work report
	Environmental expenditure intensity	Environmental expenditure/Financial expenditure
Ecological governance	Industrial waste emissions	Industrial added value/Industrial solid waste generation
	Industrial waste water emissions	Industrial added value/Ammonia nitrogen emissions from industrial waste water
	Industrial waste gas emissions	Industrial added value/Industrial sulfur dioxide emissions

2.2 Data Description

The data utilized in this study covers multiple dimensions of local government governance, forming a big data sample of comprehensive indicators for measuring local government governance levels. Detailed explanations of the different indicators are as follows:

The index of the development of market intermediary organizations and the legal institutional environment is sourced from the China Marketization Index Database.

The Digital Government Index is calculated based on the indicator system proposed by Zeng Long and Yi Ziqi (2024) ^[6], with the original data derived from the Investigation and Evaluation Report on the Electronic Government Service Capability of Provincial Governments.

The Government Transparency Index is obtained from the China Government Transparency Index Report.

For the industrial policy guidance indicator, Python is used to extract the frequency of keywords related to “new quality productivity” from the annual work reports of provincial governments. The proportion of this keyword frequency to the total word count of the government work report is calculated, and this proportion is multiplied by 100 to serve as the industrial policy guidance indicator for local governments. The same method is applied to calculate the environmental regulation intensity index.

All other data are retrieved from the EPS Database.

Considering data availability, panel data from 30 provincial administrative regions (excluding Tibet, Hong Kong, Macao, and Taiwan) for the period 2013-2022 are selected as the research sample. Missing values in the data are filled using interpolation methods.

3 Local Government Governance Level and Gini Coefficient Measurement

3.1 Index Measurement Method

The entropy weight method is employed to assess local government governance performance. This approach ensures objectivity by eliminating subjective arbitrariness in indicator weighting. For n subjects with m indicators, where x_{ijt} ($i=1,2,\dots,n$; $j=1,2,\dots,m$) denotes the normalized value of the j -th indicator for the i -th subject in year t , the comprehensive index can be calculated through five steps.

Step 1: Calculate the proportion of the indicator value of the i -th subject under the j -th indicator in the t -th year, denoted as p_{ijt} , as shown in equation 1.

$$p_{ijt} = x_{ijt} / \sum_{i=1}^n x_{ijt} \quad (1)$$

Step 2: Calculate the entropy weight e_{jt} for the j -th indicator in year t , as shown in equation 2.

$$e_{jt} = -k \sum_{i=1}^n p_{ijt} \ln(p_{ijt}), k = \frac{1}{\ln n} \quad (2)$$

Step 3: Calculate the difference coefficient g_{jt} for the j -th indicator in year t , as shown in equation 3.

$$g_{jt} = 1 - e_{jt} \quad (3)$$

Step 4: Calculate the entropy weight w_{jt} for the j -th indicator in year t , as shown in equation 4.

$$w_{jt} = g_{jt} / \sum_{j=1}^m g_{jt} \quad (4)$$

Step 5: Calculate the comprehensive governance index LGG_{it} for local governments, as shown in equation 5.

$$LGG_{it} = \sum_{j=1}^m w_{jt} p_{ijt} \quad (5)$$

3.2 Gini Coefficient Measurement Method

Using Dagum's (1997) Gini coefficient calculation method, this study examines regional disparities in the comprehensive index of local government governance performance^[7] The methodology requires calculating the overall Gini coefficient, as shown in the equation 6:

$$G = \frac{1}{2n^2\mu} \sum_{i=1}^k \sum_{j=1}^k \sum_{h=1}^{n_i} \sum_{r=1}^{n_j} |y_{ih} - y_{jr}| \quad (6)$$

In the equation 6:

K denotes the number of sample groups. In this study, the sample is divided into four regions (eastern, northeastern, central, and western), so K=4.

y_{ih} and y_{jr} respectively represent the comprehensive governance index of the h-th province in the i-th region and the r-th province in the j-th region (i or j=1,...,K)

G is the overall Gini coefficient.

μ is the average value of the comprehensive governance index across all provinces.

n is the total number of provinces in the sample.

n_i and n_j respectively denote the number of provinces in the i-th region and the j-th region.

4 Analysis of Regional Differences in Local Government Governance in China

4.1 Analysis of Regional Differences in Local Government Governance

The index of local government governance level in 30 provincial administrative regions of China from 2013 to 2022 was calculated, as shown in Table 2.

Table 2. Local Government Governance Levels of 30 Provincial Regions in China (2022)

province	LGG	province	LGG
Beijing	0.6993	Shanxi	0.3733
Shanghai	0.6627	Sichuan	0.3704
Zhejiang	0.5121	Hunan	0.3694
Jiangsu	0.4811	Heilongjiang	0.3662
Chongqing	0.4487	Liaoning	0.3473
Guangdong	0.4398	Inner Mongolia	0.3441
Tianjin	0.4352	Gansu	0.3379
Anhui	0.4300	Jilin	0.3324
Fujian	0.4126	Ningxia	0.3239
Shandong	0.4103	Xinjiang	0.3198
Qinghai	0.4058	Guizhou	0.3157
Jiangxi	0.3776	Henan	0.3119
Hebei	0.3762	Hainan	0.3091
Shaanxi	0.3760	Yunnan	0.3084
Hubei	0.3751	Guangxi	0.3001

Based on the research by Chen Jinghua et al. (2020), all provinces are classified into four levels according to the relationship between the mean (M) and standard deviation (SD) of the comprehensive governance index^[8]:

The “First Level” comprises provinces with high local governance performance, including Beijing (0.6993), Shanghai (0.6627), Zhejiang (0.5121), Jiangsu (0.4811),

and Chongqing (0.4487). Among these, Beijing and Shanghai maintain a significant lead.

The “Second Level” includes six provinces with moderately high governance levels: Guangdong (0.4398), Tianjin (0.4352), Anhui (0.4300), Fujian (0.4126), Shandong (0.4103), and Qinghai (0.4058).

The “Third Level” consists of eight provinces with relatively low governance levels: Jiangxi (0.3776), Hebei (0.3762), Shaanxi (0.3760), Hubei (0.3751), Shanxi (0.3733), Sichuan (0.3704), Hunan (0.3694), and Heilongjiang (0.3662).

The “Fourth Level” comprises eleven provinces with the lowest governance performance: Liaoning (0.3473), Inner Mongolia (0.3441), Gansu (0.3379), Jilin (0.3324), Ningxia (0.3239), Xinjiang (0.3198), Guizhou (0.3157), Henan (0.3119), Hainan (0.3091), Yunnan (0.3084), and Guangxi (0.3001).

This classification clearly reveals a significant regional imbalance in Chinese local government governance, with the eastern regions demonstrating substantially higher governance performance compared to the western and northeastern regions.

4.2 Decomposition of Regional Disparities in Local Government Governance

Using the above calculation method, the Gini coefficient of local government governance level in 30 provinces of China from 2013 to 2022 was obtained and decomposed according to regions. The results are shown in Table 3.

Table 3. Gini Coefficients of Local Government Governance Performance in China's Four Major Regions (2013-2022)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
total	0.1648	0.1566	0.1517	0.1394	0.1433	0.1336	0.1307	0.1223	0.1157	0.1149
eastern	0.1497	0.1604	0.1612	0.1495	0.1621	0.1392	0.1429	0.1354	0.1337	0.1316
central	0.0579	0.0534	0.0430	0.0542	0.0493	0.0511	0.0350	0.0178	0.0289	0.0460
western	0.0942	0.0830	0.0847	0.0670	0.0818	0.0865	0.0830	0.0721	0.0750	0.0677
northeast	0.0387	0.0718	0.0479	0.0430	0.0172	0.0245	0.0261	0.0120	0.0068	0.0216

As showed in Table 3, between 2013 and 2022, both the overall Gini coefficient of local government governance across the 30 provinces and the internal Gini coefficients within the four major regions exhibit a consistent downward trend:

The total disparity (overall Gini coefficient) decreases from 0.1648 in 2013 to 0.1149 in 2022, representing a reduction of 30.28%.

The internal Gini coefficients of the eastern, central, western, and northeastern regions decrease by 12.09%, 20.55%, 28.13%, and 44.19% from 2013 to 2022.

When comparing the internal Gini coefficients of the four regions, the ranking (from highest to lowest) remains consistent throughout the study period: eastern > western > central > northeastern. Notably, the eastern provinces display the largest internal disparities in governance levels, while the northeastern provinces exhibit the smallest internal variations.

5 Conclusions

This study uses big data on local government governance to comprehensively measure the governance level of provincial-level local governments in China from 2013 to 2022, and uses the Dagum Gini coefficient method to analyze the regional distribution differences in local government governance. The key conclusions are as follows:

There exists a significant regional imbalance in China's local government governance. The eastern regions have higher governance levels, while the western and northeastern regions have relatively lower governance levels.

The internal disparities in governance levels vary significantly among the four major regions. The eastern provinces have the largest internal disparities, while the northeastern provinces have the smallest internal differences.

The overall Gini coefficient of local government governance and the internal Gini coefficients within the four major regions all show an overall downward trend, indicating that the regional disparities in China's local government governance are gradually narrowing.

To narrow the disparities in local government governance, the central government should increase balanced transfer payments to local governments, with priority given to boosting the fiscal capacity of regions with underdeveloped governance; Strengthen horizontal assistance among local governments, for example, dispatching officials from eastern regions to provide targeted support to areas with underdeveloped governance. and accelerate the application of digital technologies to enhance the governance level of regions with underdeveloped governance.

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