

Analysis of the Level of Economic Coordination between Urban and Rural Areas in Urumqi Based on AHP

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Abstract: This paper delves into the synchronized development of urban and rural economies and employs a mixed qualitative and quantitative analysis approach, specifically utilizing the Analytic Hierarchy Process (AHP), to ascertain the weightings of indicators and gauge the extent of economic coordination between Urumqi's urban and rural regions. The study reveals that during the period from 2016 to 2023, the overall level of economic coordination in Urumqi displayed an upward trajectory, albeit remaining at a relatively low level. Key factors influencing the level of economic coordination between urban and rural areas in Urumqi encompass per capita GDP, urban-rural income ratio, urban-rural consumption ratio, and Engel coefficient.

1. Introduction

The coordinated development of the urban and rural economy is a process of mutual interaction, influence, and interconnection between urban and rural economies. It involves the rational allocation of natural resources, labor resources, technology, and other production factors between cities and rural areas, leading to the formation of a unified economic development entity. The essence of coordinated development is to transform the dualistic economic structure, achieve integrated urban-rural development, and realize the great goal of building a moderately prosperous society in all aspects.

Currently, research on the status of coordinated development between the urban and rural economy in China is still in the preliminary stage. Traditional evaluation models exhibit significant subjectivity in terms of indicator selection and evaluation methods, highlighting the need to construct a scientific and systematic evaluation model for the level of economic coordination between urban and rural areas.

The coordinated development of the urban and rural economy is a dynamic historical process. Quantitative evaluation of the urban and rural economic development in a region through indicators is beneficial for grasping the trends in coordinated development and selecting more economical models to promote integrated regional urban-rural economic development. With the continuous development of China's economy since the reform and opening-up, the gross domestic product has

been steadily increasing, and the living standards of the people have significantly improved. However, along with economic development, the dualistic structure between urban and rural areas has become more prominent. There is an increasing imbalance in the allocation of resources, and the income gap between urban and rural residents continues to widen, hindering the achievement of the goal of building a moderately prosperous society in all aspects. The report of the 18th National Congress of the Communist Party of China pointed out that "integrating urban and rural development" is the fundamental approach to addressing agricultural, rural, and farmer-related issues. The first step in achieving urban-rural integration is to manage the urban-rural economic relationship effectively.

2. Literature Review and Theoretical Framework

2.1 Principal theory

2.1.1 Urban and Rural Areas

Urban and rural areas, as regional geographical formations, objectively exhibit differences in organizational structure, functions, spatial landscapes, and other aspects. However, drawing a strictly defined boundary between the two is not an easy task (Yao 2023)^[1]. According to Lacey, "Urban areas refer to densely populated entities with convenient transportation and coverage of a certain area by people and housing; while rural areas are characterized by dispersed populations and housing." The writer defines rural areas as sparsely populated, relatively isolated areas with agriculture as the main economic base, where people's lives are generally similar but different from other parts of society, especially cities (Tong 2011). Barton describes cities as "various economic markets located within a limited spatial area, forming a network system where housing, labor, land, transportation, and other elements intertwine."

2.1.2 Urban and Rural Economy

Urban economy refers to the economic activities concentrated in urban areas, characterized by the development and prosperity of the secondary and tertiary sectors, continuous optimization of economic structure, and high concentration of production factors such as capital, technology, labor, and information. Urban economy and rural economy are inseparable and interconnected components of the national economy, encompassing economic, social, ecological, and technological information connections. Therefore, the "urban-rural economy" studied in this paper refers to the macro-level urban-rural economy, which includes the comprehensive development of the economic, social, ecological, and spatial aspects of both urban and rural subsystems (Tong 2011)^[2].

2.1.3 Urban-Rural Coordination

Urban-rural relations have always been a hot topic of research for governments and scholars. Different scholars define how urban and rural areas can better develop from different perspectives, including urban-rural integration, urban-rural integration, and urban-rural coordination. Urban-rural coordination aims to plan the economic and social development of cities and rural areas as a unified whole, taking comprehensive considerations. It not only considers the cooperation and coordinated development between urban and rural areas but also considers the openness and integration between urban and rural areas (Zhang M H. 2008).

2.2 Literature Review

2.2.1 The experience of various countries

The practice of coordinated urban-rural development in foreign countries mainly includes experiences from developed countries and developing countries. Developed countries' experiences primarily include:

Firstly, the United States' Rural Renaissance. The main measures include improving the agricultural protection policy system, strengthening rural infrastructure and social development³⁶, developing urban clusters and satellite cities, implementing diversified vocational and technical education for farmers, and establishing a legal system to promote coordinated urban-rural development. Secondly, Japan's legal protection encompasses safeguarding the advancement of rural industry and commerce, enhancing rural infrastructure, fostering large-scale land management in rural areas, advancing basic and vocational education in rural regions (Xiao J., 2004), establishing an integrated social security system harmonized with urban areas, and promoting the development of various agricultural associations.

Developing countries' experiences mainly include:

Firstly, Chile's urbanization efforts entail increased government investment, improvements in the soft and hard infrastructure for agricultural production, the enhancement of the connection mechanisms between urban and rural areas, and the coordination of social organization development in both urban and rural regions. Secondly, South Korea's "New Village Movement" encompasses increased fiscal investment in rural areas, the development of efficient agriculture, the planning of rural urbanization, the enhancement of social security, and the stimulation of farmers' participation in economic and social activities.

The practice of coordinated urban-rural development in China mainly cites the development experiences of three developed regions: Beijing, Shanghai, and Zhejiang³⁷.

In Beijing, the efforts made in the past 20 years to address the urban-rural dual structure problem can be summarized as follows: integrated urban-rural development planning and layout, strategic vision of "two axes, two belts, and multiple centers". In Shanghai, as early as 1984, the city proposed the concepts of "openness between urban and rural areas" and "urban-rural integration" in its first urban economic development strategy. Zhejiang, which leads in urban-rural development nationwide, has implemented measures such as developing rural commercial services, promoting institutional reforms, and increasing fiscal investment in rural development (Xiao J. 2004).

2.2.2 Government Policy and sustainability

The Chinese government influences in the renewable energy sector have been key growth factor (Xiao J, 2004)⁵¹. The Chinese government has invested at least \$50 billion in its goal of reducing carbon production by China (Graeml, 2004)⁷¹. These are in line with the government's goal of attaining lowest greenhouse emissions and increased reliance on green energy by 2030 (Zhang MH ,2008)⁴⁴. However, one of the inherent challenges presented for the new energy field remains the lifestyle and prestige of the old behaviors of organizations, and in some firms these components have taken precedent over the innate economic rationale (Fields,2009)⁶¹. Measures of firm-specific resources are difficult to collect on a large scale, are often proprietary and the performance consequences of differences in resources and competencies are not easily determined.

2.3 Theoretical Framework

Based on the principles of the connotation of coordinated development between urban and rural

economies and the establishment of an indicator system, considering factors such as data availability and the inappropriateness of quantifying certain elements, the following eight indicators were selected to construct the evaluation system for the level of economic coordination between urban and rural areas in Urumqi: per capita GDP, the proportion of non-agricultural GDP, non-agricultural employment rate, urban-rural income ratio, urban-rural consumption ratio, urbanization rate, per capita fiscal revenue, and the urban-rural Engel coefficient ratio. These indicators can objectively reflect the current status of economic coordination between urban and rural areas in Urumqi, as well as the scale of urban and rural economies. Based on the above analysis, the indicator system is constructed as shown in Table 1.

Table 1: Indicator System for the Evaluation of Coordinated Development between Urban and Rural Economies

	Names of Index	Index meaning and calculation method
State Indicators	Per capita GDP (X1)	GDP divided by the total urban and rural population
	Proportion of non-agricultural GDP (X2)	Value of non-agricultural industries divided by GDP.
	Proportion of non-agricultural employment (X3)	Number of employed individuals in non-agricultural sectors divided by the total number of employed individuals.
	Urban-rural income ratio (X4)	Average rural resident income divided by average urban resident income.
	Urban-rural consumption ratio (X5)	Average rural resident consumption divided by average urban resident consumption.
	Urbanization rate (X6)	Urban population divided by the total urban and rural population
	Per capita fiscal revenue (X7)	Total fiscal revenue divided by the total urban and rural population.
	Urban-rural Engel coefficient ratio (X8)	Engel coefficient for urban residents divided by Engel coefficient for rural residents.

3. Materials and Methods

3.1 Overview of the Study Area

Urumqi is the capital of the Xinjiang Uygur Autonomous Region and serves as the political, economic, cultural, educational, financial, and transportation center of the entire region. The city is divided into seven districts and one county, covering a total area of 14,000 square kilometers. As of the end of 2023, the city had a permanent population of 3.46 million people. The regional gross domestic product (GDP) reached 240 billion yuan, with a year-on-year growth of 15.0% at comparable prices. The proportion of the three industries was 1.1:38.8:60.1. The local fiscal revenue surpassed 40 billion yuan, representing a growth of 26.1% compared to the previous year. The total fixed asset investment in the region reached 127.159 billion yuan, reflecting a growth of 25.9% compared to the previous year. The per capita disposable income of urban residents for the whole year was 20,780 yuan, showing a growth of 13.0% compared to the previous year, while the per capita net income of farmers and herders was 12,065 yuan, indicating a growth of 16.5% compared to the previous year. In 2023, Urumqi achieved healthy, sustained, and stable development.

3.2 Evaluation Process

3.2.1 Establishing the Judgment Matrix

Following Saaty's (1980) nine-point scale, after comprehensive analysis, the relative importance of each indicator is determined. A comparison matrix is established and then transformed into a judgment matrix.

3.2.2 Conducting Consistency Test on the Judgment Matrix

According to Table 2, where $CI \leq 0.100$, it indicates that the consistency test for the mentioned indicators has passed.

Table 2: Consistency Test

Coordination state level	CI	RI	CR		λ		Consistency test result
	judgment value	judgment value	judgment value	standard values	judgment value	standard values	
	0.054	1.41	0.038	0.100	8.375	8.987	pass

3.2.3 Processing of Raw Data

The vector normalization method is used to standardize the raw data, and the results are shown in Table 3.

Table 3: Standardization of Raw Data

	2016	2017	2018	2019	2020	2021	2022	2023
X1	0.193	0.245	0.255	0.276	0.34	0.417	0.438	0.526
X2	0.349	0.352	0.354	0.354	0.354	0.369	0.355	0.366
X3	0.351	0.351	0.351	0.351	0.367	0.332	0.357	0.361
X4	0.175	0.196	0.193	0.197	0.235	0.201	0.212	0.208
X5	0.358	0.324	0.309	0.428	0.326	0.338	0.341	0.378
X6	0.359	0.349	0.354	0.351	0.357	0.352	0.346	0.347
X7	0.14	0.157	0.217	0.236	0.345	0.419	0.481	0.536
X8	0.37	0.336	0.348	0.334	0.336	0.375	0.364	0.353

3.2.4 Calculation of Level Scores and Comprehensive Scores for Each Indicator

Table 4: Weights and Scores of Indicators for the Coordinated Development of Urban and Rural Economies in Urumqi

	Weighting(w)	2016	2017	2018	2019	2020	2021	2022	2023
X1	0.211	0.041	0.052	0.054	0.058	0.072	0.088	0.092	0.111
X2	0.063	0.022	0.022	0.022	0.022	0.022	0.023	0.022	0.023
X3	0.058	0.020	0.020	0.020	0.020	0.021	0.019	0.021	0.021
X4	0.131	0.023	0.026	0.025	0.026	0.031	0.026	0.028	0.027
X5	0.111	0.040	0.036	0.034	0.048	0.036	0.039	0.038	0.042
X6	0.146	0.052	0.051	0.052	0.051	0.052	0.052	0.051	0.051
X7	0.096	0.013	0.015	0.021	0.023	0.033	0.04	0.046	0.051
X8	0.184	0.068	0.062	0.064	0.061	0.062	0.069	0.067	0.065
State level		0.280	0.284	0.293	0.310	0.329	0.356	0.365	0.391

The score for each indicator is calculated by multiplying the weight of the indicator by the standardized result of the original data. The comprehensive score for each year is obtained by

multiplying the standardized result of the original data by the corresponding indicator scores. The results are shown in Table 4.

3.3 Results Analysis

According to statistical analysis, the factors that influence the level of economic coordination between urban and rural areas in Urumqi include per capita GDP, urban-rural income ratio, urban-rural consumption ratio, urbanization rate, and the urban-rural Engel coefficient ratio. The sum of their weights accounts for 78.3%. The most influential indicator is per capita GDP, accounting for 21.1%. This indicates that these indicators are of utmost importance in improving the level of economic coordination between urban and rural areas in Urumqi.

From Table 3-3, it can be observed that from 2016 to 2023, the overall level of economic coordination between urban and rural areas in Urumqi showed an upward trend, which is consistent with the actual situation in Urumqi. In recent years, the Urumqi municipal government has vigorously advocated coordinated urban-rural development and proposed to set a benchmark for building a socialist new countryside in the Urumqi-Changji region. They have fully leveraged the advantages of being a "big city with small suburbs" and implemented the strategic approach of "industrial support for agriculture, urban support for rural areas" to comprehensively accelerate the construction of underdeveloped rural areas in Urumqi. However, there was a decline in 2016-2017, primarily due to a decrease in the score for the urban-rural consumption ratio from 0.359 to 0.349, indicating a significant disparity in the consumption level and quality of life between urban and rural residents. The increase in the level of economic coordination in 2018 was mainly attributed to the positive effects resulting from the proactive implementation of the strategy for coordinated urban-rural development in Urumqi.

Based on Tables 5 and Tables 6, Urumqi was in a state of discrepancy from 2016 to 2019, and in a phase of basic coordination from 2020 to 2023, indicating an overall low level of coordination. The main reasons for this were the significant disparities in per capita GDP, urban-rural income ratio, and the urban-rural Engel coefficient.

Table 5: Classification of Levels of Economic Coordination between Urban and Rural Areas

coordination degree	0-0.29	0.3-0.49	0.5-0.69	0.7-0.10
Rank of harmony degree	Discrepancy	Initial Coordination	Basic Coordination	Good Coordination
Coordination phase	Starting Coordination	Accelerated Coordination	Balanced Coordination	Achieved Coordination

Table 6: 2016-2023 Urumqi urban and rural economic coordination state level

year	2016	2017	2018	2019	2020	2021	2022	2023
Coordination level	0.280	0.284	0.293	0.310	0.329	0.356	0.365	0.391
Rank of harmony degree	Discrepancy			Initial Coordination				
Coordination phase	Starting Coordination			Accelerated Coordination				

4. Conclusion

In this study, the analytic hierarchy process was employed to determine the weights of each indicator, and a comprehensive evaluation system for the level of economic coordination between urban and rural areas was constructed. The evaluation system provided an objective reflection of the level of economic coordination in Urumqi. The research findings indicate that from 2016 to 2023, the level of economic coordination between urban and rural areas in Urumqi showed an overall

upward trend but remained at a low level. The evaluation results align with the actual situation in Urumqi and provide valuable insights for a scientifically informed understanding of the urban-rural economy in the city, as well as targeted measures to improve the level of economic coordination. Urumqi needs to prioritize coordinated urban-rural development, while also focusing on rural investment and support, and accelerating the modernization of agriculture, in order to achieve healthy and stable development of the urban-rural economy.

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