The Impact of Tourism on Zhuhai's Economy: An Empirical Analysis Based on Tourist Volume

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Abstract. At present, all countries (regions) are working hard to overcome the economic downturn. Against the backdrop of the deteriorating economic situation in many industries, in nations all over the world, tourism has the potential to evolve into a vital industry that will boost economic expansion. To investigate how tourism affects the economy, this paper selected data such as the reception of tourist groups, the total volume of the tertiary industry, and the regional Gross Domestic Product in Zhuhai from 2017 to 2023 and conducted a regression analysis. The findings indicated that: The overall size of the local tertiary sector and the Gross Domestic Product of the region are significantly correlated. It shows a negative correlation between the number of tourist receptions and the total volume of the tertiary industry. This may be because a pandemic occurred during the selected years, which led to a significant impact on the tourism industry. At the same time, the data of other industries in the tertiary industry did not show a significant decline. Another possibility is that the limited number of data points makes it easier to produce abnormal research conclusions.

Keywords: Tourism; local economy; employment; regression analysis.

1. Introduction

Against the backdrop of the current global economic slowdown, tourism, as an important component of the tertiary industry, has gradually become a pillar industry driving economic recovery and sustainable development in many countries around the world, with its strong ability to drive consumption and employment. Since entering the era of mass tourism, China's tourism industry has experienced rapid development and structural optimization, driven by national policy support and consumption upgrades. In 2018, China's total tourism revenue reached 5.97 trillion yuan, and the tourism industry's comprehensive contribution to the national economy and social employment exceeded 10%. The tourism economy continued to maintain a high growth trend [1]. Domestic tourists spent a total of 5.75 trillion yuan on travel in 2024, up 0.84 trillion yuan from the year before and 17.1% from the preceding year. Of them, urban dwellers spent 4.93 trillion yuan on travel, up 18.0% from the previous year; rural dwellers spent 0.83 trillion yuan, up 12.2% from the previous year [2]. As a frontier city of China's reform and opening up and a well-known livable city and tourist city, Zhuhai not only attracts a large number of tourists with its pleasant climate, high-quality coastal resources and unique urban landscape, but also continues to release the vitality of the tourism market with the policy dividends and development opportunities of the Hengqin Guangdong-Macao Deep Cooperation Zone. Zhuhai's tourism market is particularly prosperous during holidays, and the number of tourists continues to expand.

However, it should also be noted that the global tourism business was severely impacted by the Coronavirus Disease 2019 (COVID-19) epidemic around the end of 2019, and Zhuhai's tourism market also faced severe fluctuations. Between 2020 and 2023, travel agencies saw a sharp decrease in the number of visitors, while the added value of the tertiary industry and regional Gross Domestic Product (GDP) remained resilient. This special background provides rare data for studying the relationship between tourism and the regional economy. In this context, this paper aims to empirically test the relationship between tourism and economic growth based on Zhuhai's empirical data from 2017 to 2023. Compared with existing literature, the marginal contribution of this study is as follows: Taking the epidemic impact as an important moderating variable, it helps to reveal the characteristics of the tourism economic linkage mechanism in special periods. By constructing a two-step regression

model (first testing the impact of tourist numbers on the tertiary industry and then testing the impact of the tertiary industry on GDP), the transmission path of tourism affecting the macroeconomy is determined. The "abnormal" conclusions (such as negative correlation) that may appear in the empirical analysis are deeply explored, providing case evidence from Zhuhai for understanding the complexity of the tourism economy.

Specifically, this paper will answer the following questions in turn. Is there a stable statistical correlation between the scale of tourism reception in Zhuhai and the added value of the tertiary industry and the regional GDP? How did the COVID-19 pandemic disrupt and change the original correlation? How to explain the potential differences between empirical results and theoretical expectations? By exploring these questions, this study not only aims to discuss the impact of tourism on Zhuhai's economy but also hopes to provide some reference for Zhuhai and similar cities in the post-epidemic era.

2. Literature Review and Research Hypothesis

2.1. Literature Review

The World Travel & Tourism Council reports that in 2012, travel and tourism's overall share of the world's GDP increased by 3.0%. This growth rate outpaced the overall global economic growth rate (2.3%) and outpaced the growth rates of several major sectors, including manufacturing, financial and business services, and retail. In 2011, the travel and tourism industry contributed a total of US$6.437 trillion to global GDP. According to the World Travel & Tourism Council, this industry's contribution to the global GDP is more than twice that of the automobile sector, one-third that of the chemicals sector, and equal to three-quarters of the combined global mining, education, and communications sectors.

In 2012, globally, the tourist sector supported 262 million employments. The travel and tourism industry accounts for 8.7% of global employment, making it one of the world's leading job creators. This employment impact exceeds that of the automotive and chemical manufacturing industries and is nearly equal to that of the education sector.

Li Zhiqing proposed that a country's (region's) economic output level is determined by four variables: consumption, investment, government expenditure, and net exports [3]. Under the exogenous conditions of investment, government expenditure, and net imports and exports, the output level is also affected by the marginal propensity to consume. In other words, consumption is an endogenous variable that changes with changes in income levels. The endogenous ratio of consumption indicators directly triggers the multiplier effect of expenditure, that is, one yuan of consumption brings more output to the national economy than one yuan.

As a sector of the national economy, tourism, like other consumer spending, has a multiplier effect on national economic output. Tourism spending is not only directly related to sectors like transportation, catering, and tourist attractions, but also to the vast majority of tertiary industry.

To sum up, this paper will prove the correlation between the number of tourists and regional GDP by studying the impact of the number of tourists received on the total amount of the tertiary industry and the impact of the tertiary industry on regional GDP.

2.2. Research Hypothesis

As a pillar industry in Zhuhai, tourism has made a significant contribution to the economic development of Zhuhai. The scale of tourism, that is, the number of tourists received, is an important indicator of the tourism industry. Therefore, the following hypothesis is proposed.

Hypothesis: Tourist arrivals are positively correlated with local economic development.

$$GDP_t=\beta_0+TI\beta_1+Consump\beta_2+Invest\beta_3+GovExp\beta_4+NetExport\beta_5+\varepsilon \quad (1)$$

$$TI_t=\beta_0+Tourists\beta_1+Transport\beta_2+Catering\beta_3+Attraction\beta_4+OtherTourismExp\beta_5+\varepsilon \quad (2)$$

3. Research Methods

3.1. Data Collection

To empirically examine the impact of tourism scale on Zhuhai's economy, this study constructed an annual time series dataset covering the period from 2017 to 2023. All data were sourced from publicly available government statistical data to ensure their authority and reliability. Specifically, these data include the "Overview of Zhuhai" published by the Zhuhai Municipal Bureau of Statistics and the "Statistical Table of Zhuhai's Tourism Reception Situation" published on the official website of the Zhuhai Municipal Bureau of Culture, Radio, Television, Tourism and Sports [4,5]. This paper compiles data from these data, including the regional GDP and its growth rate, the total volume of the tertiary industry and its growth rate, and the quantity of domestic travelers that travel agencies handled between 2017 and 2023.

3.2. Data Analysis Methods

This study used Stata 18.0 statistical software for empirical analysis. The analysis process mainly included two ways under: multiple regression analysis: ordinary least squares (OLS) was used, and the regress command was used to estimate the parameters of the two models mentioned above. The regression results will report the coefficient, standard error, t-statistic, p-value, and 95% confidence interval of each variable, and the significance and direction of the relationship between variables will be judged based on these statistics. Robustness Discussion: Given that the sample period includes the extreme exogenous shock of the COVID-19 pandemic, this study will focus on the regression results in the context of reality, especially the possible unconventional findings (such as negative correlation) to explore and explain the causes and ensure the rationality of the conclusions.

4. Empirical Analysis

4.1. Descriptive Statistics

Table 1 shows the specific data for 2017-2023 that collected from the "Zhuhai Overview" document and the "Zhuhai Tourism Reception Statistics Table", including regional GDP and its growth rate, the overall volume of the tertiary industry, its growth rate, and the number of domestic tourists that travel agents receive.

Figure 1 shows the approximate situation of Zhuhai's GDP (green) and total tertiary industry (black) from 2017 to 2023. It can be seen that both are steadily increasing. Figure 2 shows the volume of tourists that Zhuhai's travel agencies handled between 2017 and 2023. It is evident that from 2017 to 2019, Zhuhai's travel businesses received a comparatively large volume of tourists. Since 2020, it has faced a cliff-like decline and did not improve until 2023. As shown in:

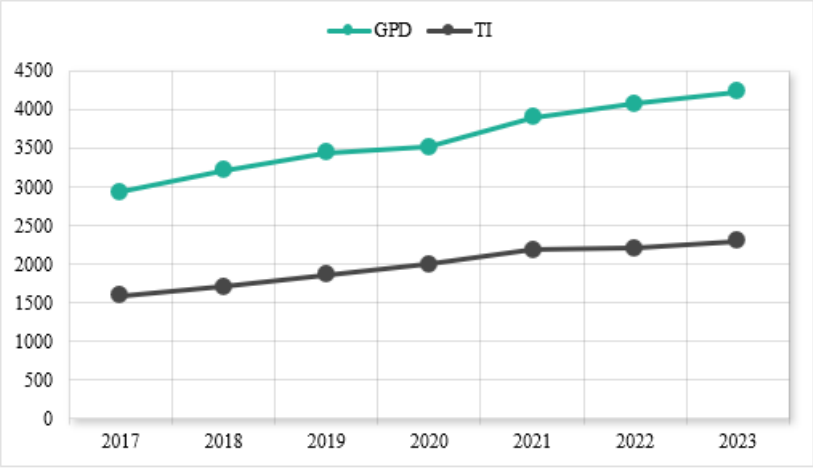

Fig 1. GD P& Tertiary Industry (TI) in Zhuhai during 2017-2023 (100M). (Picture credit: Original)

Table 1. Descriptive statistics results.

	Unit of measurement	2017	2018	2019	2020	2021	2022	2023
Gross Regional Product	100 million yuan	2943.83	3216.78	3444.23	3518.26	3896.04	4070.18	4233.22
Regional GDP growth rate	%	11.1	7.9	6.8	3	7.2	2.3	3.8
Domestic tourists received by travel agencies	number of people	1480112	1769061	1394956	292897	391366	115582	596148
Total volume of the tertiary industry	100 million yuan	1594.63	1711.86	1866.29	2004.1	2190.73	2204.43	2291.39
The growth rate of the total volume of the tertiary industry	%	10.8	3.8	9.5	4.1	6.3	0.2	3

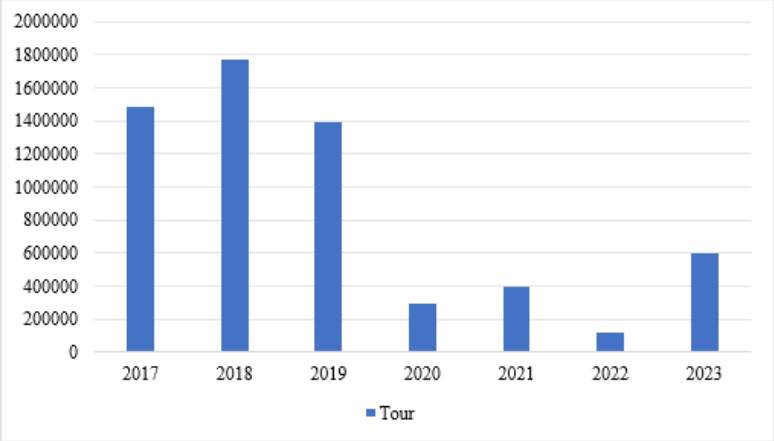

Fig 2. Tour in Zhuhai from 2017 to 2023 (person) (Picture credit: Original).

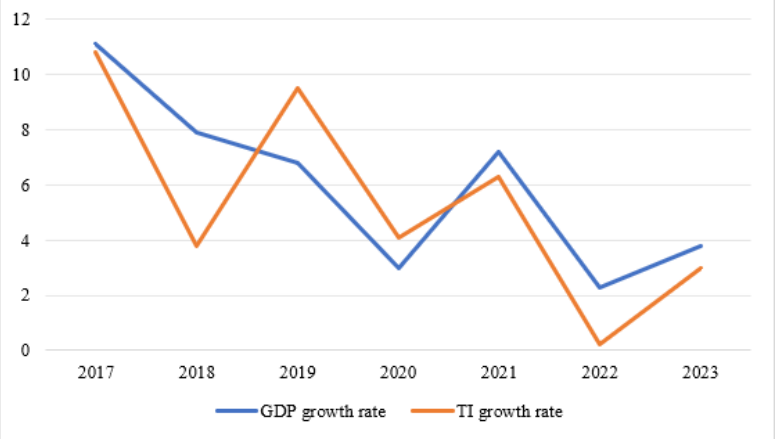

Fig 3. GDP&TI growth rate in zhuhai during 2017-2023 (%) (Picture credit: Original).

Figure 3 shows Zhuhai's GDP growth rate (blue) and tertiary industry total growth rate (orange) from 2017 to 2023. Both showed positive growth during these seven years, but the growth rates fluctuated greatly.

4.2. Regression Analysis

Table 2. Regression analysis results of regional GDP and TI.

coefficient	Standard error	t-value	p-value	95% confidence interval
1.730	0.140	12.33	0.000	[1.369,2.091]

N=7, Adj R^2=0.962, F=151.93(p=0.000)

The regression analysis of Model 1 shows that the regression coefficient for the total tertiary industry is 1.730, extremely significant (p = 0.000) at the 1% level. This suggests that from 2017 to 2023, every 100 million yuan increase in Zhuhai's tertiary industry value added will lead to an average increase of approximately 173 million yuan in regional GDP, as Table 2 shows. This result is consistent with theoretical expectations in economics and confirms the key role of the tertiary industry as the main driver of Zhuhai's economic growth.

Table 3. Regression analysis results of the TI and the tour.

coefficient	Standard error	t-value	p-value	95% confidence interval
-0.00034	0.00009	-3.61	0.015	[-0.0006, -0.0001]

N=7, Adj R^2=0.6678, F=13.06(p=0.000)

The regression analysis of Table 3 yielded a result that contradicted the theory. There was a negative correlation between the quantity of domestic travelers that travel agencies receive, which indicates that the more tourists come to Zhuhai, the smaller the total volume of Zhuhai's tertiary industry will be, which is not in line with economic logic.

Possible explanations for this unusual result are as follows:

The first and most significant reason is the impact of the COVID-19 pandemic during the sample period. Between 2020 and 2023, Zhuhai's tourist arrivals plummeted due to strict epidemic prevention policies (reaching only 115,600 in 2022, a 93.5% decrease compared to 1,769,100 in 2018). However, during the same period, Zhuhai's tertiary industry value added maintained resilient growth, increasing from 200.41 billion yuan to 220.443 billion yuan. This suggests that during the pandemic, contactless service industries such as catering, software and information technology, and online retail may have bucked the trend and effectively offset the negative impact of the tourism decline, resulting in the statistically negative correlation between declining tourist arrivals and a slight increase in the total value of the tertiary industry.

Second, the model may suffer from omitted variable bias. Tourism's impact on the economy may be transmitted through more complex channels, which a simple two-variable model cannot fully capture. For example, factors such as the structure of tourism consumption and changes in per capita tourist spending are not included in the model.

Third, there are limitations to the small sample data. Using only seven annual data points poses a challenge to the stability of the regression results, and individual outliers (such as those in epidemic years) are more likely to have a decisive impact on the regression coefficient.

5. Conclusion

This study empirically examines the relationship between tourism and economic growth using a regression model based on Zhuhai data from 2017 to 2023. The main conclusions are as follows: First, the growth of the tertiary industry has a significant positive impact on regional GDP, with a coefficient of 1.730, confirming its role as a core driver of Zhuhai's economy. Second, the study found a key fact that contradicts theoretical expectations: the number of travel agency visits is statistically significantly negatively correlated with the added value of the tertiary industry. The study concludes that this anomaly does not indicate that the tourism industry is suppressing economic growth but is primarily direct result of the exogenous shock of the COVID-19 pandemic. Specifically, the sharp decline in tourist arrivals during the pandemic, coupled with the counter-cyclical growth of other service industries, contributes to the negative relationship seen in the data. This study also has several limitations, including the limited research period and data size; the failure to consider the impact of independent tourists on the tourism market, and the use of only travel agency visit data. Future research needs to expand the scope of the study, increase the data sample, conduct in-depth analysis, and consider the impact of other variables on the dependent variable.

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