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FORECAST OF ECONOMIC DEVELOPMENT IN GUANGXI ZHUANG AUTONOMOUS REGION AND ITS VARIANCE ANALYSIS

YuFei Yang
Department of Mathematics and Statistics, Guangxi Normal University, Guilin 541006, Guangxi, China.
Corresponding Email: yangyf@stu.gxnu.edu.cn

Abstract: Today in the process of economic development across China, the economic differences between regions are not well handled. As it is often said in economics, differences in economic development are inevitable because different regions have different development patterns. Appropriate regional economic differences can reasonably optimize and allocate resources and promote regional economic development, but if the regional economic differences are too large, the regional Gini coefficient will increase, which will easily generate social conflicts and is not conducive to the development and construction of society. The balanced development of Guangxi is related to the people's livelihood and well-being of Guangxi people and the important interests of Chinese nation, as well as the long-term stability of China's frontier regions. Therefore, it is of great practical significance to discuss the differences in economic development across Guangxi and their influencing factors in order to solve the economic development problems in the less developed regions in the west. This article focuses on the differences of regional economic development in Guangxi, studies its balanced development, statistically analyzes the historical data of Guangxi's economy, predicts the future trend, analyzes the existing problems and puts forward optimization suggestions through methods such as principal component analysis, cluster analysis and establishment of ARIMA model.
Keywords: Guangxi; Regional economic differences; Principal component analysis; ARIMA model; Cluster analysis

1 INTRODUCTION

1.1 Research Background

The core issue facing China in today's world is development. High-quality development is the primary task of building a modernized socialist country in all respects. At the same time, “unbalanced and inadequate development” remains a problem in China’s current development process, reflecting the imbalanced nature of the country’s economic growth. To address these issues under such development conditions and patterns, efforts must be made to enhance the quality and efficiency of development, continuously narrow the urban-rural income gap, increase consumption levels, reduce regional economic disparities, and ultimately achieve high-quality and sustainable development.
The Guangxi Zhuang Autonomous Region is situated at the intersection of three economic circles: South China, Southwest China, and ASEAN. It features coastal and border areas, giving it distinct regional characteristics. Superficially, Guangxi enjoys a favorable geographical location and has experienced rapid economic growth in recent years, with gradual improvements in development quality and structure. However, internally, its economic development remains unbalanced. As an economically underdeveloped region in western China, an area with a revolutionary history, and a region adjacent to ASEAN, Guangxi is a key focus for achieving coordinated regional economic development in China. Studying the internal economic development disparities within Guangxi and analyzing its overall development situation will help accelerate the region’s development pace and achieve high-quality growth. Moreover, it holds significant importance for promoting economic development in western China and realizing coordinated regional economic development across the country.

1.2 Research Purpose and Significance

China is a multi-ethnic country where every ethnic group is an inseparable part of the larger Chinese nation. The destinies of all ethnic groups are closely intertwined, and their prosperity and development are directly related to the rise and fall of the Chinese nation as a whole. The Guangxi Zhuang Autonomous Region is not only an ethnic autonomous region but also a border area, sharing a direct boundary with Vietnam. Additionally, it is located north of the Beihai Sea and possesses the Beibu Gulf port. In summary, Guangxi holds a significant position among China’s ethnic regions.
Since the implementation of policies such as the “Western Development Strategy” and the “China-ASEAN Free Trade Area,” Guangxi’s economic and social development has undergone significant changes. However, due to variations in geographical location, environmental conditions, and regional advantages, development across its cities and prefectures presents diverse situations.
Regional economic development in Guangxi is a major issue. This paper aims to analyze the economic development

conditions of various cities in Guangxi through data collection and statistical research, explore their economic development levels and disparities, identify existing problems, and propose targeted optimization paths and high-quality development recommendations. This is of great significance for narrowing regional development gaps and improving people's wellbeing.

1.3 Research Status

Disparities in regional economic development have increasingly attracted attention from various sectors of society and have gradually become a critical issue in economic and social development.

From the perspective of national economic development disparities, Yang Kaizhong [1][2] used the coefficient of variation and per capita national income data from 1952 to 1985 to calculate relative differences. He found that regional economic disparities among provinces generally followed an inverted “U” shape, while disparities among the six regions—North China, Northeast China, East China, Central South China, Southwest China, and Northwest China—generally followed an inverted “S” shape.

Using indicators such as the per capita national income index to reflect the level of regional economic disparities, the standard deviation to measure the absolute value of regional economic disparities, and the coefficient of variation, weighted coefficient of variation, weighted divergence coefficient, and Gini coefficient to measure the relative value of regional economic disparities, Liu Shucheng [3] pointed out that the absolute value of regional economic disparities in China has continuously expanded over the past 40 years.

Zhang Qinghua et al. [4] noted that since the implementation of the “Western Development Strategy” in 2000, the economic growth rate of western China has surpassed that of eastern China and continues to maintain this trend. Although the economic gap between the eastern and western regions is gradually narrowing, the absolute disparity between them will continue to widen in the long run due to the weak economic foundation and low economic indicators of the western region.

Qin Chenglin[5], Chen Guang[6], and Nie Hualin[7] studied the coordinated economic development issues in China's regions. Chen Tian[8], Lei Yuan[9], and Lu Xiao[10] researched regional economic issues in Guangxi as well as rural economic development in the area. These studies have provided significant inspiration for this paper.

2 RELATED CONCEPTS AND THEORETICAL FOUNDATIONS

2.1 Related Concepts

2.1.1 Regional economic disparities

Regional economic disparities refer to the phenomenon within a unified country where some regions experience faster growth rates, higher levels of economic development, and stronger economic capabilities than others, resulting in a spatial pattern where developed and underdeveloped regions coexist. At the same time, economic disparities between regions are a common economic phenomenon. Addressing regional economic disparities is one of the core issues in regional economic research.

2.2 Theoretical Foundations

2.2.1 Regional economic growth theory

Regional economic growth theory explores the differences in economic growth and development among different regions. This theory posits that disparities in economic growth and development between regions primarily depend on the following factors:

Geographical Location and Resource Endowment: Geographical location and resource endowment are significant factors influencing regional economic growth. For instance, regions near seaports or major transportation hubs often have better trade and logistics conditions, making it easier to achieve economic growth.

Technological Innovation and Human Capital: Technological innovation and human capital are key drivers of regional economic growth. High-tech industries and knowledge-intensive sectors often require highly skilled talent, which tends to concentrate in cities and regions with an innovative environment.

Policy and Institutional Environment: The policy and institutional environment plays a crucial role in regional economic growth. Government policies, such as industrial and tax policies, can positively or negatively impact regional economic development.

Capital and Financial Markets: The development level of capital and financial markets also influences economic growth disparities between regions. If a region lacks financing channels or financial institutions, it may constrain local businesses' ability to secure funding and expand.

Based on these factors, regional economic growth theory suggests that disparities in economic growth and development among regions result from the interaction of multiple factors. Therefore, achieving balanced regional economic development requires measures such as policy and institutional reforms to improve the local economic environment and resource endowment conditions, enhance human capital quality, promote technological innovation, develop capital markets, and strengthen economic cooperation between regions.

2.2.2 Regional balanced development theory

Regional balanced development theory is an economic theory that emphasizes promoting economic development across

different regions through policy interventions to achieve economic and social balance.

This theory argues that within a country or region, differences in economic development levels between regions may lead to unequal distribution of resources and wealth, which in turn can trigger social and political issues. To prevent such problems, governments can employ a range of policy measures to promote balanced economic and social development.

3 RESEARCH DESIGN

3.1 Research Methods

3.1.1 Principal Component Analysis

Principal Component Analysis (PCA) is an analytical technique used to examine multiple variables and is a common method for reducing data dimensionality. It transforms several correlated variables into a set of less correlated variables. PCA is widely applied in mathematical modeling, data analysis, and social and economic research.

In this study, PCA is used to reduce the dimensionality of 12 indicators reflecting regional economic development in Guangxi. These 12 indicators are transformed into three principal components, which collectively capture the majority of the original information.

3.1.2 Cluster analysis

Cluster analysis, also known as grouping analysis, is a multivariate statistical analysis method that classifies samples or indicators based on the principle of "birds of a feather flock together." It deals with large numbers of samples that need to be reasonably categorized according to their respective characteristics, without any pre-existing model or prior knowledge to reference. Cluster analysis is conducted in the absence of prior knowledge.

In this study, cluster analysis is employed to classify the regional economies of Guangxi's 14 cities using multiple variables. The classification is based on extracted principal component scores and comprehensive scores, and the differences among the categories are analyzed.

3.1.3 ARIMA model forecasting

The ARIMA forecasting model is a statistical analysis method for time series forecasting, which fits time series data with stationarity. In the ARIMA (p, d, q) model, "d" represents the number of times the time series is differenced, "p" denotes the order of the autoregressive component, and "q" indicates the order of the moving average component. Building an ARIMA forecasting model requires ensuring the time series is stationary, selecting an appropriate model for fitting, and evaluating the model based on metrics such as the AIC value and DW value.

In this study, the ARIMA model is used to predict Guangxi's economic growth in the coming years.

3.2 Indicator System

To study the regional economic disparities in the Guangxi Zhuang Autonomous Region, this paper selects three first-level indicators—economic development level, social development level, and social stability—based on the definition of regional economic development quality in Guangxi and the principles of indicator selection, combined with Guangxi's current stage of economic development. The economic development level is further decomposed into four second-level indicators, social development level into five second-level indicators [11], and social stability into three second-level indicators. The results are shown in Table 1.

Table 1 Evaluation Indicator System for Regional Economic Disparities in Guangxi

First-level Indicators	Second-level Indicators	Unit	Indicator Code
Economic Development Level	Per Capita GDP	10,000 Yuan	x_1
	Per Capita Fiscal Revenue	Yuan	x_2
	Total Import and Export Volume	100 Million Yuan	x_3
	Growth Rate of Fixed Asset Investment	%	x_4
	Urbanization Rate	%	x_5
Social Development Level	Number of Students Enrolled in Regular Institutions of Higher Education	10,000 Persons	x_6
	Number of Health Institution Personnel	Person	x_7
	Number of Beds in Health Institutions	Unit	x_8
	General Public Budget Expenditure	100 Million Yuan	x_9
	Percentage of GDP from Secondary and Tertiary	%	x_{10}

Social Stability	Industries Value-added of GDP from Secondary and Tertiary Industries	100 Million Yuan	x_{11}
	Year-end Permanent Resident Population	10,000 Persons	x_{12}

3.3 Data Sources

The indicators and data selected in this paper are primarily sourced from the Statistical Yearbooks published by the Guangxi Zhuang Autonomous Region Bureau of Statistics and the bureaus of statistics of its subordinate prefecture-level cities. The specific data are presented in Table 2.

Table 2 Values of Indicators for Each City

	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}
Nanning	5.83	9383.66	1231.92	3.1	69.8	65.20	103071	60576	775.40	88.1	3814.97	883.28
Liuzhou	7.33	9639.55	354.07	-8.5	70.3	11.18	46912	29579	423.98	91.6	2259.59	417.53
Guilin	4.68	4400.82	91.61	-4.3	53.4	28.07	52353	28508	461.79	76.2	911.31	494.59
Wuzhou	4.85	4770.23	80.81	21.6	55.6	3.63	29192	18046	259.05	85.7	666.38	282.67
Beihai	8.07	12343.52	300.10	11.1	58.9	NA	17181	10282	179.27	85.0	1045.09	187.24
Fangchenggang	7.75	9496.59	885.56	-13.2	62.5	0.02	8884	4899	143.03	85.3	583.71	105.68
Qinzhou	4.98	6186.12	256.03	27.1	42.8	3.47	30397	21487	246.11	80.8	566.51	331.08
Guigang	3.46	3517.69	45.76	4.5	50.4	0	34744	24546	292.81	82.7	692.50	435.03
Yulin	3.56	2420.82	38.86	25.4	50.4	2.27	47172	39432	375.91	80.7	627.53	581.58
Baise	4.39	4673.29	426.33	26.4	44.6	2.46	37312	25855	430.55	81.2	461.82	357.20
Hezhou	4.50	4222.34	21.26	13.4	49.7	2.15	16872	10423	219.09	81.9	483.81	202.66
Hechi	3.05	2849.29	58.49	31.0	45.9	2.85	32972	21260	372.92	77.9	305.28	341.91
Laibin	4.01	3776.11	13.23	20.4	49.1	2.91	17918	13908	234.15	76.5	335.51	207.78
Chongzuo	4.73	3526.37	2127.11	11.5	44.9	12.06	18203	10244	260.14	79.8	202.24	208.77

3.4 Data Processing

The data were standardized. Due to missing data for the number of higher education students in Beihai in 2021, this study used data from 2003 to 2020 to predict the value, resulting in an estimated 46,800 students.

4 PRINCIPAL COMPONENT ANALYSIS

4.1 KMO and Bartlett's Test

Principal Component Analysis (PCA) is based on the existence of correlations among indicator data. Before conducting PCA, the KMO and Bartlett's tests were performed on the indicator data. The results are shown in Table 3.

Table 3 Results of KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.531
Bartlett's Test of Sphericity	225.316
	66
	0.000

The KMO test results indicate that the data exhibit a moderate level of correlation, making them acceptable for Principal Component Analysis.

4.2 Extraction of Principal Components

Principal components with eigenvalues greater than 1 were extracted. The analysis was conducted using SPSS 26.0, and the results are presented in Table 5. In this study, the 12 indicators were transformed into three principal components. The first principal component accounts for 51.956% of the variance, the second principal component accounts for 28.915%, and the third principal component accounts for 8.768%. The cumulative variance contribution rate of the three principal components is 89.640%, indicating that they collectively capture 89.640% of the original information. Detailed data are provided in Table 4.

Table 4 Eigenvalues and Variance Contribution Rate of Principal Components

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	Variance%	Cumulative%	Total	Variance%	Cumulative%
1	6.235	51.956	51.956	6.235	51.956	51.956
2	3.470	28.915	80.872	3.470	28.915	80.872

3	1.052	8.768	89.640	1.052	8.768	89.640
4	0.572	4.764	94.404			
5	0.382	3.185	97.589			
6	0.127	1.062	98.650			
7	0.065	0.545	99.195			
8	0.060	0.497	99.692			
9	0.024	0.200	99.892			
10	0.010	0.085	99.977			
11	0.002	0.014	99.992			
12	0.001	0.008	100.000			

4.3 Principal Component Analysis

Table 5 Rotated Component Matrix

	Component		
	1	2	3
Per Capita GDP	-.182	.933	.167
Per Capita Fiscal Revenue	.014	.924	.070
Total Import and Export Volume	.085	.155	.948
Growth Rate of Fixed Asset Investment	-.049	-.721	-.287
Urbanization Rate	.379	.881	-.009
Number of Students Enrolled in Regular Institutions of Higher Education	.836	.239	.383
Number of Health Institution Personnel	.991	.109	.029
Number of Beds in Health Institutions	.981	.016	-.083
General Public Budget Expenditure	.969	.028	.105
Percentage of GDP from Secondary and Tertiary Industries	.215	.840	-.075
Value-added of GDP from Secondary and Tertiary Industries	.785	.588	.080
Year-end Permanent Resident Population	.982	-.013	-.049

As can be seen from Table 5, Principal Component 1 has high loadings on x6, x7, x8, x9, x11, x12, indicating that it is correlated with the level of social development and stability. In contrast, Principal Component 2 and Principal Component 3 are associated with the level of socioeconomic development.

4.4 Score Calculation

Using SPSS 26.0, the scores of Principal Component 1, Principal Component 2, and Principal Component 3 for each city in the Guangxi Zhuang Autonomous Region were calculated. The comprehensive scores were then computed using Formula $F = \frac{(F_1 \times 51.956 + F_2 \times 28.915 + F_3 \times 8.768)}{89.640}$. The 14 cities in Guangxi were ranked based on their comprehensive scores, and the results are shown in Table 6.

Table 6 Scores and Rankings

Rank	City	Score
1	Nanning	2.01613
2	Liuzhou	0.74716
3	Guilin	0.27039
4	Yulin	0.01673
5	Beihai	-0.11755
6	Guigang	-0.14766
7	Baise	-0.17359
5	Wuzhou	-0.20853
9	Fangchenggang	-0.22356
10	Qinzhou	-0.33610
11	Chongzuo	-0.37516
12	Hechi	-0.39813
13	Hezhou	-.049123
14	Laibin	-.057892

As the capital of the Guangxi Zhuang Autonomous Region, Nanning achieved the highest comprehensive score, leading other cities in terms of socioeconomic development, social development level, and social stability. However, in terms of per capita GDP and per capita fiscal revenue, Liuzhou, Fangchenggang, and Beihai outperformed Nanning. Additionally, the proportion of GDP contributed by the secondary and tertiary industries in Liuzhou was higher than that in Nanning.

5 CLUSTER ANALYSIS

5.1 Hierarchical Clustering

The initial 12 standardized indicators were used as variables for hierarchical clustering. The 14 cities of the Guangxi Zhuang Autonomous Region were divided into four categories:Category 1 includes Nanning (1 city).Category 2 includes Fangchenggang and Beihai (2 cities).Category 3 includes Liuzhou (1 city).Category 4 includes Chongzuo, Guilin, Hezhou, Laibin, Wuzhou, Guigang, Hechi, Qinzhou, Baise, and Yulin (10 cities).

5.2 Analysis

Table 7 Average Scores of Each Category

	Category1	Category 2	Category 3	Category 4
Mean of F_1	2.81288	-1.14006	0.35519	-0.0888
Mean of F_2	0.89898	1.454285	1.86888	-0.56764
Mean of F_3	0.97924	0.21596	-0.62926	-0.7819
Mean of F	2.01613	-0.17056	0.74716	-0.24222

As shown in Table 7, Category 1 has the highest scores in Principal Component 1, Principal Component 3, and the comprehensive score, indicating that Nanning excels in social development, economic development, and stability among the 14 cities in Guangxi, demonstrating comprehensive development. Category 2 cities have relatively high scores in Principal Component 2 and Principal Component 3, outperforming Categories 3 and 4, suggesting better economic development and stability in these regions. Category 3, represented by Liuzhou, a renowned industrial city in Guangxi, exhibits a high level of economic development, with the second-highest comprehensive score. Category 4 regions have low scores across all three principal components, all negative, indicating significant gaps in social and economic development compared to the other categories.

In Category 1, Nanning's F1 and F4 scores far exceed those of the other categories, highlighting disparities in economic and social development between Nanning and other cities. Nanning leads in higher education development, with the highest general public budget expenditure and the largest number of higher education students. It also significantly outperforms other regions in healthcare, with the highest number of health institution personnel and beds. Additionally, Nanning's foreign trade volume far surpasses that of other regions. The other three categories show progressively lower F1 and F4 scores, accompanied by decreasing public budget expenditures, resulting in poorer public infrastructure and healthcare facilities. Categories 2 and 3 have relatively high F2 mean scores, attributed to their strong industrial and tourism foundations, which serve as pillar industries. Coupled with smaller populations compared to Nanning, these

cities achieve higher per capita fiscal revenues. However, their overall development levels still lag behind Nanning, with economic disparities evident in per capita GDP and total import-export volume, while social development gaps are reflected in general public budget expenditure, higher education development, and healthcare standards.

The above analysis reveals significant disparities in economic and social development among cities in the Guangxi Zhuang Autonomous Region, particularly between Category 1 (Nanning) and Category 4 cities. This underscores the issues of inadequate and unbalanced development within Guangxi.

6 ARIMA MODEL

6.1 Data Sources

All data were sourced from the *Statistical Yearbooks* published by the Guangxi Zhuang Autonomous Region Bureau of Statistics over the years. The specific data are shown in Table 8.

Table 8 GDP of Guangxi from 2001 to 2021

Year	GDP	Year	GDP	Year	GDP	Year	GDP
2001	2279.34	2007	5823.41	2013	12448.36	2019	21237.14
2002	2523.73	2008	7021	2014	13587.8	2020	22120.87
2003	2821.11	2009	7759.16	2015	14797.8	2021	24740.86
2004	3433.5	2010	8552.44	2016	16116.55		
2005	3984.1	2011	10299.94	2017	17790.68		
2006	4746.16	2012	11303.55	2018	19627.81		

The unit of GDP is 100 million yuan

6.2 Unit Root Test and Randomness Test

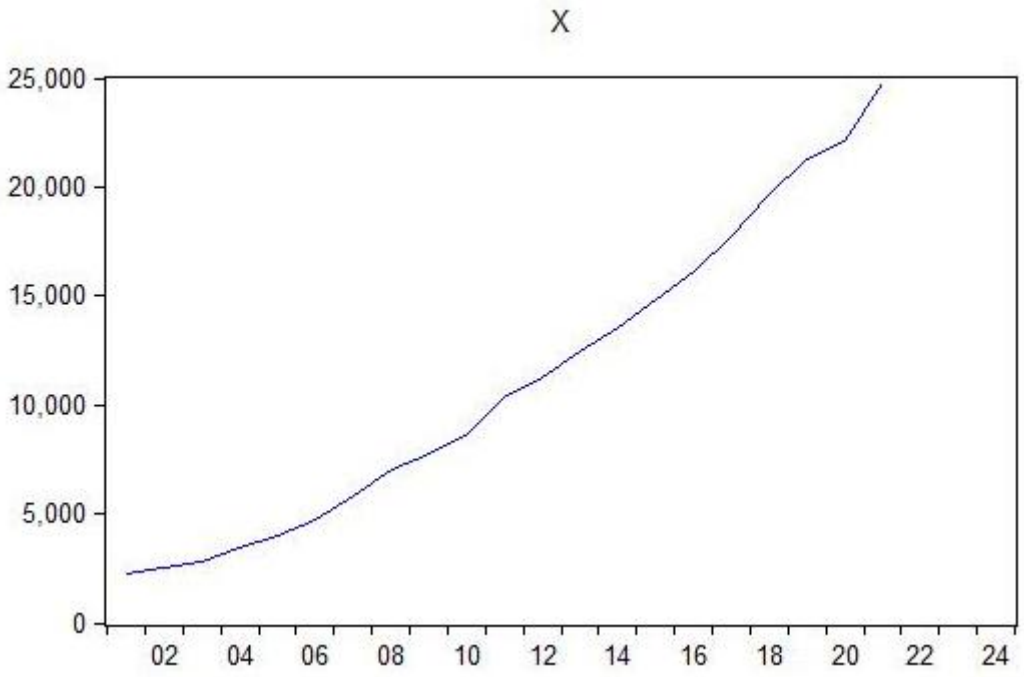

Figure 1 GDP Time Series Plot

The time series plot of Guangxi's GDP from 2001 to 2021 is shown in Figure 1 and 2. To eliminate heteroscedasticity, logarithmic transformation and first-order differencing were applied to the data. Unit root and randomness tests were subsequently conducted.

Table 9 Unit Root Test Results

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.480733	0.0119
Test critical values:	1% level	-4.571559	
	5% level	-3.690814	
	10% level	-3.286909	

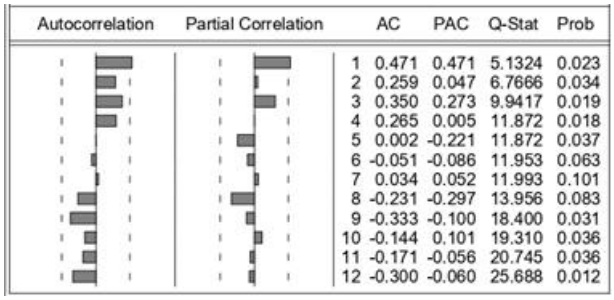

Figure 2 Autocorrelation Results

As shown in Table 9 and Figure 2, the data passed the unit root test and randomness test, indicating that an ARIMA model can be constructed.

6.3 Model Construction

Figure 2 shows the tailing and truncation characteristics, leading to the preliminary selection of an AR(1) model, with an MA(1) model as an alternative.

Table 10 AR(1) Model Test Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.120616	0.018636	6.472279	0.0000
AR(1)	0.471258	0.213027	2.212194	0.0409
R-squared	0.223525	Mean dependent var		0.120143
Adjusted R-squared	0.177850	S.D. dependent var		0.047358
S.E. of regression	0.042940	Akaike info criterion		-3.358706
Sum squared resid	0.031346	Schwarz criterion		-3.259292
Log likelihood	33.90771	Hannan-Quinn criter.		-3.341882
F-statistic	4.893802	Durbin-Watson stat		2.024824
Prob(F-statistic)	0.040930			
Inverted AR Roots	.47			

As shown in Table 10, the AR(1) model is reasonable, and the p-values of its residual tests are all greater than 0.05.

Table 11 MA(1) Model Test Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.119768	0.013837	8.655464	0.0000
MA(1)	0.474044	0.213946	2.215717	0.0398
R-squared	0.204205	Mean dependent var		0.119229
Adjusted R-squared	0.159995	S.D. dependent var		0.046276
S.E. of regression	0.042412	Akaike info criterion		-3.388108
Sum squared resid	0.032379	Schwarz criterion		-3.288535
Log likelihood	35.88108	Hannan-Quinn criter.		-3.368670
F-statistic	4.618903	Durbin-Watson stat		1.898568
Prob(F-statistic)	0.045472			
Inverted MA Roots	-.47			

As shown in Table 11, the MA(1) model is reasonable, and the p-values of its residual tests are all greater than 0.05. Based on the above conclusions, both AR(1) and MA(1) are reasonable models. Therefore, we will compare specific details to select one as the final model, see Table 12.

Table 12 Comparison of AR(1) and MA(1) Models

	AIC	SBC	DW
AR(1)	-3.358706	-3.259292	2.024824
MA(1)	-3.388108	-3.288535	1.898568

We selected the MA(1) model with smaller AIC and SBC values. The final mathematical expression of the model is

$$\begin{cases} y_t = \log\left(x_t / x_{t-1}\right) \\ y_t = 0.119768 + \varepsilon_t - 0.474044\varepsilon_{t-1} \end{cases}$$

First, the model was used for in-sample prediction, and the data from the last three years were taken to analyze the model's fitting performance.

Table 13 Comparison of Actual and Predicted Values

Year	Actual Value (100 Million Yuan)	Predicted Value (100 Million Yuan)	Relative Error
2019	21237.14	21943.77	3.33%
2020	22120.87	23570.67	6.55%
2021	24740.86	24196.22	2.20%

As shown in Table 13, the relative error is within an acceptable range, indicating a good model fit. Dynamic forecasting was conducted based on the above model, yielding the following results: the GDP for 2022 is predicted to be 28,184.62 billion yuan, followed by 31,770.70 billion yuan in 2023, and 35,813.06 billion yuan in 2024.

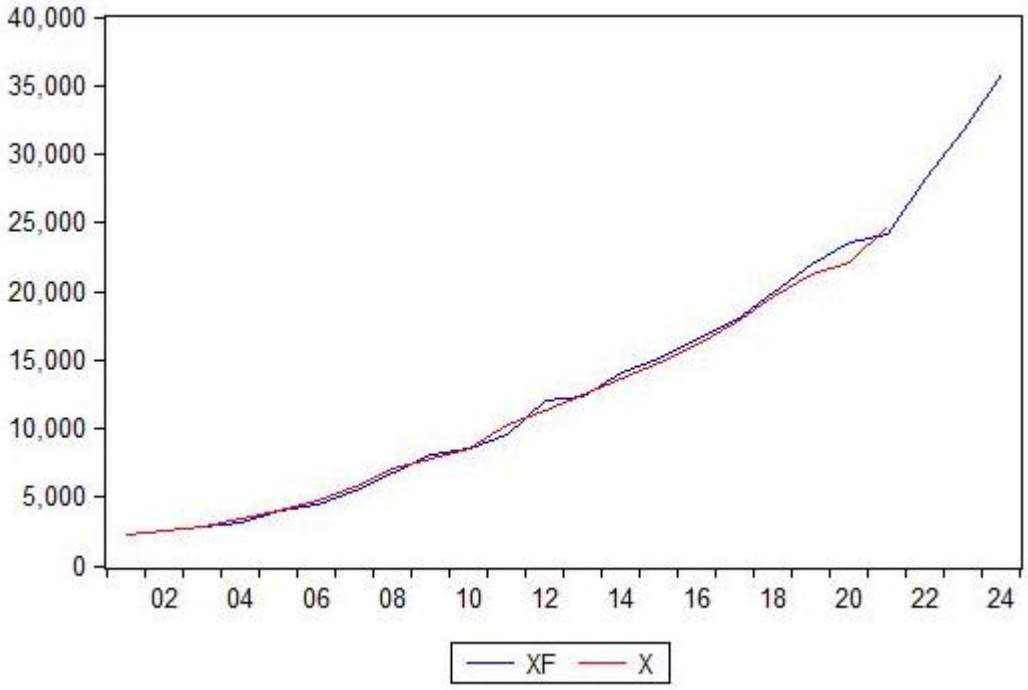

Figure 3 Comparison of Predicted and Actual Values

As can be seen from Figure 3, the model demonstrates a good fit, and Guangxi's future GDP shows a rapid growth trend.

7 Research Conclusions and Outlook

7.1 Basic Conclusions

The coastal economic zone of southern Guangxi has experienced relatively rapid economic development, while the eastern and western economic zones lag behind. This regional economic imbalance is influenced by factors such as natural conditions, policy support, infrastructure development, and population quality.

Based on the above research, Nanning, as the capital of the Guangxi Zhuang Autonomous Region, far surpasses other cities in terms of economic development level, social development level, and social stability. Cities such as Liuzhou and Beihai also exhibit considerable economic and social development levels due to their industrial and tourism development. However, other cities in Guangxi still lag significantly behind the aforementioned ones. Although economic disparities among Guangxi's cities have narrowed in recent years, the gap remains substantial.

Overall, the economic and social development levels of Guangxi's cities are continuously improving. Among them, cities such as Nanning, Guilin, and Liuzhou demonstrate strong economic development and comprehensive strength, while cities like Guigang and Beihai possess certain advantages in developing port trade and modern service industries. Additionally, all cities in Guangxi prioritize the development of tourism and cultural industries to enhance their soft power and attractiveness.

7.2 Strategies to Narrow Disparities

Promote the construction of urban clusters by strengthening cooperation and exchange among cities, particularly in the urban clusters formed by Nanning, Liuzhou, and Guilin, to facilitate the flow and allocation of resources and enhance the overall strength of these clusters. Develop advanced manufacturing by actively introducing advanced manufacturing enterprises, upgrading industrial technology and added value, and promoting the transformation of manufacturing towards high-end, intelligent, and green development to support Guangxi's industrial upgrading. Foster the digital

economy by strengthening digital infrastructure construction, promoting digital transformation, cultivating new digital industries, and improving the technological content and added value of industries to drive economic transformation and upgrading. Enhance infrastructure construction by accelerating the development of transportation, energy, and information infrastructure to reduce regional distances and disparities, thereby increasing regional development vitality and attractiveness. Advance rural revitalization by strengthening rural infrastructure construction, developing rural tourism and industries, improving farmers' income levels, and promoting integrated urban-rural economic development. Through the implementation of these measures, coordinated development among various regions in Guangxi can be further strengthened, promoting balanced and sustainable economic growth.

7.3 Research Outlook

In recent years, disparities in regional economic development in Guangxi have narrowed. Guangxi has made positive progress in implementing regional development strategies and promoting urban cluster construction, gradually reducing development gaps between different regions.

Cities such as Nanning, Liuzhou, and Guilin have consistently served as pillars of Guangxi's economy, leading in economic output and development speed. Simultaneously, Guangxi has vigorously developed the Beibu Gulf Economic Zone and the ASEAN Economic Circle, strengthening cooperation and exchange with surrounding regions and enhancing its economic influence. On the other hand, Guangxi has also adopted a series of measures to promote economic development in impoverished areas, including strengthening infrastructure construction, supporting rural industrial development, and facilitating talent introduction, achieving remarkable results. These initiatives help promote balanced economic development across regions and narrow development gaps.

The future development prospects for Guangxi are positive. As the only open coastal economic zone in southwestern China, Guangxi has always been an important gateway for China's opening-up and will continue to play a significant role in the future. In summary, Guangxi will continue to leverage its unique geographical, resource, and cultural advantages, strengthen cooperation and exchange with surrounding regions, strive for high-quality economic development and comprehensive social progress, and become a modern open economic zone with international competitiveness.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

REFERENCES

[1] Wu Aizhi, Yang Kaizhong, Li Guoping. A Review of Research on Changes in Regional Economic Disparities in China. Economic Geography, 2011, 31(05): 705-711.
[2] Ma Jiantang, He Xiaodong, Yang Kaizhong. Theory, Application, and Policy of Economic Structure. Beijing: China Social Sciences Press, 1991: 506-509.
[3] Liu Shucheng, Li Qiang, Xue Tiandong. Research on Regional Economic Development in China. Beijing: China Statistics Press, 1994: 141-165.
[4] Zhang Qinghua, Huang Zhijian, Guo Shufen. Regional Economic Development Disparities and Catch-Up Model Predictions. Statistical Decision-Making, 2017(15): 146-149.
[5] Qin Chenglin. Research on Regional Economic Disparities in China. China Economic Press, 1997.
[6] Chen Guang. Exploring Local Tax Policies to Promote Coordinated Regional Economic Development: A Case Study of Guangxi. Economic Research Reference, 2015(23): 63-67.
[7] Nie Hualin, Wang Chengyong. Introduction to Regional Economics. Beijing: China Social Sciences Press, 2006.
[8] Chen Tian. Research on Coordinated Regional Economic Development in Guangxi Zhuang Autonomous Region: From Imbalance to Coordination. Southwest Minzu University, 2022.
[9] Lei Yuan. Analysis of Regional Economic Development Disparities in Rural Areas of Guangxi Zhuang Autonomous Region. Guangxi University, 2022.
[10] Lu Xiao. Study on Regional Disparities and Development Strategies in Guangxi. Guangxi University, 2004.
[11] Tan Yan. Analysis of Regional Economic Disparities Based on Cluster Analysis Model: A Case Study of Sichuan Province. China Market, 2021(14): 4-7.