Spillover Effects of Land Port Economy: A Case Study of Huaihua International Land Port in Hunan, China

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Previous studies have shown that the construction and development of international land ports have a significant economic spillover effect on the neighboring regions. The construction and development of Huaihua International Land Port inevitably exerts economic spillover effects on the adjacent regions. It is necessary to analyze and predict the trend of economic data before and after the construction of the land port in the study area to evaluate accurately the role and effect of the land port in driving the economic development of the local and neighboring regions. Then, the impact of land ports as a variable is quantified by analyzing the difference between the predicted and actual results, thus providing a basis for formulating scientific policies. Local governments' general public budget revenue (GPBR) is an important indicator to measure the economic development of a region. The paper uses the local governments' GPBR of Huaihua International Land Port Economic Development Zone, Hecheng District, and Zhijiang Dong Autonomous County from January 2019 to June 2023. Based on this, time series decomposition and SARIMA modeling are carried out. It analyzes the impact of Huaihua International Land Port on the region and its economic spillover effect on the surrounding regions. The results found that the impact presented by the model is consistent with the actual situation. Therefore, the evaluation results have high accuracy and reliability.

Keywords: Huaihua International Land Port, local governments' GPBR, time series decomposition, SARIMA model

INTRODUCTION

In the economic development of non-coastal regions worldwide, much attention has been paid to the construction and development of inland ports, especially international land ports. They contribute more

positively to the development of the regional economy (Pablo, Ivan, and Violeta et al., 2023). China's vast central and western regions are far from the coastline. Therefore, building and developing international land ports has become essential for regional economic development. International and domestic practice shows that building international land ports facilitates the development of the regional export-oriented economy.

Furthermore, they can promote industrial agglomeration and transfer and advance the high-quality development of logistics. They can also accelerate the integration of industry and urban development and stabilize society. In particular, they exert an economic spillover effect on the neighboring regions. Therefore, international land ports should be highly emphasized and researched. The construction and development of Huaihua International Land Port in Hunan Province of China is taken as an example. It applies the SARIMA time series analysis model to analyze the local governments' GPBR. Thus, it can quantitatively evaluate the economic benefits of the construction of the Huaihua International Land Port and then investigate the spillover effect of such benefits on the economic development of the surrounding regions.

The history of economic development of countries has proved that the export-oriented economy must be developed vigorously for long-term and stable economic development. Under the premise of promoting regional economic development and growth, the export-oriented economy must fully consider international market demand and expand exports. While effectively utilizing the resource advantages in China, it should make full use of foreign resources and factors of production and adopt an export-oriented development path. Moreover, it should actively participate in the economic structure, economic operation mechanisms, and systems based on the international division of labor and international competition (Per, Lokesh, and Violeta, 2023). The construction and development of international land ports can more effectively promote the local communities to give full play to their location advantages and transportation and logistics platform strengths.

Further, it can drive the concentration of advantageous industries and resource elements and bring into play the effects of the scale of enterprises, population, and land. Moreover, it can actively develop export-oriented, chained, high-performance industrial clusters, constantly enhancing the overall industrial competitiveness of international land ports and ultimately boosting regional economic development. The achievements of countries worldwide have shown that international land ports can help optimize the urban layout and build high-class port towns and cities. Moreover, they can promote the integrated development of urban and rural areas and new urbanization, thus increasing employment opportunities, raising incomes, and stabilizing society (Sinan, 2023). In short, international land ports can fully use international and Chinese resources and markets. It can further open Western China to the outside world and engage it deeply in the global economic division of labor and economic cycle.

In recent years, Chinese government leaders have put forward significant propositions. China should build a new development pattern and create a center of inland reform and opening up from the perspective of national development strategy. They have called for earnest efforts in the central and western inland regions. Since the beginning of the 21st century, several international land ports have been built and operated in Western China. They have contributed significantly to Western China's economic and social development (Liu, 2023). After repeated research and demonstration, the Hunan Provincial People's Government has decided to develop Huaihua International Land Port in Huaihua City, a city in Western Hunan Province. It aims to promote the economic development of the Huaihua area and take a new path for the economic development of Hunan Province and even the Greater South China region (Zhang, 2023). Huaihua International Land Port Project is a node project for building the New International Land-Sea Trade Corridor and connecting the "Belt and Road." It will become an important engine to drive the coordinated development of the western Hunan region and a critical window for shaping a new pattern of opening up the Hunan Province to the outside world in all aspects. At the same time, it will vigorously promote the regional development of South China.

Since the early establishment of the international land port, local officials in Huaihua City have regarded it as a significant strategic measure for the city's economic and social development. All social sectors in Huaihua recognize that the construction and development of the international land port is a significant historic opportunity to promote the city's high-level opening and high-quality development

(Yang et al., 2023). However, since the commencement of the project in September 2021, no method has been developed to fully quantify the impact of the construction of the port on the local economy. It hinders the validity testing of the government's decision-making and significantly affects its and enterprises' future investment plans. The Huaihua International Land Port must be quantitatively analyzed to overcome this dilemma. In this way, it can provide a further decision-making basis for the smooth progress of the project.

This paper uses the time series analysis model, SARIMA model, as the research method and tool. The financial indicator of local governments' GPBR is modeled and analyzed. Then, it quantitatively evaluates the impact of the construction of Huaihua International Land Port on the economy of the Economic Development Zone and the surrounding areas. Regarding the theoretical significance and contribution of this study, it empirically tests the validity of the SARIMA model. Furthermore, the analysis is extended to the judgment of large-scale economic projects and their spillover effects. It is expected to give theoretical guidance to China and other countries for analyzing international land ports' results and spillover effects.

LITERATURE REVIEW

Internationally, there is still a significant gap in the research on land ports. On the contrary, China has a considerable advantage in this field. The concept of land ports was also coined by Ping Xi (2001), the father of land ports in China. The SARMA model is a commonly used method for modeling stationary time series. At present, many scholars have adopted the SARIMA model, a time series model, to forecast the results of economic development. Many favorable forecasting results have been produced.

Land Ports

To promote the development of a local export-oriented economy in recent years, the inland areas of China have seen a boom in constructing international land ports. Building international land ports, especially those in line with the current national strategy and local policy supports, will highly facilitate the financing of local state-owned enterprises.

With the implementation of the Belt and Road Initiative in the last decade, there have been numerous studies on the export-oriented economy, especially the land port economy, in China. Chinese scholars have investigated the utility of the export-oriented economy to countries, regions, enterprises, and individuals through case studies, indicator development, and modeling. Li (1985), Liang (1985), Wang (1985), and Zhang (1985) intensively researched the establishment of special economic zones to boost the development of local export-oriented economy. Their studies focus on the reforms of economic institutions and mechanisms, economic development models, and factors of production. Since then, the theories on developing a local export-oriented economy have expanded. Fu, Liao (2013), Wu (2021), Lu (2022), Zhao (2022), and Shu (2022) examined the export-oriented economy in Hainan, Shanghai, Shenzhen, Alashankou, Xiangyang, Shandong, and Hubei. Then, they put forward appropriate recommendations for the development of these areas.

Regarding the study of land port economy, Xi et al. (2001) presented the idea of establishing an international land port in Western China, i.e., Xi'an Land Port. In addition, the central and local governments have emphasized land port development since around 2010. A boom in the development of inland ports has also been observed in various inland areas far from the coastline. Related studies have also been launched continuously. Based on Xi's research, Zhu and Dong (2009) made a new expression of the essence and connotation of international land ports. They indicated that international land ports are established in inland areas, relying on information technology and convenient transportation corridors. These ports are logistics nodes with integrated functions such as container distribution, freight forwarding, third-party logistics, and port supervision.

Furthermore, they are inland hubs with perfect coastal port functions and convenient outbound transportation operation systems. Chen and Huang (2011) constructed an evaluation index system for the competitiveness of international land ports from internal and external development circumstances. They also conducted an empirical study using the Fuzzy-ANP evaluation approach. While elaborating on the functional positioning of Xi'an Land Port, Zhang et al. (2015) further analyzed the necessity and feasibility

of enhancing the function of Xi'an Land Port as an international transit hub. They presented path analysis and countermeasure suggestions that may serve as a reference for inland areas. Specifically, it can gather more land ports in the hubs and expand cargo sources. Adopting the data envelopment analysis approach, Yang and Li (2019) constructed an evaluation system for the coordinated development of logistics capacity and socio-economic development in cities of international land ports.

Moreover, they conducted an empirical study on representative cities with international land ports in China. With the construction of Huaihai International Land Port, He and He (2023) examined the planning and layout of the port, its functional position, project progress, institutions, and mechanisms. Based on this, they considered that the three systems of land port construction (industrial system, open system, logistics system) help to support and guarantee the management service mechanism.

Research on GDP, CPI, and Other Economic Indicators Based on the SARIMA Model

In the research on time series on the GDP (Gross Domestic Product) and Consumer Price Index (CPI), Sun (2018) et al. modeled China's quarterly GDP data from 2000 to 2016 by using a seasonal time series model. They forecast the quarterly data for 2017. The fitting and forecasting results of the GDP forecasting model based on SARIMA have high reliability and accuracy. Chen (2021) sampled 66 quarters of GDP data from Q1 2003 to Q2 2019 in Guizhou Province. He modeled this time series by the SARIMA model. Furthermore, he forecast the GDP from Q3 2019 to Q3 2020. The results show a high fitting accuracy, and the forecasting results of the GDP forecasting model based on SARIMA provide a practical reference for setting economic development targets in Guizhou Province.

Geng and Ye (2018) constructed a CPI model of SARIMA with the sample data of Sichuan's CPI from 2009 to 2016. They made a short-term forecast of the CPI from January to July 2017 in Sichuan Province. The analysis indicated that the model has a high forecasting accuracy. Li (2020) modeled and forecasted the monthly CPI of Henan Province using SARIMA, SARIMA-LSTM, and LSTM models. It was found that the SARIMA-LSTM model was the most effective and could truly reflect Henan Province's CPI. Besides, the model is highly effective in forecasting the actual CPI.

Research on Industry Trends Based on the SARIMA Model

In this regard, extensive scholarly attention has been drawn regarding the simulation of SBP tariff forecasts utilizing a SARIMA model. It derives the aging status for specific operational strategies and features of incremental cost segments (Olk et al., 2019). Chen et al. (2019) developed a statistical model to predict international undergraduate enrollment in the central and western regions. During the COVID-19 pandemic, Wickramasinghe et al. (2020) forecast the economic losses caused by the pandemic. Andreana et al. (2021) estimated the disruptive impact of the COVID-19 outbreak on macro-regional air transportation. Turkish agricultural economists Çevrimli et al. (2023) used Box-Jenkins and Winter's exponential smoothing approach to develop models for time series data on Turkey's honey prices between 1998 and 2018.

Moreover, they assessed the application of such models to forecast the changes in the exchange rate of the Turkish lira to the US dollar in 2019-2020. Polish researchers Sitkiewicz et al. (2021) applied predictive models and neural networks to analyze electricity consumption in Poland. Indonesian researchers Fajari et al. (2021) used the SARIMA approach to identify the best model for forecasting the average rice price of wholesales or retail trade from July 2020 to June 2021 in Indonesia. Furthermore, the data used in this model are average figures.

Chinese researchers forecast vegetable prices in Shanghai from January to June 2020 using the SARIMA model, comparing and analyzing the forecast data (adjusted for the Chinese New Year) with the actual wholesale vegetable prices in Shanghai. The average error rate of static forecast for this model was 7.3%, and that for dynamic estimates was 4.6%. It shows that the SARIMA(3, 1, 3)×(2, 1, 0)12 model can well represent the volatility characteristics of vegetable prices in Shanghai. That is, the vegetable prices in Shanghai are closely correlated with those of the previous three months and the same period of the last two years. Hence, the SARIMA model can help analyze and predict the future trend of Shanghai vegetable prices and guide the development of the vegetable industry (Zheng, 2020). At the same time, the researchers

also selected the consumer vouchers issued in Hangzhou and Ningbo, Zhejiang Province. Using the SARIMA model, they analyzed the economic stimulating effects of the general-purpose consumer vouchers (Hangzhou) and industry-specific consumer vouchers (Ningbo), respectively. They identified significant differences in the outcomes across models. The overall effect of general-purpose vouchers is weaker than that of industry-specific vouchers. The results of the two types of vouchers differ significantly in the catering, tourism, retail, and accommodation sectors. It is then suggested that consumer vouchers should be designed with strong connections with specific industries based on the characteristics of the regional economy and regional consumer groups. It is further recommended that consumer vouchers have a significant time decay effect, and local governments should not issue them repeatedly over the long term (Wu and Wu, 2021).

Zhou et al. (2020) investigated time series trends in other industries in China using the SARIMA model. They selected the daily business volume data of a branch office of a courier company. They built a SARIMA model based on time series analysis using R language and optimized the linear fitting of the model residuals. Given that the time series model only applies to short-term forecasting, they built a sliding window model with a forecasting period of three days. Then, they forecast a courier company's daily express delivery business volume, with an average error of the forecast results of 7.0%. According to An and Ho (2022), the data from the forecasting model can better assist the express delivery industry in addressing possible risks and uncertainties. It provides an essential reference for the future development of the regional economy and express business.

Song (2022) applied two forecasting methods, SARIMA and ANFIS, to forecast the demand for electricity materials. Then, he used the BP neural network to integrate the results of these two forecasting methods to derive the final results. At the same time, he verified the reliability and accuracy of the method by applying it to Shenzhen Power Supply Co., Ltd. In recent years, bicycle-sharing programs have been introduced in many cities in China. Using the monthly active users (MAU) of Hellobike, Dong, and Lou (2023) built SARIMA and ARIMA-GARCH models to predict its user size. They found that the MAPE values of both models were less than 5%, with a slight forecasting deviation and a satisfactory forecasting effect. The ARIMA-GARCH model can better capture the fluctuating aggregation characteristics of MAU data and achieve higher prediction accuracy. Also, it can better reflect the short-term changes in the size of bike-sharing users.

For meteorological monitoring and forecasting, Zhang et al. (2021) applied the CAR (Continuous Time Autoregressive) model based on the O-U mean-reversion process, the SARIMA (Seasonal Autoregressive Integrated Moving Average) model, and the wavelet neural network algorithm. They fitted the model by selecting the temperature of representative cities with geographical characteristics, such as Mohe, Beijing, Urumqi, Wuhu, Kunming, and Haikou. Moreover, they tested the model's prediction accuracy using the indicators of unbiased absolute percentage error, absolute percentage error, and average absolute proportion error.

Research on Import and Export Trade Based on SARIMA Model

Wang and Guan investigated the import and export trade using the SARIMA model. Using the time-series test method, they analyzed the correlation between China's monthly historical data of total import and export trade from 1994 to 2016. Then, they established the corresponding SARIMA model. The time-series forecast model of China's monthly total import and export trade showed prominent U-shaped trends and quarterly variations. Based on the monthly data of trade in Chinese herbal medicines of five Central Asian countries from January 2010 to November 2021, Wang and Zhu (2022) established a forecasting method with the SARIMA model. They discovered a seasonal pattern in the demand for Chinese herbal medicines in Central Asia. The need for Chinese herbal medicines in Central Asia peaks in the fall (July and September) and will see sustained growth. The forecast will provide a reference for the future action strategies of the government, enterprises, and medicinal herb growers in the trade of Chinese herbal medicines.

Research on Regional Growth Based on the SARIMA Model

In recent years, Chinese scholars have paid much attention to how infrastructure development contributes to regional economic growth. Based on a comprehensive consideration of the synergistic effects of multidimensional factors on regional economic growth in China, Zhang (2012) built a model of spatial spillovers of transportation infrastructure on regional economic development. He empirically analyzed China's provincial panel data from 1993 to 2009 based on spatial econometrics. It was concluded that the output elasticity of China's transportation infrastructure to regional economic growth was about 0.05-0.07. He affirmed the critical effect of transportation infrastructure on regional economic growth in China. Pan (2012) investigated the spatial distribution pattern and characteristics of per capita GDP in Chinese provinces and regions from 1988 to 2009 by applying exploratory spatial data analysis tools.

On the one hand, there is a positive spatial autocorrelation in the whole area, which increases with time. On the other hand, the local correlation analysis also shows that China's localized spatial agglomeration becomes increasingly visible. The empirical analysis also revealed that the spatial spillover effect decreases with the increased distance between regions.

In summary, many Chinese and foreign scholars have applied time series modeling to forecast various economic phenomena. However, there are very few studies on local international land ports. Very few studies have been conducted on the economic spillover effects of the Huaihua International Land Port on the neighboring regions. This study can compensate for the absence of research and pioneer such research. Specifically, three representative districts and counties in Huaihua City (Huaihua International Land Port Economic Development Zone, Hecheng District, and Zhijiang Dong Autonomous County) were selected. Using the SARIMA model and the GPBR statistics of the three regions, it makes a short-term prediction and analysis of the economic spillover effect of Huaihua International Land Port. It is intended to provide a reference for the smooth progress of the project.

MODELING AND DATA ANALYSIS

In this paper, the SARIMA model was built for forecasting and analysis. Seasonal data are analyzed because the statistical analysis of economic indicators across China is conducted on a seasonal basis. The data for each month is recurrent and repetitive, with a cycle of one year. Such data are consistent with the characteristics of seasonal data.

Introduction to the SARIMA Model

First of all, we introduce the SARIMA model, which is expressed as follows:

$$\Theta_p(B^S)\theta_p(B)(1-B^S)^D(1-B)^d y_t = \Phi_Q(B^S)\phi_q(B)\varepsilon_t \quad (1)$$

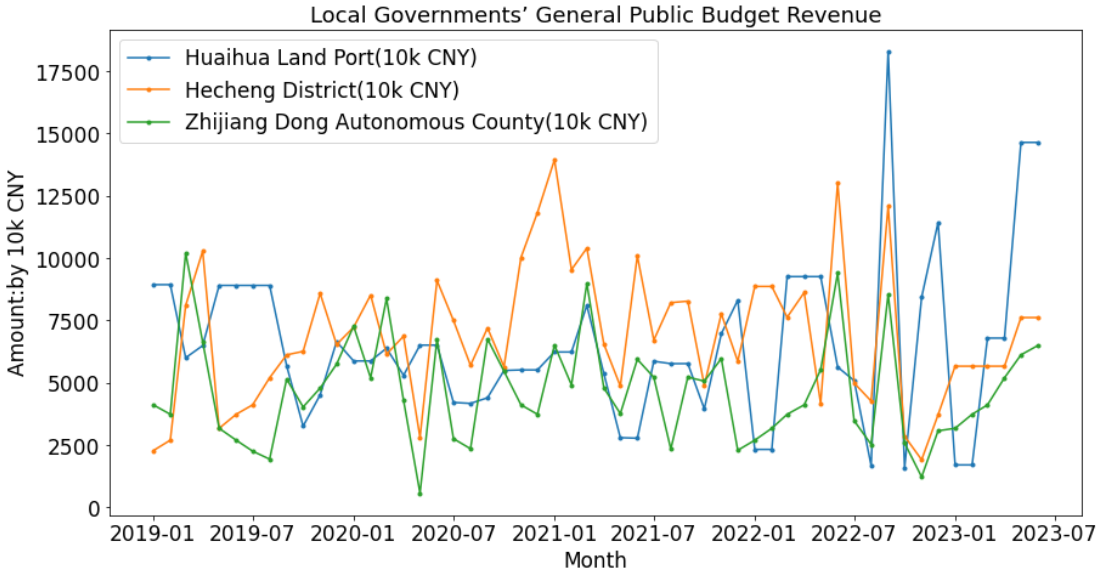
It is usually abbreviated as 〖SARIMA(p,d,q)(P,D,Q)〗_s model. The parameters can be roughly categorized into two types. One is seasonal parameters, including seasonal autoregressive order P, the number of seasonal differences D, the order of seasonal moving average Q, and the length of the seasonal cycle s. The other is non-seasonal parameters, including non-seasonal autoregressive order p, the number of one-step differences d, and the order of non-seasonal moving average q. The indicator analyzed in this paper is Local Governments' General Public Budget Revenue (GPBR), in ten thousand yuan. The data were obtained from the monthly economic statistics report published on the local government's website. Moreover, the data were briefly cleansed. The raw data were the cumulative GPBR as of the end of the current month. It was subtracted from the previous month's data to get the GPBR of the current month. Missing values were complemented with the average of the figures of the previous and next periods.

The statistical criteria of GPBR is the fiscal revenue mainly based on local tax revenue. It comprises the revenue of the local government, the tax rebates and transfer payments from the superior government to the local government, and the revenue turned over by the subordinate government. It can represent the development of the local economy well. Therefore, this indicator is chosen to analyze the impact of the

construction of Huaihua International Land Port on the economy of the region, as well as the spillover effect on the surrounding areas.

The data analyzed in this study were selected from the data of the Huaihua International Land Port Economic Development Zone. In addition, only the data of the nearby Hecheng District (excluding the data of the Economic Development Zone) and Zhijiang Dong Autonomous County were selected. The impacts of the Huaihua International Land Port on other regions will be analyzed and introduced in the subsequent research results. The time frame of this study is from January 2019 to June 2023, as shown in Figure 1.

FIGURE 1
LOCAL GOVERNMENTS' GENERAL PUBLIC BUDGET REVENUE



Time Series Decomposition

There are many models to decompose time series, such as additive model, multiplicative model, hybrid model, X11 decomposition, SEATS decomposition, STL decomposition, and fbprophet decomposition. The multiplicative model is one of the most used decomposition models in the economic field and is expressed as follows:

$$X_t = T_t + S_t + R_t, t = 1,2,\ldots \quad (2)$$

where, X_tis the time series value, T_tis the trend term, S_tis the seasonal term, and R_t is the random term.

The multiplicative model applies to analyzing data where the effects of the various factors on the time series are not independent. In addition, the seasonal fluctuations and trends in the data may change over time. Most economic indicators are consistent with this assumption, and the local governments' GPBR analyzed in this paper is no exception. Thus, this model is used to decompose the time series of the GPBR of Huaihua International Land Port Economic Development Zone (the Economic Development Zone), Hecheng District, and Zhijiang Dong Autonomous County, respectively. The decomposition results are shown in Figure 2, 3, and 4.

FIGURE 2
THE RAW DATA, TREND, SEASONAL AND RANDOM TERMS OF THE ECONOMIC DEVELOPMENT ZONE'S GPBR

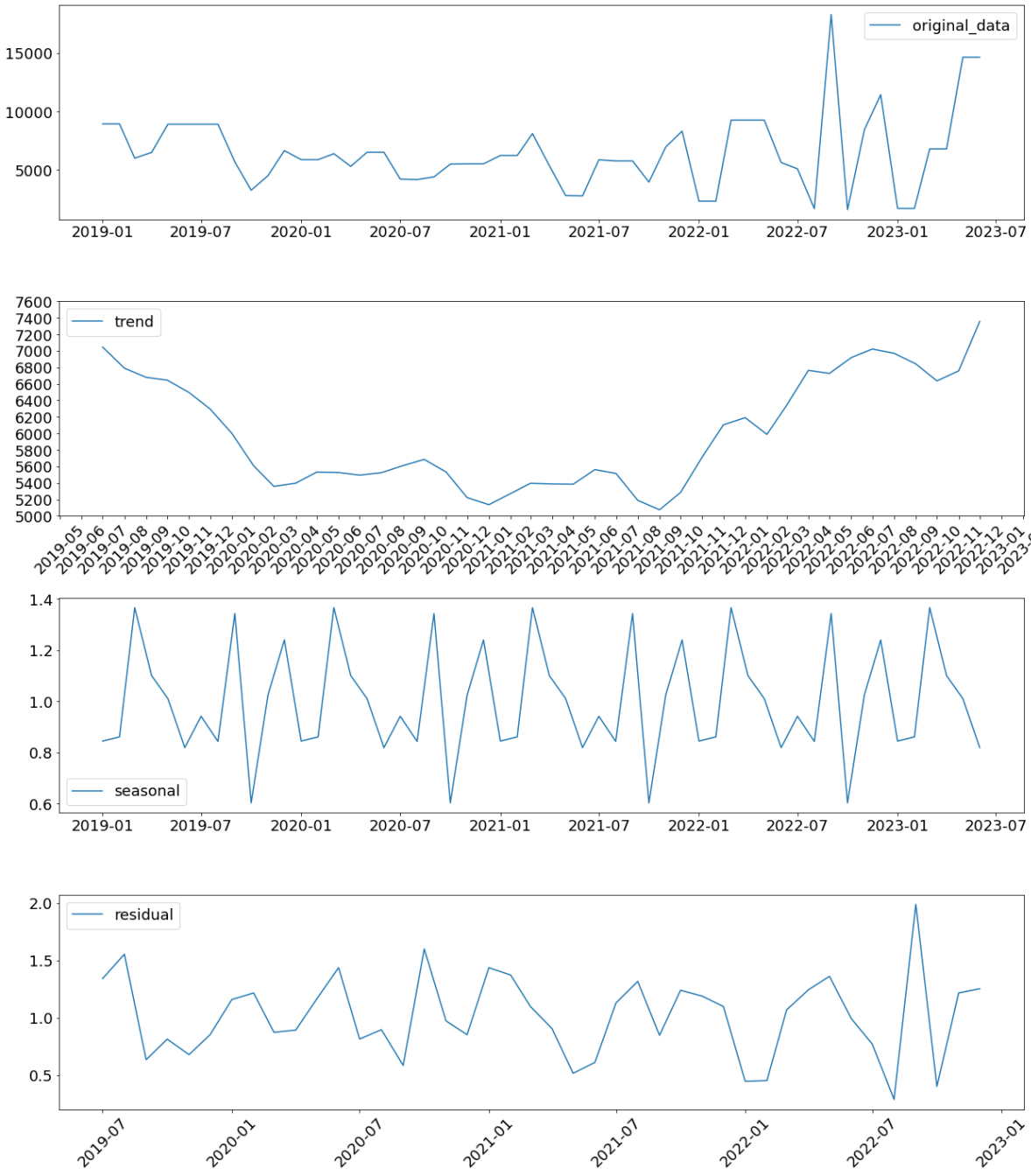


FIGURE 3
THE RAW DATA, TREND, SEASONAL AND RANDOM TERMS OF HECHENG DISTRICT'S GPBR

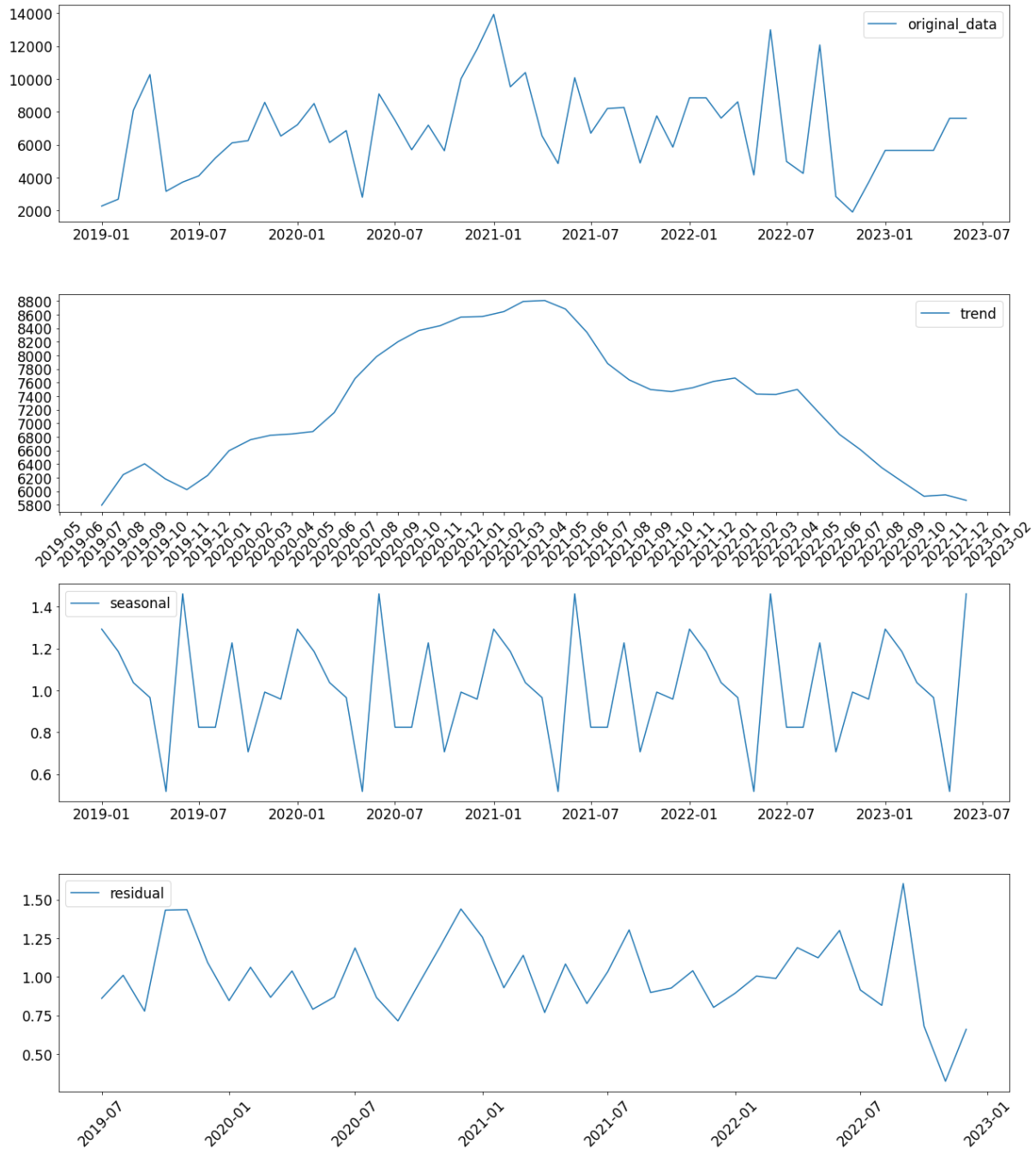
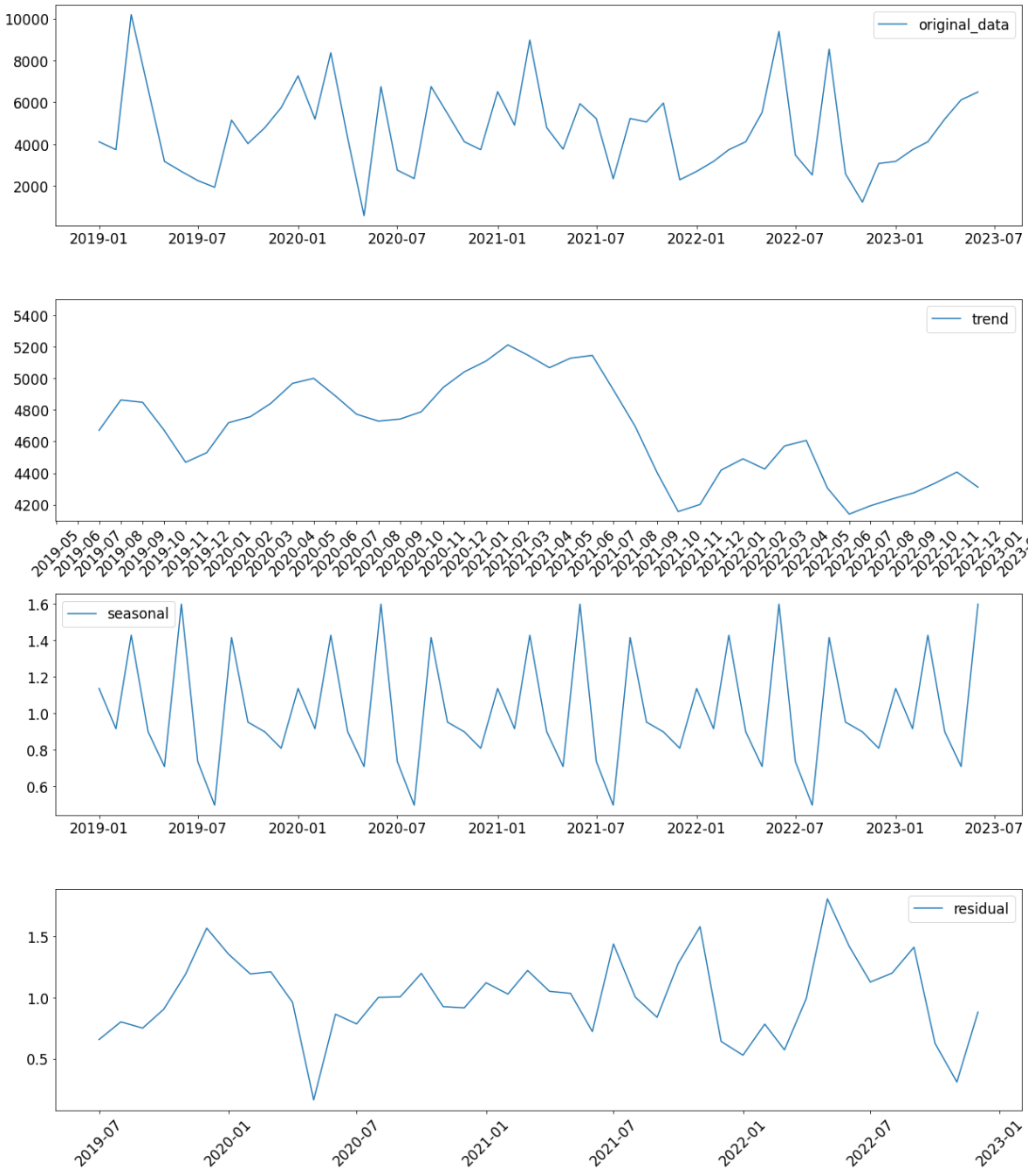


FIGURE 4
THE RAW DATA, TREND, SEASONAL AND RANDOM TERMS OF ZHIJIANG COUNTY'S GPBR



The Economic Development Zone's GPBR declined from 2019, stabilized by 2020, and remained low. The trend changes from September 2021, when the curve rises rapidly. The trend agrees with the reality. From January 2020 to September 2021, the COVID-19 pandemic had a strong negative impact on the local economy. The Port commenced construction in September 2021, bringing great opportunities to all aspects of the Economic Development Zone. In particular, there has been rapid progress in its economic development. Local governments' GPBR faithfully captures these messages and indirectly verifies the

credibility of its proxy for economic growth. The decomposed series of seasonal factors reveals that local governments' GPBR is characterized by marked seasonal fluctuations (Figure 2).

Hecheng District's GPBR consistently rose from 2019 to early 2021, remained stable from 2021 to 2022, and always significantly declined from early 2022. The reason may be that the construction of Huaihua International Land Port has created many policy dividends for the Economic Development Zone, such as tax incentives, financial subsidies, and financial support. It attracted many businesses and enterprises in the Hecheng District in the short term, resulting in a significant decline in tax revenues. The decomposed series of seasonal factors shows that Hecheng District's GPBR is also characterized by marked seasonal fluctuations (Figure 3).

Zhijiang Dong Autonomous County's GPBR rose from late 2019, peaking in 2021 and declining in the first half of 2021 until October 2021. Since then, the data has remained essentially flat, stopping the decline. In 2021, the development of the Huaihua International Land Port boosted Zhijiang's economy. Analyzing Zhijiang Dong Autonomous County as a typical case demonstrates the positive economic spillover effect of the Huaihua International Land Port on the surrounding areas. The decomposed series of seasonal factors still shows that significant seasonal fluctuations characterize Zhijiang's GPBR. The second quarter is the peak of the annual wave (Figure 4).

Stationarity Test on the Data Before Construction of Huaihua International Land Port

September 2021, the commencement date of the Huaihua International Land Port, is used as the dividing node to analyze the economic impacts of the port better. The local governments' GPBR data were divided into pre- and post-construction. The pre-construction data were modeled statistically.

From Figure 1, we cannot directly observe the stationarity of local governments' GPBR in the Economic Development Zone, Hecheng District, and Zhijiang Dong Autonomous County before constructing the international land port. Therefore, the Autocorrelation Function (ACF), Partial Autocorrelation Function (PACF), and Unit Root Test were needed. ADF test, which is the most commonly used unit root test, is used in this paper. The original hypothesis of the test is that the time series is non-stationary.

After the ADF test, the P-values of the GPBR of the Economic Development Zone, Hecheng District, and Zhijiang County were approximately 0.0028, 0.0022, 2.5871×10^(-5), approaching 0. The observation of the three ACF charts and three PACF charts reveals that the autocorrelation coefficients of the three-time series rapidly decrease and converge to zero in the range of small lag order. To summarize the above results, we can reject the original hypothesis and conclude that the time series data of the three regions' GPBR are stationary.

FIGURE 5
ADF TEST, ACF, AND PACF OF THE ECONOMIC DEVELOPMENT ZONE'S GPBR

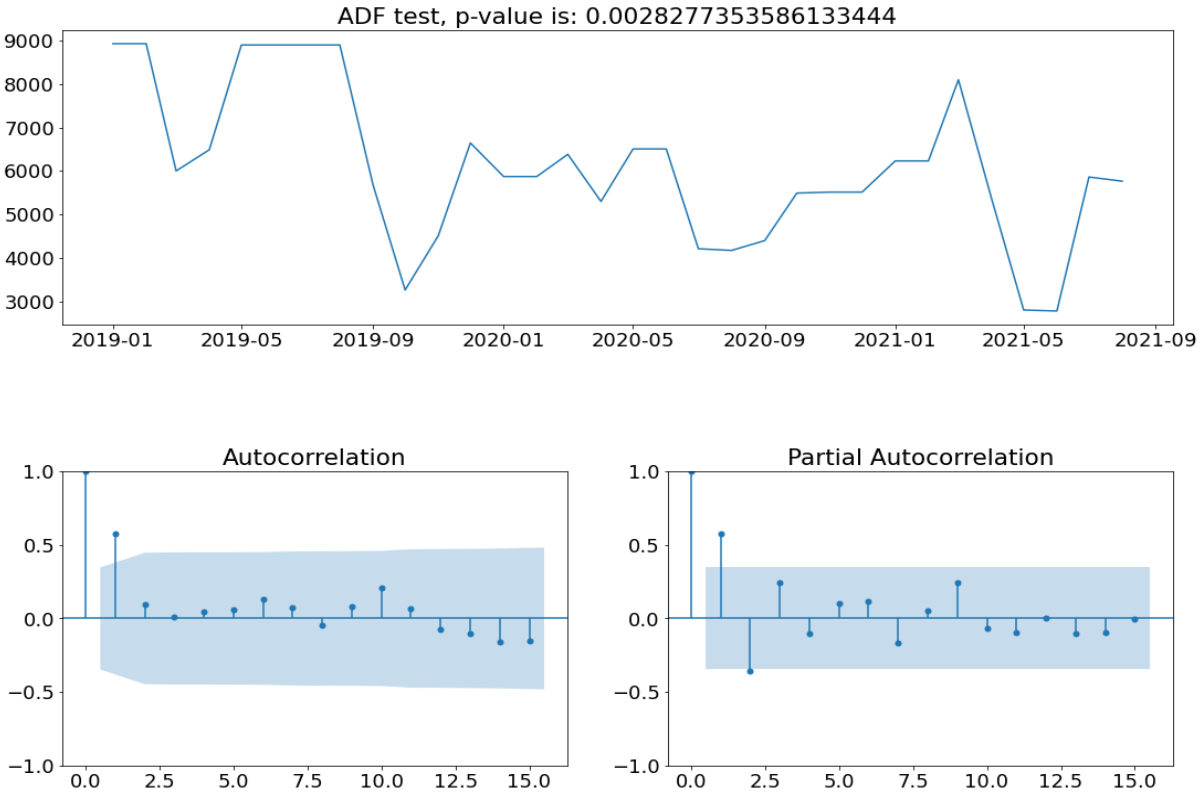


FIGURE 6
ADF TEST, ACF, AND PACF OF HECHENG DISTRICT'S GPBR

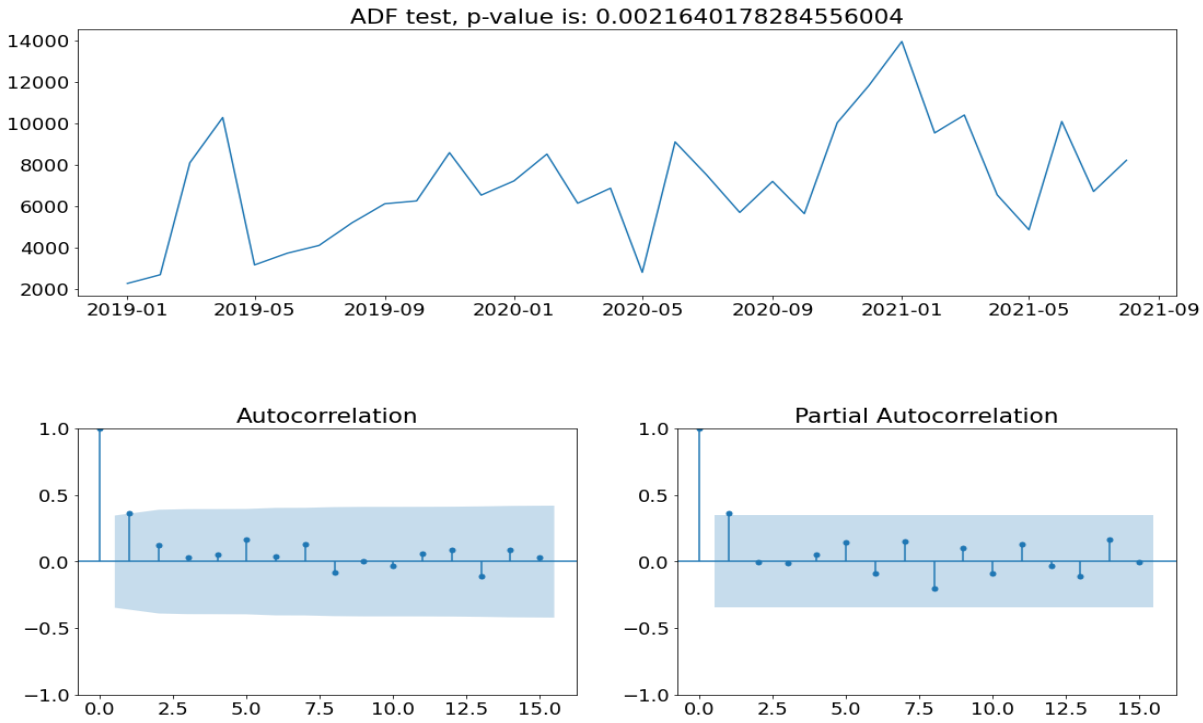
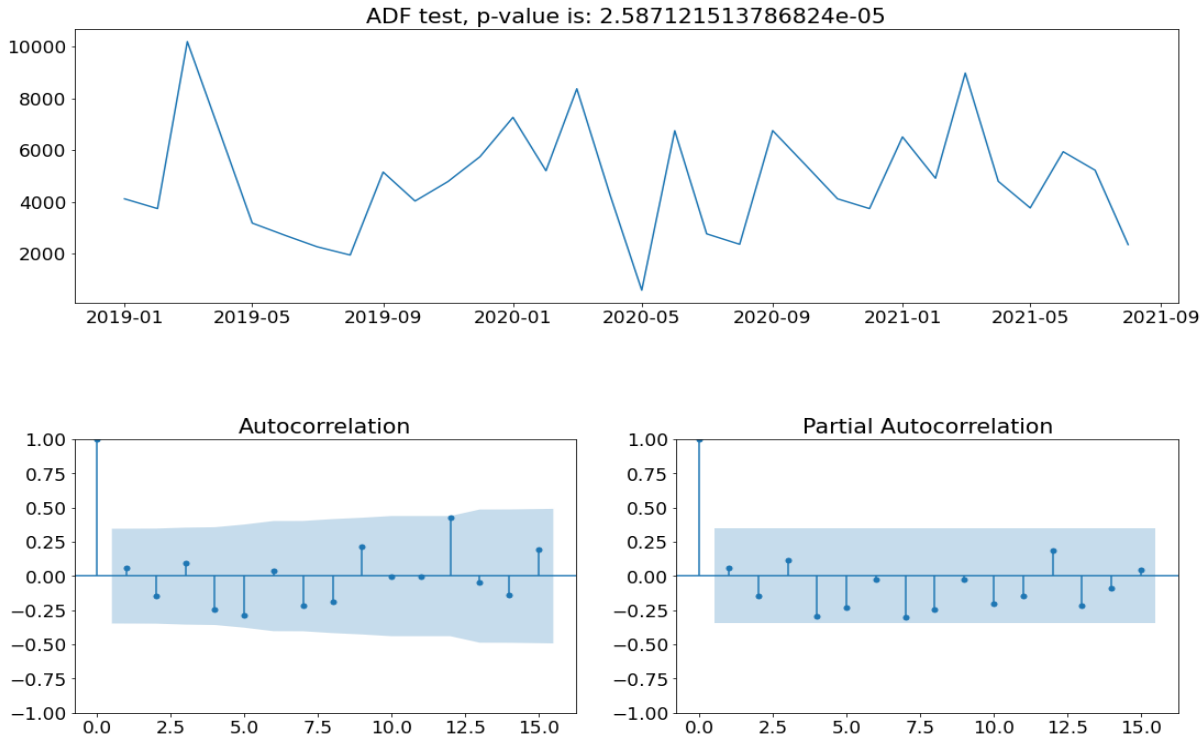


FIGURE 7
ADF TEST, ACF, AND PACF OF ZHIJIANG COUNTY'S GPBR



White Noise Test

In this paper, the Ljung-Box test, or LB test, is used to determine whether the time series of local governments' GPBR is a white noise series. If it is a white noise series, no valuable information can be extracted from the data, and the analysis ends. The original hypothesis is that the series is a white noise series. The results are shown in Tables 1-3.

TABLE 1
LB TEST OF THE ECONOMIC DEVELOPMENT ZONE'S GPBR

lags	lb_stat	lb_pvalue
1	11.661932	0.000638

TABLE 2
LB TEST OF HECHENG DISTRICT'S GPBR

lags	lb_stat	lb_pvalue
1	4.649948	0.031054

TABLE 3
LB TEST OF ZHIJIANG COUNTY'S GPBR

lags	lb_stat	lb_pvalue
1	0.116588	0.732765
2	0.847313	0.654649
3	1.178102	0.758261
4	3.510623	0.476265
5	6.884644	0.229362
6	6.942189	0.326227
7	8.941521	0.256882
8	10.530701	0.229733
9	12.687700	0.177254
10	12.687710	0.241660
11	12.689614	0.314095
12	22.656133	0.030791

The P-values of the LB test for the GPBR of the Economic Development Zone and Hecheng District were 0.000638 and 0.031054, respectively, less than 0.05. Hence, the original hypothesis can be rejected. The p-value of the LB test of Zhijiang County's GPBR in period 12 was 0.030791, less than 0.05. Therefore, the original hypothesis can be rejected, and the time series can be considered to have long-run autocorrelation. It can be concluded that the analyzed time series of GPBR of the Economic Development Zone, Hecheng District, and Zhijiang Dong Autonomous County were not white noise. Therefore, the data is of value for modeling and analysis.

Building SARIMA Model

The time series data of local governments' GPBR are characterized by pronounced seasonality and non-stationarity. Thus, we choose to build a SARIMA model to predict and analyze the GPBR of the three regions. The results show a good fit of the model. The fitted value (fitted), the actual value (GPBR), and the forecast value (forecast) and actual value were in good agreement (Figure 8, Figure 9, and Figure 10).

FIGURE 8
SARIMA MODEL OF THE ECONOMIC DEVELOPMENT ZONE'S GPBR

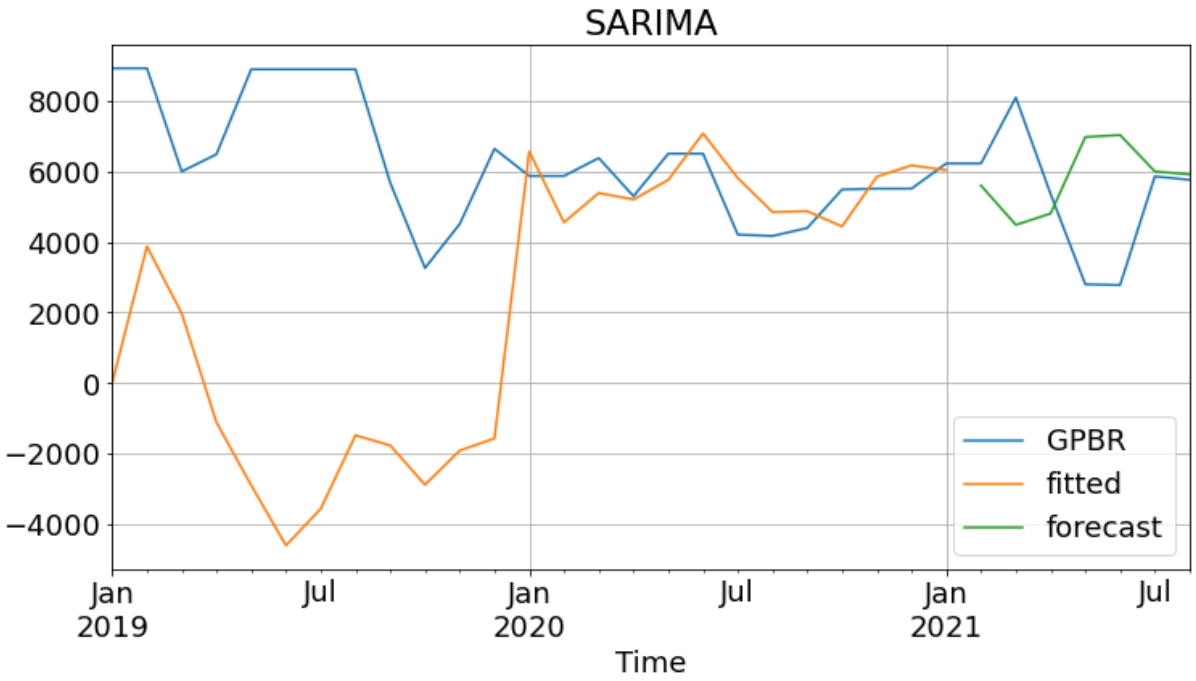


FIGURE 9
SARIMA MODEL OF HECHENG DISTRICT'S GPBR

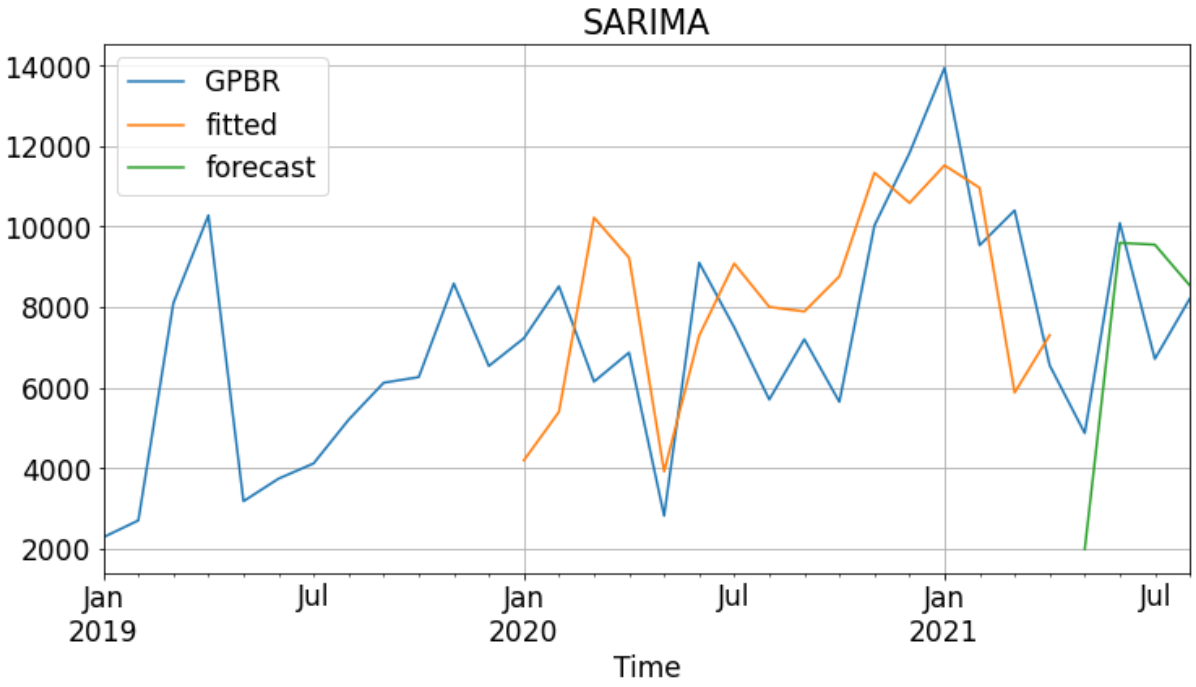
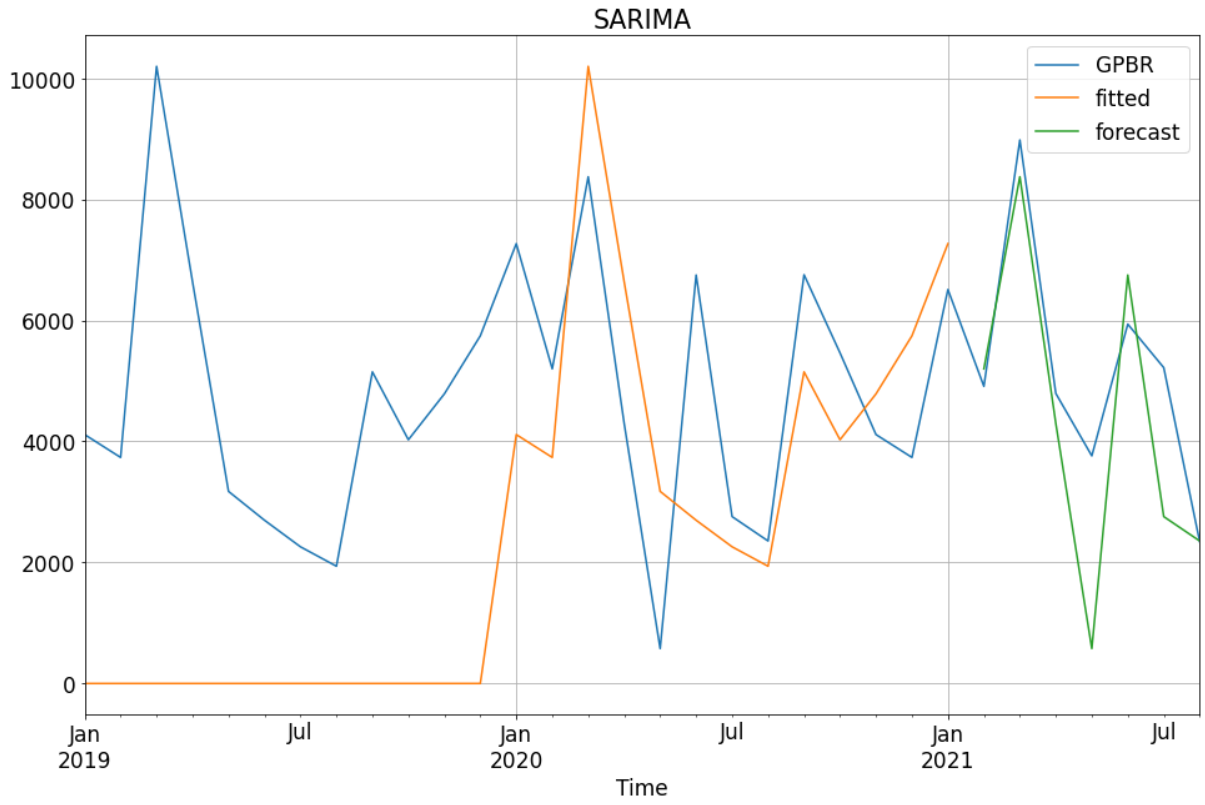


FIGURE 10
SARIMA MODEL OF ZHIJIANG COUNTY'S GPBR



Model Forecast

The above-trained model forecasts the GPBR of Huaihua International Land Port Economic Development Zone, Hecheng District, and Zhijiang Dong Autonomous County. The forecast period is from September 2021 to June 2023 after the construction of Huaihua International Land Port. The forecast results of the three regions are shown in Tables 4-6.

TABLE 4
GPBR FORECAST OF THE ECONOMIC DEVELOPMENT ZONE

Date	Forecast value	Actual value
2021-09	4372.286019	5768
2021-10	3804.994219	3955
2021-11	4181.109671	6963
2021-12	5338.063379	8310
2022-01	6451.228931	2328
2022-02	6344.324401	2328
2022-03	5531.949036	9256
2022-04	5139.610420	9256
2022-05	6519.891363	9256
2022-06	6409.827838	5629
2022-07	5467.245126	5088
2022-08	5680.340777	1684
2022-09	4662.738444	18288

2022-10	4360.330180	1604
2022-11	4557.871645	8427
2022-12	5398.716455	11429
2023-01	6233.516347	1707
2023-02	5967.171490	1707
2023-03	5247.894585	6790
2023-04	5126.618528	6790
2023-05	6723.224401	14635
2023-06	6672.271168	14635

TABLE 5
GPBR FORECAST OF HECHENG DISTRICT

Date	Forecast value	Actual value
2021-09	7897.886948	8272
2021-10	6795.275292	4898
2021-11	8099.734177	7765
2021-12	9044.130686	5861
2022-01	9650.609281	8862
2022-02	7578.969744	8862
2022-03	8700.973634	7627
2022-04	7081.150918	8618
2022-05	6629.962392	4168
2022-06	7773.204408	13002
2022-07	6649.191339	4990
2022-08	7669.305370	4267
2022-09	7332.401239	12079
2022-10	7149.726570	2855
2022-11	7089.414733	1914
2022-12	7069.502188	3716
2023-01	7062.927866	5664
2023-02	7060.757289	5664
2023-03	7060.040651	5664
2023-04	7059.804046	5664
2023-05	7059.725929	7614
2023-06	7059.700138	7614

TABLE 6
GPBR FORECAST OF ZHIJIANG COUNTY

Date	Forecast value	Actual value
2021-09	4922.648847	5228
2021-10	4121.446660	5064
2021-11	3427.543075	5968
2021-12	2822.501259	2293
2022-01	4353.652109	2698
2022-02	4016.050298	3175
2022-03	6142.551173	3736
2022-04	4570.450715	4114
2022-05	4647.986247	5228

2022-06	4009.081328	5064
2022-07	4709.247999	5968
2022-08	3202.561646	2293
2022-09	3747.378393	2698
2022-10	3550.373032	3175
2022-11	3621.610035	3736
2022-12	3595.850784	4114
2023-01	3605.165312	5519
2023-02	3601.797185	9396
2023-03	3603.015097	3481
2023-04	3602.574701	2528
2023-05	3602.733948	8549
2023-06	3602.676364	2581

It is necessary to define the influence ratio first. It can help to estimate more intuitively and accurately the impact of the construction of Huaihua International Land Port on the Economic Development Zone, Hecheng District, and Zhijiang Dong Autonomous County. The specific formula is as follows:

$$\text{Influence ratio} = \frac{\sum \text{Actual value} - \sum \text{Forecast value}}{\sum \text{Forecast value}} * 100\% \quad (3)$$

The actual cumulative GPBR of the Economic Development Zone was RMB 1,558,330,000, and the cumulative forecast value was about RMB 1,201,910,000. Therefore, the influence ratio was about 29.65%. The actual cumulative GPBR of Hecheng District was RMB 1,456,400,000, and the cumulative forecast value was about RMB 1,645,740,000, so the influence ratio is about -11.51%. The actual cumulative GPBR of Zhijiang County was RMB 966,060,000, and the forecast cumulative value was about RMB 870,790,000. Therefore, the influence ratio was about 10.94%.

CONCLUSION

The construction of Huaihua International Land Port contributes significantly to the economic growth of the Economic Development Zone. In the 22 months after the construction of the land port, the GPBR of the Economic Development Zone increased by RMB 356,400,000 than expected, with a positive influence ratio of more than 29.65%. It reflects the vital role of the land port as an economic booster. In contrast, the GPBR of Hecheng District decreased by RMB 189,340,000 than expected in the 22 months, with an influence ratio of about -11.51%. It shows a significant negative economic spillover effect. Due to the construction of Huaihua International Land Port, enormous resources and policies have been favorably deployed, attracting many enterprises registered or planning to be recorded in the Hecheng District. Therefore, it affects the local tax revenue in the short term. With the gradual maturity of Huaihua International Land Port, we expect that the total economic size of Huaihua City will grow bigger and bigger. The short-term negative impact on Hecheng District will be diminished, and the positive economic spillover effect will become apparent.

Zhijiang Dong Autonomous County is geographically close to the Economic Development Zone, but their economic endowments differ. Zhijiang showed completely different changes from Hecheng District. Its GPBR increased by RMB 95,270,000 more than expected in 22 months, with an influence ratio of 10.94%. The construction of Huaihua International Land Port has significant positive spillover effects on Zhijiang's economy. First, Zhijiang County has the only civil aviation airport in Huaihua City. Huaihua International Land Port has seen the development of air-rail and air-rail-road multimodal transportation. It increases the passenger and freight transportation capacity of Huaihua Zhijiang Airport and drives the development of Zhijiang's logistics and transportation industries. Secondly, the agricultural products of Zhijiang County can be exported through Huaihua International Land Port, boosting the growth of

agricultural output value. Thirdly, the construction of Huaihua International Land Port enhances the national and international visibility of Huaihua City. It also positively affects Zhijiang's tourism and service industries.

Due to the problems of too many missing data, outliers in the raw data, and small data volume, the model error in this study is not accurate enough. As Huaihua International Land Port's construction is prolonged, the data will increase, and the model can be corrected accordingly. This analysis is only based on local governments' GPBR, and some representative economic indicators should be analyzed in the future. Regarding research objects, only the Economic Development Zone, Hecheng District, and Zhijiang Dong Autonomous County were selected. This study was initially planned to include Zhongfang County in Huaihua City. However, the data for this county is not yet complete, so it is not included in this study. The follow-up study is intended to explore further the economic spillover effects of the international land port on the 13 cities and counties of Huaihua and the greater western Hunan region. In this way, we can understand the construction of Huaihua International Land Port more comprehensively and in detail. Thus, it can help the government to make policies and enterprises to make decisions.

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