Empirical Analysis of the Relationship Between the Development of China's Tourism Industry and Economic Growth Based on VAR Model

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Abstract

The relationship between tourism development and economic growth has been a hot topic in the field of tourism economy in recent years, and whether there is a long-term equilibrium relationship between tourism development variables and economic variables (usually GDP) is also a hot topic. By identifying the long-term equilibrium relationship between two variables, we can find the quantitative variation law (generally effect) of one variable with the other. Based on the vector autoregression of the time series data of China's tourism development from 2000 to 2019, it is found that there is a long-term equilibrium relationship between China's tourism foreign exchange income and domestic tourism gross income and their respective GDP, and the long-term effect is 99% respectively. Through the establishment of the VAR model for the development of China's tourism industry and economic growth, in the long run, they have a balanced relationship of mutual promotion, so as to further guide the development of China's tourism.

Keywords: tourism industry, VAR model, equilibrium relationship, relationship of causality

1. Introduction

Researchers have discussed the relationship between tourism and economic growth according to the actual situation of tourism development in different regions and regions.The main research methods are as follows: first, empirical measurement is carried out by constructing mathematical models, including input-output model, TSA tourism satellite account, VAR model, co-integration and Granger causality test, variance decomposition, impulse response and other measurement methods. In the studies on the relationship between tourism industry and economic growth, scholars have drawn different conclusions through empirical research methods such as data analysis, but the mainstream view is that the two have a significant promoting role. Using the multivariate VAR model, Katircioglu (2009), Kim et al. (2006) reached the same conclusion as Dritsakis (2004) in their respective studies on Taiwan and Malaysia of China.Balaguer, Cantavella-Jorda (2002) and Dritsakis (2004) put forward the theory of tourism-led economic growth hypothesis, and conducted empirical tests with the data of Spain. The study concluded that there is a long-term equilibrium relationship between tourism development and economic growth, and tourism development has a one-way Granger for overall economic growth.The conclusion supports the hypothesis of tourism-led economic growth.Brida (2008) used the co-integration test, VAR model, Granger causality test and impulse response function to make an empirical analysis of the quarterly data of Mexico from 1975 to 2007, and the results showed that there was a co-integration vector between the two, and the development of tourism industry was a one-way Granger cause of economic growth.The second is to discuss the relationship between tourism and economic growth by calculating correlation coefficient, elasticity coefficient, contribution rate and grey correlation degree.Due to the difficulty in obtaining basic data and the poor continuity of calculation results, these methods have their own advantages and disadvantages.From the perspective of research scale, on the one hand, it focuses on the national and provincial level, on the other hand, it focuses on the prefecture-level research.

2. Literature Review

In the studies on the relationship between tourism industry and economic growth, scholars have drawn different conclusions through empirical research methods such as data analysis, but the mainstream view is that the two have a significant promoting role. Durbarry, R (2004) and Dragouni, M.; Filis, G.; Antonakakis, N (2013) introduced the

co-integration theory into the study on the causal promoting relationship between tourism and economic growth, and concluded that the development of tourism has a positive promoting effect on the growth of the entire national economy.Eugenio-Martin et al. (2004) studied the relationship between tourism and economic growth in Latin American countries from 1980 to 1997 and reached the same conclusion.Dritsakis (2004) used the multivariate VAR model to analyze the quarterly data of Greece from 1960 to 2000 and conducted the Granger causality test on the basis of ECM, and the results showed that there was a two-way Granger causality between the development of tourism industry and economic growth.Using similar methods, Katircioglu (2009), Kim et al. (2006) reached the same conclusion as Dritsakis (2004) in their respective studies on Taiwan and Malaysia of China.Balaguer, Cantavella-Jorda (2002) and Dritsakis (2004) put forward the theory of tourism-led economic growth hypothesis, and conducted empirical tests with the data of Spain. The study concluded that there is a long-term equilibrium relationship between tourism development and economic growth, and tourism development has a one-way Granger for overall economic growth.The conclusion supports the hypothesis of tourism-led economic growth.Brida (2008) used the co-integration test, VAR model, Granger causality test and impulse response function to make an empirical analysis of the quarterly data of Mexico from 1975 to 2007, and the results showed that there was a co-integration vector between the two, and the development of tourism industry was a one-way Granger cause of economic growth.Based on similar test methods, Belloumi (2008), Cardenas-Garcia, P. J.; Pulido-Fernandez, J. I. (2017) et al. reached a conclusion consistent with theirs.However, while tourism has become the largest industry in the world, there is no consensus in the academic circles on whether tourism has become a favorable factor to promote economic growth.In addition to the mainstream view that the two are mutually reinforcing, some studies have reached conflicting conclusions.Chien-Chianlee and Chun-Pingchang (2007) questioned the conclusions of Balaguer, Cantavella-Jorda (2002) and Dretsakis (2004) when they studied Spain. They believed that their studies were obtained under specific samples and that Spain was the largest recipient of international tourism in the world, so their conclusions were not universally applicable.Further, some of the literature on empirical studies have shown that South Korea South Korea's tourism development and economic growth, the relationship between the performance of economic growth led to the development of the tourism consumption, but the tourism income and there is no long-term equilibrium relationship between GDP, South Korea is not a tourist leading economic development model, but a DaiDongXing tourism economic development mode.For some other countries or regions, Kulendran and Wilson, Shan and Wilson, Hyunjeong Kim and Ming-Hsiang Chen (2005) conducted researches respectively, and found that there is no mutually promoting relationship between tourism development and economic growth in most countries or regions.Their research conclusions are different from the theory of tourism-led economic growth or the theory of economic-driven tourism development.In their studies on Hong Kong and the United States respectively, Tang and Jang (2009) and Jin (2011) found that the development of tourism industry did not have a long-term stable relationship with economic growth, and the one-way Ganger causality between the two was not obvious, but there was a mechanism for economic growth to promote tourism development.The latter believes that in the short term, the tourism industry can promote the economy, but this influence is not sustainable in the medium and long term.Although there are many research literatures on the relationship between tourism industry and economic growth, the differences in research objects, research methods, model setting and theoretical construction lead to different conclusions.However, the view that supports the development of tourism industry to promote economic growth is always the most representative.

3. Development of China's Tourism Industry

Since the reform and opening up in 1978, after more than 40 years of development, China's tourism industry has entered a period of comprehensive development.

3.1 Booming Domestic Tourism

The rise of domestic tourism in China in the mid-1980s, the national policy from "do not advocate, do not oppose, do not encourage" to "according to local conditions, correct guidance, steady development".In 1984, the number of domestic tourists was 204 million. In 2004, the number of mainland Chinese tourists reached 1.102 billion, breaking the mark of 1 billion for the first time, and the domestic tourism revenue reached 471.1 billion yuan, an increase of 36.9 percent over the previous year. In 2019, the number of tourists on the Chinese mainland reached 6.06 billion, and the domestic tourism revenue reached 5.725.092 billion yuan, 12.15 times that of 2004.For details, see Tables 1 and 2. The share of domestic tourism revenue in GDP increased from 0.89% in 1985 to 6.69% in 2019. After the government issued the regulation to extend the holidays, the domestic tourism is more prosperous, forming a consumption boom, and the domestic tourism has further developed into the pillar of China's tourism economy.The development of China's domestic tourism industry marks that China's tourism industry has entered a new period of development, the structure of tourism industry is increasingly perfect.

Table 1. Basic situation of domestic tourism in 2004

year	Total person-times (100 million person-times)	* Traveling rate (%)	Total expenditure (100 million yuan)	Per capita cost (yuan)
The national total	11.02	84.8	4710.71	427.5
Urban residents	4.59	126.6	3359.04	731.8
Rural farmers	6.43	68.7	1351.67	210.2

Note: travel rate refers to the proportion of the number of urban residents or rural farmers traveling in its population

Table 2. Basic situation of domestic tourism in 2019

year	Total person-times (100 million person-times)	* Traveling rate (%)	Total expenditure (100 million yuan)	Per capita cost (yuan)
The national total	60.06	94.8	57250.92	953.25
Urban residents	44.71	163.7	47508.99	1062.64
Rural farmers	15.35	88.9	9741.93	634.66

Note: travel rate refers to the proportion of the number of urban residents or rural farmers traveling in its population

3.2 Rapid Rise of Inbound Tourism

With the implementation of China's national policy of opening up to the outside world and the increase of foreign exchanges, the number of tourists to China has shown a growing trend: from 1.8092 million in 1978 to 109.04 million in 2004, ranking the fifth in the world.Foreign exchange revenue from tourism increased from US $262.9 million in 1978 to US $25.7 billion in 2004, making it the seventh largest foreign exchange earner in the world.By 2019, the number of inbound tourists will reach 145.3078 million, ranking third in the world; foreign exchange revenue from tourism will increase to US $131.254 billion; and international foreign exchange earnings will rank second in the world. The number of visits to the mainland by our compatriots from Hong Kong, Macao and Taiwan will be 107.2901 and 6.1342 million respectively. It can be seen from Table 3 and 4 that China's international tourism has developed rapidly.

Table 3. Basic situation of international tourism in 2019

year	Total person-times (100 million person-times)	* Traveling rate (%)	Total expenditure (100 million yuan)	Per capita cost (yuan)
The national total	11.02	84.8	4710.71	427.5
Urban residents	4.59	126.6	3359.04	731.8
Rural farmers	6.43	68.7	1351.67	210.2

Note: travel rate refers to the proportion of the number of urban residents or rural farmers traveling in its population.

Table 4. Statistics on the number of international tourists in 2019

year	Inbound tourists (10,000)	Number of inbound tourists Foreigners (10,000)	Number of Inbound Hong Kong and Macao (10,000)	Number of Inbound Tourists Taiwan Compatriots (10,000)	International tourism revenue ($100 million)
1978	180.92	22.96	157.96	156.15	2.63
2004	10903.82	1693.25	8842.05	368.53	257.39
2019	14530.78	3188.34	10729.01	613.42	1312.54

4. Empirical Analysis of the Relationship Between China's Tourism Industry Development and Economic Growth

4.1 Data Source and Index Selection

A country's gross domestic product is the most direct reflection of its economic development of an indicator.Tourism revenue is the most direct indicator of the development of such a closely related industry as tourism.Therefore, when studying the relationship between the development of China's tourism industry and economic growth, two indicators are selected for analysis by referring to the research of relevant scholars and combining with the actual situation of China.China's economic growth is reflected by gross domestic product (GDP), which is denoted as GDP (unit: 100 million yuan).The total income of the tourism industry is taken as the index to evaluate the development of the tourism industry, which is denoted as TR (unit: hundred million yuan). The paper selects the annual data from 2000 to 2019 as the sample interval.The main data sources are China Statistical Yearbook, database of China Research Network, data of China Foreign Affairs and Overseas Chinese Tourism Administration and the latest tourism income statistics of China National Bureau of Statistics.When looking for data, the statistics bureau calculates international tourism income and domestic tourism income separately. In the calculation process, the international income is firstly multiplied by the exchange rate and then the domestic tourism income is added.In addition, in order to eliminate the influence of heteroscedasticity on data analysis, each variable will be analyzed with its natural logarithm to eliminate the influence of changing trend. The logarithm of the two variables is expressed by lnGDP and LNTR.

Table 5. 2000-2019 GDP and tourism revenue TR in China

year	GDP (100 million)	LNGDP	TR (100 million)	LNTR
2000	100280.14	11.52	4303.11	8.37
2001	110863.12	11.62	4758.90	8.47
2002	121717.42	11.71	5295.12	8.57
2003	137422.03	11.83	4651.99	8.45
2004	161840.16	11.99	6499.57	8.78
2005	187318.90	12.14	7321.93	8.90
2006	219438.47	12.30	8589.20	9.06
2007	270092.32	12.51	10684.00	9.28
2008	319244.61	12.67	11587.89	9.36
2009	348517.74	12.76	12941.10	9.47
2010	412119.26	12.93	15763.84	9.67
2011	487940.18	13.10	22673.64	10.03
2012	538579.95	13.20	26183.17	10.17
2013	592963.23	13.30	29866.77	10.30
2014	643563.10	13.37	34267.31	10.44
2015	688858.22	13.44	42093.73	10.65

2016	746395.06	13.52	47730.00	10.77
2017	832035.95	13.63	54238.25	10.90
2018	919281.13	13.73	60111.95	11.00
2019	990865.11	13.81	66373.07	11.10

Note: The unit of gross regional product (GDP) and gross tourism revenue (TR) is RMB 100 million respectively.The unit of income from international tourism is ten thousand US dollars, and the total income is calculated by the current exchange rate

Source: National Research Network, China Statistical Yearbook (2000-2019)

In order to ensure the reliability of the data source of the selected indicators and the scientific nature of the measurement, this study attempts to analyze the relationship between China's tourism income and GDP growth from the dimension of long time (2000-2019) by applying unit root test, co-integration test and Granger causality test.

4.2 Establishment of Relationship Model Between Tourism Industry Development and Economic Growth

Generally, the traditional regression model is based on economic theory, which applies the model to describe the behavior of economic subjects appropriately, and then analyzes how the exogenous variables affect the endogenous variables.The core idea of VAR model is not to consider economic theory, but directly consider the relationship between economic variables of time series.Before establishing vector autoregressive (VAR) model for time series, it is necessary to determine whether the variable data is stationary or not. Therefore, the ADF unit root test proposed by Dickey and Fuller for the serial correlation of residual items is used to test the stationarity of the variable data.If the data is non-stationary, differential processing is performed to make it a stationary time series.If the variable is integral, the Pedrion test method is used to carry out the co-integration test on the variable.If the co-integration relationship exists, that is, the relationship between the variables is stable and balanced in the long run, then the vector autoregressive model (VAR) is further established for the two variables to test the relationship between the two economic variables.After the establishment of the VAR model, in order to better understand the causality of variables and avoid the emergence of pseudo-regression, the Granger causality test method was selected to test it. Finally, the impulse response function and variance decomposition were used to further analyze the economic significance contained in the VAR model.

The method adopted in this paper is to use VAR model to establish a framework for the analysis of the two.The VAR model is established for the relationship between China's economic growth and the development of tourism industry. The general form is as follows:

$$y_{t=} \sum_{t=1}^{k} A_i \, Y_{t-1} + \varepsilon_t$$

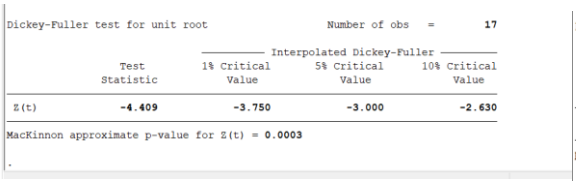
Wherein, Y_t = (LNGDP, LNTR), k is the lag order of the model, A_i is the coefficient matrix to be estimated, Y_{t-1} is the i order lag variable of Y_i vector, and ε_t is the error term, which can be regarded as random interference term in this model.

4.2.1 Data Stability Test

In order to eliminate the false regression phenomenon in the regression of non-stationary data, the stationarity test of the data is carried out first.Unit root test is a common and accurate method to test the stability of data by using statistics.

In this paper, using Stata15.0 software, ADF (Augmented Dickey-Fuller) unit root test method to test the stability of variables GDP and TR.The data in the study were taken as the natural logarithm of all variables, i.e., lnGDP and LNTR.The purpose of this approach is mainly because the original data is too large and the statistical caliber of different data is inconsistent. Taking logarithm for empirical test can reduce the influence of the original data error on the result to a certain extent. The test results are shown in the table.

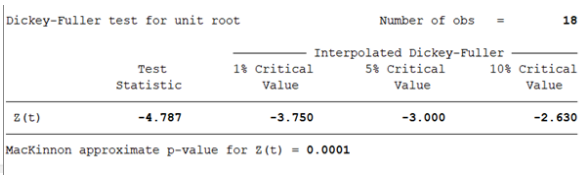
The variables of unit root test results:



Dickey-Fuller test for unit root — Number of obs = 17

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.409	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.0003



Dickey-Fuller test for unit root — Number of obs = 18

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.787	-3.750	-3.000	-2.630

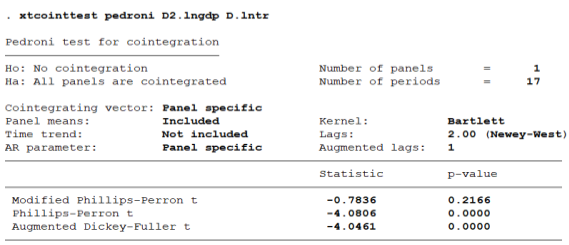
MacKinnon approximate p-value for Z(t) = 0.0001

As can be seen from the ADF test results above, the above two variables are non-stationary variables. After the second-order and first-order difference processing, the hypothesis of the existence of a unit root is rejected, that is, they become stationary variables. One of the two variables is a first-order simple integral and the other is a second-order simple integral.There may be some kind of stable relationship between them.

4.2.2 Co-integration Test

Since lnGDP and LNTR are both integral sequences, they meet the precondition of co-integration test.Pedrion co-integration test is a test method based on vector autoregression (VAR) model, so the structure of VAR model must be determined before the co-integration test.In order to maintain a reasonable degree of freedom that the parameters of the model has strong explanatory, at the same time, in order to eliminate autocorrelation of error term, so choose to AIC criterion, the rule of SC and LR statistic as choosing the optimal lag order inspection standards, and verify the VAR model of residual whether to obey the normal independent identical distribution, finally established for cointegration test VAR model lag order to 2.

The test results are shown in the table below:



. **xtcointtest pedroni D2.lngdp D.lntr**

Pedroni test for cointegration

Ho: No cointegration — Number of panels = 1
Ha: All panels are cointegrated — Number of periods = 17

Cointegrating vector: **Panel specific**
Panel means: **Included** — Kernel: **Bartlett**
Time trend: **Not included** — Lags: **2.00 (Newey-West)**
AR parameter: **Panel specific** — Augmented lags: **1**

	Statistic	p-value
Modified Phillips-Perron t	-0.7836	0.2166
Phillips-Perron t	-4.0806	0.0000
Augmented Dickey-Fuller t	-4.0461	0.0000

From the above test results, the characteristic root test and the maximum eigenvalue test of the co-integration test, it can be seen that P is 0 significantly rejects the existence of the co-integration relation of the null hypothesis.

4.2.3 Relational Model Construction

The long-term stable co-integration relationship among variables is the basis of establishing vector white regression (VAR) model.Through the above results, it can be found that from 2000 to 2019, there is a long-term and stable co-integration relationship between the development of China's tourism industry and economic growth.In order to further explore the relationship between the two, tourism income (TR) and GDP reflecting economic growth are regarded as endogenous variables, and the VAR model is established after taking the natural logarithm to estimate the dynamic relationship between them.Vectors autoregressive model is similar to simultaneous equation model. Its biggest feature is that it does not need to determine in advance which variables are endogenous variables and which variables are exogenous variables. It eliminates the influence of human subjectivity and analyzes all variables as endogenous variables.

4.2.3.1 Determination of Lag Order

Based on the selected variables LNGDP and LNTR, a 2-dimensional vector autoregressive model can be constructed.First, determining the optimal lag order of the VAR model can eliminate the autocorrelation existing in the residual error and improve the effectiveness of the model parameter estimation.The following results give the LR, FPE (final prediction error criterion), AIC (Akakike information criterion) and SC (Schwartz) criteria of 0-7 order VAR model to determine the lag order.The results are as follows, so it can be determined that the lag order of the vector autoregressive model is 2 periods.

```
varsoc lngdp lntr,maxlag(7)

Selection-order criteria
Sample:  2007 - 2019                              Number of obs     =        13
```

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	10.4011				.000942	-1.29248	-1.31034	-1.20556
1	49.3019	77.802	4	0.000	4.5e-06*	-6.66183	-6.71543	-6.40109
2	50.1534	1.7029	4	0.790	7.7e-06	-6.17744	-6.26677	-5.74286
3	56.0622	11.818	4	0.019	6.8e-06	-6.47111	-6.59616	-5.8627
4	59.7069	7.2895	4	0.121	.000011	-6.41645	-6.57724	-5.63422
5	64.1684	8.9229	4	0.063	.000025	-6.48744	-6.68396	-5.53138
6	731.251	1334.2	4	0.000	.	-108.5	-108.732	-107.37
7	788.546	114.59*	4	0.000	.	-117.315*	-117.547*	-116.185*

```
Endogenous:  lngdp lntr
 Exogenous:  _cons
```

4.2.3.2 Establishment of Vector Autoregression (VAR) Model

```
Vector autoregression

Sample:  2001 - 2019                              Number of obs     =         19
Log likelihood =    61.51738                      AIC               =  -5.843935
FPE            =    9.99e-06                      HQIC              =   -5.79346
Det(Sigma_ml)  =    5.28e-06                      SBIC              =  -5.545691
```

Equation	Parms	RMSE	R-sq	chi2	P>chi2
lngdp	3	.033144	0.9981	10037.18	0.0000
lntr	3	.085462	0.9922	2404.968	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lngdp						
lngdp						
L1.	1.151465	.0622838	18.49	0.000	1.029391	1.273539
lntr						
L1.	-.1445592	.0507932	-2.85	0.004	-.244112	-.0450064
_cons	-.4132431	.3180677	-1.30	0.194	-1.036644	.2101581
lntr						
lngdp						
L1.	.5099904	.1606001	3.18	0.001	.1952201	.8247608
lntr						
L1.	.592533	.1309712	4.52	0.000	.3358342	.8492318
_cons	-2.415559	.8201437	-2.95	0.003	-4.023011	-.8081067

The VAR model equation is as follows:

$$\ln GDP = \ln GDP - 1 + \ln TR - 1$$

The empirical results show that the total fitting degree of the model is 0.99, and the mutual influence between the two variables can be seen from the above equation.

(1) When the lag order is the first order, the influence coefficient of the economic growth variable on itself is positive, and the influence coefficient of the total tourism revenue on the economic growth variable is negative.When the lag order is second order, the influence coefficient of the economic growth variable on itself is negative, and the influence coefficient of the total tourism income variable on the economic growth variable is positive.That is to say, the increase in tourism income does not have an immediate positive effect on economic growth, but this positive effect will be reflected in the long run.The economic growth has an immediate impact on its own, but in the short term there will be certain fluctuations, affecting its own growth.In terms of the overall coefficient, the influence coefficient is positive, that is, China's economic growth has been positively promoted under the influence of tourism development and economic growth.

(2) As shown above, when the lag order is the first order, the impact coefficients of economic growth variable and tourism income variable on the income of the entire tourism industry are both positive;The lag order number for the second order, and tourism revenue to its negative influence coefficient, economic rights long still positive impact on the tourism income, it can be seen that in the short term, economic rights and tourism income effect on its own is a positive, after a period of time, the tourism income creates a weak negative effect on its own will, but from the point of integral coefficient, the total influence coefficient is positive, that is, from the long-term drinking in the short term, tourism development and economic growth of China's overall tourism industry has a promoting effect.

4.2.3.3 Stationary Test of VAR Model

After the establishment of the VAR model, the stationarity test is required. If the stationarity test cannot be passed, the conclusion drawn by the model may be invalid, and further analysis of the impulse response function and

variance decomposition cannot be carried out on the model.

The following results give the results of the VAR model's stationarity test. No characteristic root is outside the unit circle, that is, the model is stable.

Prais-Winsten AR(1) regression -- iterated estimates

Source	SS	df	MS		
Model	17.8775037	2	8.93875183	Number of obs	= 20
Residual	.086825284	17	.00510737	F(2, 17)	= 1750.17
				Prob > F	= 0.0000
				R-squared	= 0.9952
				Adj R-squared	= 0.9946
Total	17.9643289	19	.945490997	Root MSE	= .07147

LNGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
LNTRw	.0158121	.1055009	0.15	0.883	-.2067754	.2383996
LNTRn	.7137285	.0865976	8.24	0.000	.5310236	.8964334
_cons	5.876353	.4632402	12.69	0.000	4.899001	6.853704
rho	.7775873					

Durbin-Watson statistic (original) 0.383572
Durbin-Watson statistic (transformed) 1.831212

4.2.3.4 Granger Causality Test

Granger causality test is based on some assumption conditions and important method used to study the cause and effect relationship, if the contains a variable Y, and X past information conditions, the prediction effect of variable Y is superior to separate only by Y past information to the prediction effect of Y, namely, if the variable X help to explain the change in the future, of variable Y is considered variable X is the granger cause of the variable Y. AR model has been established for the two variables of tourism industry income and economic growth, which can indicate that there is a certain stable relationship between the two variables, but the causality of the two variables cannot be determined. Therefore, in order to avoid false causality, the Granger causality test of the two sets of data is carried out by using the software Stata. The test results are shown in the table below.

```
. xtgcause lngdp lntr,lag(2)


Dumitrescu & Hurlin (2012) Granger non-causality test results:
------------------------------------------------------------------
Lag order: 2
W-bar =          1.4455
Z-bar =         -0.2773   (p-value = 0.7816)
Z-bar tilde =   -0.3232   (p-value = 0.7465)
------------------------------------------------------------------
H0: lntr does not Granger-cause lngdp.
H1: lntr does Granger-cause lngdp for at least one panelvar (id).
```

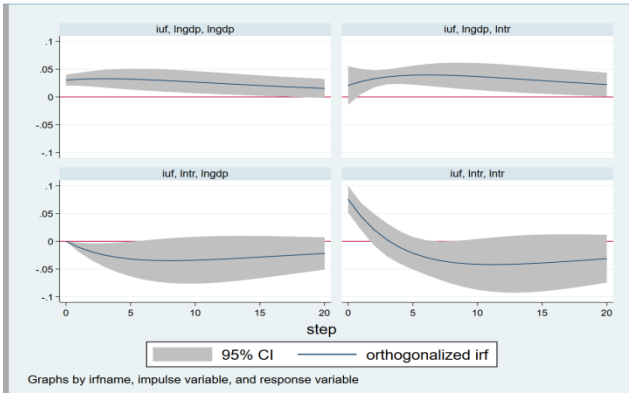
```
. xtgcause lntr lngdp,lag(2)


Dumitrescu & Hurlin (2012) Granger non-causality test results:
------------------------------------------------------------------
Lag order: 2
W-bar =          8.0635
Z-bar =          3.0318   (p-value = 0.0024)
Z-bar tilde =    2.0065   (p-value = 0.0448)
------------------------------------------------------------------
H0: lngdp does not Granger-cause lntr.
H1: lngdp does Granger-cause lntr for at least one panelvar (id).
```

As can be seen from the above test results, there is a two-way causality between LNGDP and LNTFI, that is, in China's economic system, the development of tourism industry and economic growth are mutually causal.LNGDP is the Granger cause of LNTFI, and it can be seen from Akike criterion that the second phase should be delayed.

4.2.3.5 Impulse Response Function Analysis

In the VAR model, a single coefficient of each only reflects a local relationship and cannot capture a comprehensive and complex dynamic process.Granger test also only discusses the existence of causality between variables from the perspective of statistics.However, the impulse response function related to the VAR model can comprehensively reflect the dynamic relationship among various variables.The impact of one standard deviation information on another variable of random perturbation term is analyzed.However, the premise is that the VAR model is stable. It can be seen from the above unit root test results that the constructed VAR model is stable. Therefore, the impulse response function can be selected to analyze the dynamic relationship between the variables LNGDP and LNFI.

The figure shows the analysis results of the impulse response function of the VAR (2) model. The vertical axis represents the response value, and the horizontal axis represents the number of lag periods.

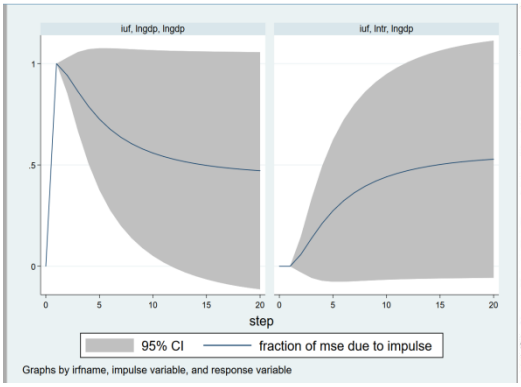


The analysis results of impulse response can be seen from the figure as follows: (1) The variable LNTR immediately showed a positive response to the positive impact of one unit of itself, and the response continued to grow steadily, reaching the maximum at the seventh stage.It shows that in the long and short term, the increase of tourism income has an obvious long-term and stable promotion effect on itself, but its growth rate decreases with the increase of periods. Therefore, in the long term, the increase of tourism income needs multiple factors to maintain the stability of its growth rate.(2) variable LNDGP units of a positive impact, and did not cause variable LNR rapid response, in the second period LNRbefore reaction, and steady growth, on the seventh period reached the highest growth rate after the slowdown, suggesting that LNTFI for LNGDP shock reaction lag, but once you start, its growth is faster.In general, it can be seen that LNDGP has a long-term and stable promoting effect on the variable LNTR.

As can be seen from the figure, (1) the variable LNDGP immediately had a strong response to a positive standard deviation information of its own, and the response was rapid and sustained. It reached the peak in the seventh phase, and then the rate of increase slowed down.This indicates that the positive promoting effect of LNDGP is greater.(2) After the positive impact of one unit of variable TR, the variable LNDGP almost had no response. However, in the second period, the LNDGP began to grow continuously, and reached the highest value in the eighth period with a small increase, and the growth rate slowed down after the eighth period.This indicates that in the short term, the impact of LNDGP on LNTFI is small, and in the long term, it has a promoting effect, but the positive promoting effect is smaller than the effect of the variable LNDGP itself.In other words, the promoting effect of LNTFI on LNDGP is small and the positive effect of LNDGP on LNR.

4.2.3.6 Variance Decomposition Analysis

Impulse response function can capture the osmosis image path of the impact factor of one variable to another variable, while variance decomposition can decompose the variance of a variable in the VAR system to each disturbance term, so as to evaluate the importance of impact of different structures.The established VAR model was decomposed into variance, and the results are as follows



. irf table fevd,r(lngdp)

Results from iuf

step	(1) fevd	(1) Lower	(1) Upper	(2) fevd	(2) Lower	(2) Upper
0	0	0	0	0	0	0
1	1	1	1	0	0	0
2	.94229	.854737	1.02984	.05771	-.029843	.145263
3	.862443	.667465	1.05742	.137557	-.05742	.332535
4	.788145	.504754	1.07154	.211855	-.071536	.495246
5	.7263	.376442	1.07616	.2737	-.076159	.623558
6	.676586	.277204	1.07597	.323414	-.075968	.722796
7	.636917	.200021	1.07381	.363083	-.073814	.799979
8	.605161	.13919	1.07113	.394839	-.071132	.86081
9	.579555	.090546	1.06856	.420445	-.068563	.909454
10	.558733	.051125	1.06634	.441267	-.066341	.948875
11	.54166	.018809	1.06451	.45834	-.064511	.981191
12	.527552	-.007932	1.06303	.472448	-.063035	1.00793
13	.51581	-.030225	1.06184	.48419	-.061845	1.03022
14	.505976	-.048917	1.06087	.494024	-.06087	1.04892
15	.497694	-.064657	1.06004	.502306	-.060045	1.06466
16	.490684	-.07795	1.05932	.509316	-.059317	1.07795
17	.484724	-.089198	1.05865	.515276	-.058646	1.0892
18	.479638	-.098724	1.058	.520362	-.058	1.09872
19	.475282	-.106793	1.05736	.524718	-.057358	1.10679
20	.471541	-.113624	1.05671	.528459	-.056707	1.11362

95% lower and upper bounds reported
(1) irfname = iuf, impulse = lngdp, and response = lngdp
(2) irfname = iuf, impulse = lntr, and response = lngdp

As can be seen from variance decomposition of LNDGP, the impact of the development of tourism industry on the economic growth in the first period is only 5.11%, and its influence continues to decline until the fourth period. After that, it starts to grow slowly and reaches the highest value in the tenth period, which is 21.07%.This shows that in the short term, the impact of tourism industry on economic growth has been reduced to a certain extent, but in the long run, it still plays a positive role in promoting economic growth, but the role is not very big.In addition, China's economic growth is largely influenced by itself, which indicates that it is influenced by many other factors.From LNTFI variance decomposition can see, the influence of the economic growth for the tourism industry revenues in the first period is 0, then began to rise year by year, peaked at 10, 36.33 it shows that in the short term, economic growth does not increase the instant impact on tourism revenues, but look from the long-term equilibrium and its positive role is increasing, and economic growth for the rights and the contribution of tourism industry income is greater than the contribution of tourism income increase on economic growth.At the same time, since the first period, the impact of tourism industry's income on itself has slowed down year by year, indicating that the increase of tourism industry's income cannot be improved only by its own development as time goes by. There are more factors affecting the increase of tourism industry's income.

5. Conclusion and Discussion

This study is based on tourism revenue, regional GDP data of China's tourism income and GDP growth correlation analysis, the following conclusions: from the point of the whole city scope, China between LNGDP and LNTR correlation coefficient is 0.99, further analysis of China's tourism income is not the granger cause of GDP growth, GDP is the granger reason of tourism revenue.As an important part of modern service industry, tourism plays a limited role in driving China's economic development. However, the rapid economic development in recent years has provided a basic guarantee for the development of tourism.This leads to the thinking of the development of China's tourism industry in the past 20 years: the government should be inclined to support the development of tourism economy when making decisions, and actively develop the service consumption industry, so as to raise the tourism industry to a new level from the perspective of service and management, and promote the driving effect of tourism on the regional economy.

6. Research Limitations

Although this paper selects 20 years of data through the vector autoregressive model to carry out an empirical study on the relationship between the development of China's tourism and economic growth, so as to put forward some suggestions for the development of China's tourism.However, there are some limitations in the research. Firstly, as tourism income is a part of GDP, the empirical study of their relationship cannot well explain the problem.The data are from the National Bureau of Statistics of China, but there are some gaps in the data, and the interpolation method may have some deviation, which will affect the accuracy of the research results.Second, the data volume is not large enough.Due to the difficulty of obtaining a large amount of data, static data were collected for 20 years in this study, which may affect the accuracy of the research results.In the future research, if a large amount of data can be collected, the analysis results will be more accurate. In the future research, the author will demonstrate the relationship between tourism development and economy from various elements of tourism.

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