A Vector Autoregressive Model-Based Numerical Measurement Approach for Coordinating Relation Between Tourism Development and Financial Support

Changyan Cai[1,2], Beatrice Lim Fui Yee[1(✉)], and Kasim Mansur[1]

[1] Faculty of Business, Economics and Accountancy, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia
beatrice@ums.edu.my

[2] Xichang University, Xichang 615000, China

Abstract. Tourism industry, as one of the important driving forces for economic growth, can greatly promote regional economic development and accelerate the positive externalities of resource flow among regions. Finance is a vital component of modern economies, playing a critical role in allocating resources and driving economic development. Firstly, the study will conduct data analysis on the current situation of tourism development and financial support in liangshan prefecture. Secondly, an explanation of the vector autoregressive model will be provided; then, the vector autoregression model will be used to evaluate the coordinating relation between tourism development and financial support.

Keywords: Vector Autoregression Model · Financial Support · Tourism Development · China

1 Introduction

Tourism is an important force for the development of the national economy.As an important tool for resource allocation and macroeconomic regulation, finance is becoming increasingly important in the diversified tourism. With the rapid development of the tourism industry, the government has gradually increased its financial support for the tourism industry, issuing financial support policies. These policies actively guide all parties to provide financial assistance to support the tourism sector, providing financial guarantees for the structural upgrading of the tourism industry, the cultivation of advantageous industries, and the development of emerging industries.

LS Yi Autonomous Prefecture (refer to LS) is situated in the southwest region of China. LS tourism industry is a significant force for economic development, and poverty alleviation. However, in 2020, due to the impact of COVID-19, the tourism industry experienced a decline. In order to revitalize and advance tourism in LS, government have ramped up their support for the industry. This study will use the Vector Autoregression model to evaluate the coordinating relation between tourism development and financial

J. C. Hung et al. (Eds.): FC 2023, LNEE 1131, pp. 42–49, 2024.
https://doi.org/10.1007/978-981-99-9299-7_6

support. In order to facilitate the harmonious development of both the tourism and financial industries in LS, it is crucial to implement effective financial support measures that can foster the growth of the tourism.

2 Literature Review

Lately, finance plays an important role in the national economy, leading to a growth in scholarly research on the coordination between tourism development and financial support.

Markandya et al. (2005) proposed that World Bank projects should provide more help and support to the tourism industry, and that the expected benefits of the tourism industry must be carefully evaluated [1]. Pericet et al. (2011) emphasized that the economic impact of the tourism industry is significant, and international financial institutions should pay more attention to investing in the tourism industry [2], which is consistent with the research conclusions of Markandya et al. (2005). Dar and Mehta (2014) pointed out that the credit support of financial institutions has a positive economic impact on the development of the tourism industry. Financial institutions can provide various types of tourism loan programs to tourism development [3]. Katircio and Altinay (2017) pointed out that there is a long-term interactive relationship between Turkey's tourism development and financial development, and finance has a positive impact on growth of Turkey's tourism economy [4]. Cannonier and Burke (2017) indicated that tourism expenditure has positive impact on financial development in Caribbean countries, and increasing support for the tourism industry can also lead to a higher level of financial system depth [5]. Ohlan (2017) analyzed India's tourism industry, economic growth and financial development from 1960 to 2014. It was found that the relationship is stable [6]. Cozorici et al. (2019) found through their research that the main problem faced by tourism companies is a shortage of funds, and proposed the path of using the capital market to expand tourism company financing [7]. AYH Saif and Saha (2021) studied the data of 17,077 banks and found that there was an interaction between tourism and finance, with high-income countries having the least negative impact of banks on the tourism industry compared with developing countries [8].

The previous studies findings have revealed a strong correlation between finance and industry. However, as each country has unique national conditions and different levels of development, the significance of the tourism industry in the local economy may vary. Thus, this study will use vector autoregression model to study the financial support for tourism development in Liangshan Prefecture.

3 The Financial Support for the Development of Tourism in LS

The government of LS has introduced multiple policies and measures to support tourism, mainly including the following aspects. Increase financial support, optimize financial services, introduce differentiated and specialized financial products and services, and improve the financing capacity of tourism enterprises. Strengthening financial regulation and risk management, improving the financial regulatory system, and preventing and controlling financial risks. Strengthen tourism marketing, increase the influence of the

LS tourism brand, expand the market share of LS tourism, and increase tourism revenue. Optimizing tax policies to reduce the burden on tourism enterprises and improve their profitability.

There are still some shortcomings, lack of targeted financial products and services for the needs of tourism enterprises; lack of professional financial institutions and personnel support; lack of sound financial regulation and risk management systems; and lack of financial guidance and training for tourism enterprises.

4 Methodology

Vector Autoregression model is based on the statistical nature of the data model, the general mathematical expression of the Vector Autoregression model is[9]:

$$Y_t = \alpha + \sum_{i=1}^{p} A_i Y_{t-i} + \sum_{j=1}^{r} B_j X_{t-j} + \varepsilon_t \tag{1}$$

In the formula (1), Y_t is the vector of endogenous variables; X_t is the vector of exogenous variables; p is the lag order of endogenous variables; r is the lag order of exogenous variables; A_i and B_j are the parameter matrix to be estimated, and ε_t is the random perturbation variable.

(1) **Stability test principle**

Before testing, we must ensure that the time series data are stable, otherwise the results will not be ideal. The equation is as follows:

$$\Delta y_t = \alpha + \beta_t + (\gamma - 1) y_{t-1} + \sum_{j-1}^{p} \delta \Delta y_{t-1} + \varepsilon_t \tag{2}$$

In the formula (2), α, β, γ, δ are the parameters, ε_t is the random error term, and the value of formula p is the minimum p value that guarantees ε_t.

(2) **Cointegration test principle**

The specific operation of co-integration inspection are as follows:

First, test the CI (d, b) order cointegration relationship of sequence Y_t and X_t. .First, the unit root test was conducted on each variable, and each variable was an I (d) sequence, and then the variable Y_t was selected to perform OLS regression on X_t, that is, the co-integration regression equation as formula 3:

$$Y_t = \alpha + \beta X_t + \varepsilon_t \tag{3}$$

Using $\hat{\alpha}$ and $\hat{\beta}$ to express the estimate of the regression coefficient, the model residual estimate as formula(4):

$$\hat{\varepsilon} = Y_t - \hat{\alpha} - \hat{\beta} X_t \tag{4}$$

Second, the unit root test was performed with ADF for the residual term ε_t in Eq. (4.4). If the results indicate that ε_t is an I (0) sequence, ε_t~I(0), then ε_t is a stationary sequence, and it can be concluded that Y_t and X_t are CI (d, b) order, and their cointegration vector is (I, -$\hat{\beta}$).

(3) **The Granger causality test principle**

The formula is as followsin Eq. (5):

$$X \to Y \leftrightarrow \sigma^2(y_t/y_{t-h}, h > 0) > \sigma^2(y_t/y_{t-h}, X_{t-h}, h > 0) \tag{5}$$

The Granger causality test model is as follows:

$$y_t = a_{10} + \sum_{i-1}^{m} a_{1i} y_{t-i} + e_{1t} \tag{6}$$

$$y_t = a_{20} + \sum_{i-1}^{m} a_{2i} y_{t-i} + \sum_{i-1}^{m} b_{2i} x_{t-i} + e_{2t} \tag{7}$$

To test the single-term Granger causality from Xt to Yt, testing the null hypothesis H0: $b_{2j} = 0(j = 1, 2, \ldots n)$ test statistic:

$$F = \frac{(ESS_1 - ESS_2)/n}{ESS_1/[T - (M + N + 1)]} \sim F_{\{m, T-(m+n+1)\}} \tag{8}$$

In the formula, ESS_1 and ESS_2 are the sum of the residual squares of the formulas (6) and (7), respectively, and T is the total number of observations of Y. With α as confidence, in formulas (8), if F > Fa, H0 is rejected, that is, X has Granger causality for Y with the probability of 1- α; otherwise, accept the null hypothesis, X does not have Granger causality for Y [10].

5 Analysis of Financial Support for Tourism in LS: An Empirical Study

In this chapter, we conduct analysis of the relationship between tourism and financial support in LS.

5.1 Variable Selection

This paper selects the tourism income (recorded as TI) as the index of the tourism development in LS. And selects the following three indicators: the proportion of financial deposits and loans in GDP (recorded as FS) to present the financial development, the per capita deposit (recorded as SDP) to present financial developmen and the loan-to-deposit ratio (recorded as FE) to present the financial development.

5.2 Data Preprocessing

The data of this paper are mainly derived from the Statistical Bulletin of National Economic and Social Development of LS from 2002 to 2020. To avoid issues with data heteroscedasticity, the paper first takes the natural logarithm of the variables. Thus, the natural logarithm of each variable is denoted as LnTI1, LnFS1, LnSDP1, and LnFE1, respectively.

Table 1. ADF test results for the related variables

Variables	Inspection type	ADF	prob	stable or not
Lnti1	(C,N,0)	−0.836813	0.7839	not
Lnfs1	(C,N,0)	−1.612969	0.4559	not
Lnsdp1	(C,N,0)	−1.338658	0.5864	not
Lnfe1	(N,N,0)	−0.506905	0.4825	not
△Lnti1	(C,N,0)	−4.753345	0.0018	stable
△Lnfs1	(C,N,1)	−5.070829	0.0011	stable
△Lnsdp1	(N,N,2)	−3.096727	0.0486	stable
△Lnfe1	(C,N,3)	−6.914860	0.0001	stable

5.3 Empirical Analysis

(1) ADF inspection

The testing framework is as follows, See Table 1.

Based on the results of the ADF test presented in the table, it can be observed that the time series data for LnTI1, LnFS1, LnSDP1, and LnFE1 are non-stationary. However, after performing first-order differencing on the series (△LnTI1, △LnFS1, △LnSDP1, and △LnFE1), they become stationary, meeting the requirements for the Engle-Granger two-step co-integration test.

(2) E-G two-step co-integration test

1 Cointegrating Equation(s): Log likelihood 75.48640

Normalized cointegrating coefficients (standard error in parentheses)

LNTI1	LNFS1	LNSDP1	LNFE1
1.000000	-6.021335	-1.081794	-3.644806
	(0.71749)	(0.16327)	(0.52983)

Fig. 1. Co-integration test result

According to the results of the cointegration test in Fig. 1, we can get the consolidation equation:

$$\mathbf{LnTI1 = -6.021335LnFS1 - 1.081794LnSDP1 - 3.644806LnFE1}$$

From the results of the consolidation test, there is a long-term balanced relationship between financial support and tourism revenue.

(3) Granger test of causality

The Granger test of causality results are presented below:

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 06/07/22 Time: 09:54
Sample: 2002 2020
Included observations: 17

Dependent variable: LNTI1

Excluded	Chi-sq	df	Prob.
LNSDP1	7.032008954...	2	0.029717936...
LNFS1	8.528123264...	2	0.014065059...
LNFE1	6.259714638...	2	0.043724035...
All	12.50132393...	6	0.051675021...

Dependent variable: LNSDP1

Excluded	Chi-sq	df	Prob.
LNTI1	1.440153757...	2	0.486714836...
LNFS1	0.273555770...	2	0.872163925...
LNFE1	3.561218564...	2	0.168535430...
All	6.417994232...	6	0.378029189...

Dependent variable: LNFS1

Excluded	Chi-sq	df	Prob.
LNTI1	1.170589951...	2	0.556941553...
LNSDP1	1.526188187...	2	0.466221659...
LNFE1	4.719457655...	2	0.094445830...
All	8.577486417...	6	0.198771014...

Dependent variable: LNFE1

Excluded	Chi-sq	df	Prob.
LNTI1	1.789230292...	2	0.408764883...
LNSDP1	1.134334481...	2	0.567129707...
LNFS1	0.036073604...	2	0.982124887...
All	6.940725693...	6	0.326363684...

Fig. 2. Granger causality test result

According to the results of Fig. 2: LnTI1, LnFS1, LnSDP1, LnFE1 have a one-way causal relationship, LnFS1, LnSDP1, LnFE1 are Granger reasons for LnTI1, LnTI1 is not the Granger reason for LnFS1, LnSDP1, LnFE1.

(4) Stability test of the Vector Autoregression model

To ensure the reliability of the analysis, this paper examines the stability of the Vector Autoregression model as Fig. 3 shown:

Root	Modulus
0.534984 - 0.760776i	0.930047201701601...
0.534984 + 0.760776i	0.930047201701601...
0.835964 - 0.122021i	0.844822061002333...
0.835964 + 0.122021i	0.844822061002333...
-0.504599 - 0.486508i	0.700935528162967...
-0.504599 + 0.486508i	0.700935528162967...
0.274424 - 0.610909i	0.669715089674758...
0.274424 + 0.610909i	0.669715089674758...

No root lies outside the unit circle.
VAR satisfies the stability condition.

Fig. 3. Stability test result

(5) Variance analysis

The results in Fig. 4 indicate that over time, the contribution of financial development to tourism income in LS will gradually increase.

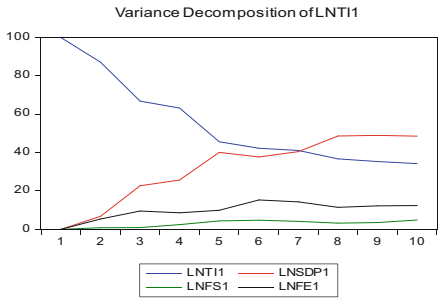

Fig. 4. Variance analysis result

(6) Regression analysis

In order to analyze the impact of these three indicators on the tourism development more specifically, the stepwise forwards regression analysis is conducted, and the regression results are as Fig. 5 shown:

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	4.221790	0.343825	12.27888	0.0000
LNSDP1	1.697460	0.096193	17.64632	0.0000
LNFE1	0.900700	0.397609	2.265293	0.0377
R-squared	0.951846	Mean dependent var		4.291845
Adjusted R-squared	0.945827	S.D. dependent var		1.426064
S.E. of regression	0.331919	Akaike info criterion		0.776088
Sum squared resid	1.762724	Schwarz criterion		0.925210
Log likelihood	-4.372835	Hannan-Quinn criter.		0.801325
F-statistic	158.1331	Durbin-Watson stat		1.409865
Prob(F-statistic)	0.000000			

Fig. 5. Regression results

The following regression equations can be obtained from the above regression results:

$$\text{LnTI1} = 1.69746\text{LnSDP1} + 0.9007\text{LnFE1} + 4.22179 \quad (9)$$

According to the regression results in formula (9), the adjusted R squared is 0.945827, and the model had a high goodness of fit. The F statistic is 158.1331, and the concomitant probability is 0.000, indicating that the model overall passed the significance test. According to the regression coefficient, the financial development level and financial development efficiency have a positive relationship with the development of tourism. When the level of SDP and FE increase by 1% respectively, the TI will increase by 1.69% and 0.90%. In general, the above empirical results show that increasing the financial support of LS can promote the further development of LS tourism.

Acknowledgement. Fudings: Sichuan Province Social Science Key Research Base - China Panxi Health Industry Research Center, Project Name: Study on Tourist Satisfaction of Kangyang Tourism in LS, Project Number: PXKY-YB-202113.

References

1. Markandya, A., Taylor, T., Pedroso, S., et al.: Tourism and sustainable development: lessons from recent world bank experience. Econ. Tour. Sustain. Dev. 225–251 (2005)
2. Peric, J., Mujacevié, E., Simunic, M.: International financial institution investments in tourism and hospitality. J. Int. Bus. Cult. Stud. 1–17 (2011)
3. Dar, A.A., Mehta, S.K.: Assessment of the role of financial institutions in tourism development of Kashmir: a field study from demand side of market. J. Kashmir Tour. Cater. Technol. **1**(2), 14–23 (2014)
4. Katircio, Lu.S., Altinay, M.: Interactions between tourism and financial sector development: evidence from Turkey. Serv. Ind. J. **38**, 519–542 (2017)
5. Cannonier, C., Burke, M.G.: Tourism and financial development in small states: evidence from Caribbean countries. Tour. Econ. Bus. Finan. Tour. Recreat. **23**(6), 1369–1377 (2017)
6. Ohlan, R.: The relationship between tourism, financial development and economic growth in India. Future Bus. J. **3**(1), 9–22 (2017)
7. Cozorici, A.N., Prelipcean, G., Scutaru, L.: Financing tourism companies through the capital market. In: Springer Proceedings in Business and Economics, pp. 111–119. Springer, Heidelberg (2019). https://doi.org/10.1007/978-3-319-89468-3_9
8. Saif-Alyousfi, A., Saha, A.: Do tourism receipts affect bank profitability? analytical evidence from 85 tourism economies. Res. Int. Bus. Financ. **4**, 101437 (2021)
9. Saori, O., Takashi, S.: Re-examining the effects of official development assistance on foreign direct investment applying the VAR model. Economies **10**(10), 236 (2022)
10. Yu, J., Zhang, M., Liu, R., Wang, G.: Dynamic effects of climate policy uncertainty on green bond volatility: an empirical investigation based on TVP-VAR models. Sustainability **15**(2), 1692 (2023)