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Abstract

This paper explores the validity of the tourism-led growth hypothesis for Thailand using quarterly data during 2006 and 2017. The results from the residual-based test for cointegration show that the positive long-run relationship between tourism receipts and real GDP is linear when taking into account the existence of structural breaks. Furthermore, the results from short-run dynamics reveal that this long-run linear relationship is stable since any deviation from the long-run equilibrium will be corrected. The possibility of asymmetric adjustment to long-run equilibrium is also examined by using threshold cointetration tests, TAR and MTAR models. The estimated MTAR indicates the existence of nonlinearity, but asymmetric adjustment to the long-run equilibrium is not found. The causality analysis suggests that there is short-run causality running from tourism receipts to real GDP in the lower regime from the estimated MTAR model. On the contrary, long run causality is evidenced. The overall results suggest that the tourism-led growth hypothesis holds for Thailand. The findings in this paper give some policy implications.

Keywords: Tourism receipts, economic growth, threshold coinegration, causality
JEL Classification: C22, F14

1. Introduction

Tourism receipts have become one of main sources of foreign exchange income for Thailand and other emerging market economies. In addition, tourism development can create employment opportunities in the tourism sector. Tourism industry has been gradually more important to the Thai economy. In 2005, the ratio of tourism receipts and total exports of the country was 9 percent. This ratio increased to 15 percent in 2014. The average ratio was 12 percent per annum. The growing importance of tourism can enhance economic growth for the Thai economy.

Besides the export-led growth hypothesis, the tourism-led growth hypothesis has been widely explored by many researchers. Some researchers posit that tourism is a long-run economic growth factor. Balaguer and Cantavella-Jorda (2002) examine the role of tourism in the Spanish long-run economic development. They find that the Spanish economic growth is sensible to persistent expansion of international tourism. Similarly, Nikolaos (2004) investigates the impact of tourism on long-run economic growth in Greece under a multivariate framework. The evidence for Greece supports the tourism-led growth hypothesis. Carrera et al. (2008) examine the impact of tourism on long-run economic growth in Mexico and find evidence of the validity of the tourism-led growth hypothesis from the results of a linear cointegration analysis. However, Oh (2005) finds that the tourism-led growth hypothesis does not hold for South Korea. Recently, Ertugrul and Mangir (2015) validate the tourism-led growth hypothesis for Turkey. Phiri (2015) finds evidence that supports the tourism-led growth hypothesis for South Africa under the linear cointegration analysis. On the contrary, Brida et al. (2016) examine the validity of the tousim-led growth hypothesis for Argentina and Brazil using a nonlinear conintegration technique. They find that the tourism-led growth hypothesis holds only in the case of Brazil.

This paper attempts to investigate whether tourism leads to economic growth by using the recently available quarterly data during 2006 and 2017. In other words, the paper tests the tourism-led growth hypothesis for Thailand. To answer this empirical issue, both linear and non-linear cointegration tests are used. The possibility of nonlinearity in the tourism-growth nexus has been ignored in many previous studies. The main finding in the present paper is that the significantly positive relationship between tourism receipts and real GDP is both linear and nonlinear and thus lends a support for the validity of the tourism-led growth hypothesis.

The paper is organized as follows. The next section describes the data and empirical methodology. Section 3 presents empirical results. Concluding remarks are in Section 4.

2. Data and Methodology

2.1 Data

The data from 2006Q1 to 2017Q4 are used to examine the validity of the tourism-led growth hypothesis. The series of tourism receipts from the Balance of Payments statistics and consumer price index are obtained from the website of the Bank of Thailand. The series of real tourism receipts is obtained by deflating the series of tourism receipts by consumer price index. The new series of real GDP (chain volume measured) is obtained from the database of the National Economic and Social Development Board. All series are transformed into logarithmic series.

2.2 Estimation methods

Since the long-run relationship between tourism receipts and real GDP can be linear or nonlinear, two types of tests for cointegration are used: (1) Gregory-Hansen cointegration test proposed by Gregory and Hansen (1996), and (2) threshold cointegration tests both TAR and MTAR models proposed by Enders and Granger (1998) and Enders and Siklos (2001).

2.2.1 Residual-Based Test for Cointegration with Breakpoints

The Gregory-Hansen cointegration test is employed to estimate the long-run equilibrium relationship, which is expressed as:

$$gdp_t = \alpha_0 + \beta_1 D_t + \beta_2 tr_t + e_t \tag{1}$$

where *gdp* is the log of real GDP, and *tr* is the log of real international tourism receipts, and *e* is the error term. Under this procedure, the unknown break date is determined endogenously. The dummy variable D_t is created from the determined unknown breakpoint from this cointegration test.

The second step is the test for unit root in the estimated residual (e_t) by the following equation:

$$\Delta e_t = \rho e_{t-1} + \sum_{i=1}^{k} \beta_i \Delta e_{t-i} + u_t \tag{2}$$

where k is the optimal lag order. Eq. (2) is the Augmented Dickey-Fuller test. The t-statistic of the coefficient the lagged residual term is compared with the critical value provided by Gregory and Hansen (1996). If the t-statistic is larger than the critical value statistic, the null hypothesis of no cointegration is rejected. On the contrary of the t-statistic is smaller than the critical value statistic, the null hypothesis is accepted. It should be noted that this residual-based test for cointegration takes into account possible structural breaks.

The Gregory-Hansen cointegration test implicitly assumes a linear adjustment mechanism. However, this test is misspecified when the adjustment is asymmetric. The symmetric adjustment under short-run dynamics using error correction mechanism (ECM) is expressed as:

$$\Delta gdp_t = \alpha + \sum_{i=1}^{k} \beta_i \Delta gdp_{t-i} + \sum_{i=1}^{k} \gamma_i tr_{t-i} + \lambda e_{t-1} + u_t \tag{3}$$

The lag order k can be determined by using appropriate information criterion. The significance of the coefficients of the lagged tourism receipts variables using the Wald-F test indicates short-run causality running from tourism receipts to economic growth. In addition, the significance of coefficient λ of the error correction term, which has a negative sign and the absolute value of less than one, indicates that any deviation from the long-run equilibrium will be corrected. On the contrary, the insignificance of coefficient λ reveals that the logn-run relationship is not stable. Even though linear conintegrating relationship is found, some alternative tests of cointegration can be employed to detect the possibility of nonlinearity in the long-run relationship and asymmetric adjustment to the long-run equilibrium.

2.2.2 Nonlinear Cointegration Tests with Asymmetric Adjustment

The models that take into account of asymmetric adjustment mechanism are recently developed for cointegration tests. These are modified models of the residual-based test. The first model is known as threshold autoregressive model (TAR) developed by Enders and Granger (1998) and Enders and Siklos (2001), which is a nonlinear extension of the residual-based framework. The nonlinear cointegration function of the TAR model is specified as:

$$\Delta e_t = I_t \rho_1 e_{t-1} + (1 - I_t) \rho_2 e_{t-1} + \sum_{i=1}^{k} \beta_i \Delta e_{t-i} + v_t \tag{4}$$

where Δ is first difference operator, I_t is the heaviside indicator function such that it is one if e_{t-1} is greater than or equal to τ and it is zero if e_{t-1} is smaller than τ and τ is the value of the threshold. The lagged first differences of the lagged error term are augmented to Eq. (4) to remove serial correlation.

According to the TAR model, the necessary and sufficient conditions for the sequence of e_t is that ρ_1 and ρ_2 are less than zero and $(1+\rho_1)(1+\rho_2)$ is less than one. Since the value of τ is unknown, this value is to be estimated. In some circumstance, the value of τ might be set to zero so that the cointegrating vector coincides with the attractor.

For the momentum threshold autoregressive (MTAR) model, the nonlinear cointegration function differs from the TAR model. The test equation is expressed as:

$$\Delta e_t = M_t \rho_1 e_{t-1} + (1 - M_t)\rho_2 e_{t-1} + \sum_{i=1}^{k} \beta_i \Delta e_{t-i} + v_t \qquad (5)$$

In Eq. (5), the Heaviside indicator function is defined as M_t is one if Δe_{t-1} is greater than or equal to τ, and it is zero if Δe_{t-1} is less than τ.

If the threshold cointegration is found, one can proceed with the Granger causality test by the threshold error correction model (TECM). The TECM is specified as:

$$\Delta gdp_t = \alpha_1 + \sum_{t=1}^{k} \delta_{1i} \Delta gdp_{t-i} + \sum_{t=1}^{k} \varphi_{1i} \Delta tr_{t-1} + \lambda_1 Z_t e_{t-1} + u_{1t} \qquad (6)$$

and

$$\Delta gdp_t = \alpha_2 + \sum_{t=1}^{k} \delta_{2i} \Delta gdp_{t-i} + \sum_{t=1}^{k} \varphi_{2i} \Delta tr_{t-1} + \lambda_2 (1 - Z_t) e_{t-1} + u_{2t} \qquad (7)$$

where Zt is It for TAR and Mt for MTAR, (1-Zt) is (1-It) for TAR and (1-Mt) for MTAR. The significance of coefficients λ_1 and λ_2 indicates the existence of asymmetric adjustment toward the long-run equilibrium. In causality sense, the significance of one of φ_i indicates short-run causality (Granger, 1988).

3. Empirical Results

In order to test for cointegration between real GDP and tourism receipts, it is necessary to perform unit root tests to determine the order of integration of the series. Next, linear and nonlinear cointegration tests are analyzed.

3.1 Unit Root Tests

Among various conventional unit root testing procedures, the augmented Dickey-Fuller (ADF) tests are used to test for stationarity property of each variable. The results are reported in Table 1.

Table 1
Results of ADF tests for unit root, 2006Q1-2017Q4.

Variable	ADF statistic (constant)	Lag
gdp	-0.430	7
Δgdp	-4.754***	6
tr	-0.060	4
Δtr	-3.748***	3

Note: The optimal lag length is determined by Schwarz Information Criterion (SIC), and *** denotes significance at the 1 percent level.

The results the ADF tests reveal that the real GDP series and tourism receipts are not stationary in their level, but stationary in their first differences. Therefore, it can be argued that both series are I(1) series.

The results reported in Tables 1 do not take into account the existence of structural breaks. However, it is also important when examining the time series property of the variables by taking into account possible structural breaks. Using Zivot-Andrews breakpoint unit root tests proposed by Zivot and Andrews (1992), which are concerning possible structural breaks, the results are reported in Table 2.

Table 2
Results of unit root tests allowing for structural breaks, 2006Q1-2017Q4.

Variable	Break date	Test statistic	p-value
gdp	2009Q3	-2.029	0.981
Δgdp	2009Q2	-9.610***	< 0.01
tr	2010Q4	-2.020	0.981
Δtr	2010Q2	-4.956***	< 0.01

Notes: Dummy type is 'shift', one-sided p-values are provided by Vogelsang (1993), and *** denotes significance at the 1% level.

The results of unit root tests allowing for structural breaks indicate one break for each series. However, the break points for all series are different. The structural break seems to occur after the 2008 global economic crisis. The results in Table 3 indicate that the two series are also I(1) series.

Due to the possibility on nonlinearity stationarity of variables, the non-linearity stationary test proposed by Kapetnious et al. (2003) can be used to test whether the two series are nonlinear stationary. The approximated equation of this test can be expressed as follows:

$$\Delta x_t = \mu + \delta x_{t-1}^3 + \sum_{t-1}^{k} b_i \Delta x_{t-i} + u_t \tag{8}$$

where x is the series of variables in question, u is an i. i.d. error with zero mean and constant variance. The null hypothesis of $\delta = 0$ is tested against the alternative hypothesis of $\delta < 0$. The acceptance of the null hypothesis indicates the presence of unit root in a series and vice versa. The results of nonlinear unit root test are reported in Table 3.

Table 3
Results of nonlinear unit root tests, 2006Q1-2017Q4.

Variable	t-statistic	lag
gdp	-1.604	1
Δgdp	-7.715***	1
tr	-0.779	2
Δtr	-4.215**	1

Note: The optimal lag length is determined by Schwarz Information CriterionSIC, *** and ** denote significance at the 1 and 5 percent, respectively.

The results in Table 3 suggest that the variables are I(1) series. The tests are significant at least at the 5 percent level. Therefore, the TAR and MTAR models are likely to be suitable models for nonlinear cointegration tests.

3.2 Residual-Based Cointegration Test

The results of Gregory-Hansen cointegration test reveal that the break date is 2008Q4, which might be due to the impact of the 2008 global economic crisis, and the t-statistic obtained from the augmented Dickey-Fuller procedure with 4 lags is -6.054 which is larger than the critical value of -3.592 at the 1% level provided by Gregory and Hansen (1996). Therefore, the null hypothesis of no linear cointegration is rejected. The estimated long-run relationship between real GDP and tourism receipts is reported in Table 4. The coefficient of dummy variable is statistically significant while the coefficients of intercept and tourism receipts are highly significant. The impact of 2008 global economic crisis seems to exert a slightly positive impact on the relationship between tourism receipts and aggregate output. Since the estimate is performed on logarithmic series, it can be concluded that a 1% increase in tourism receipts causes real GDP to increase by 0.22%.

Table 4
The long-run relationship between tourism receipts and real GDP, 2006Q1-2017Q4.
Dependent variable: gdp

Variable	Coefficient	Std. Error	t-statistic	p-value
tr	0.216***	0.012	18.564	0.000
D_t	0.061***	0.011	5.364	0.000
Intercept	6.483***	0.060	107.866	0.000

Note: *** indicates significance at the 1 percent level.

The standard error correction mechanism (ECM) implicitly assumes that the adjustment process to equilibrium is symmetric. The appropriate ECM is selected such that there is no serial correlation. The significance of the coefficient of the error correction term implies that any deviation from the long-run equilibrium will be corrected. The results from the estimated symmetric ECM are reported in Table 5.

Table 5
Short-run dynamics, 2006Q1-2017Q4.
Dependent variable: Δgdp_t

Variable	Coefficient	Standard Error	t-statistic	p-value
$\hat{e}_{t-1}$	-0.703**	0.327	-2.153	0.037
Δgdp_{t-1}	-0.114	0.249	-0.457	0.649
Δtr_{t-1}	0.021	0.062	0.344	0.732
Intercept	0.009	0.007	1.334	0.189
Adjusted R^2 = 0.195 F = 3.703				
Serial correlation test: $\chi^2_{(1)}$ = 1.597 (p-value = 0.213)				

Note: ***, ** and * indicates significance at the 1%, 5% and 10%, respectively.

The estimated ECM does not exhibit serial correlation because the null hypothesis of no serial correlation is accepted. There is no short-run causality running from tourism receipts to real GDP since the F-test on the coefficient of change in tourism receipts gives F statistic = 0.119 with p-value = 0.732, which leads to an acceptance of the null hypothesis of no short-run causality. Moreover, the coefficient of the error correction term ($\hat{e}_{t-1}$) has the correct sign and is statistically significant. This evidence indicates that the long-run relationship between real GDP and tourism receipts is stable. Even though the evidence of symmetric adjustment toward long-run equilibrium is found, it is also important to examine the possibility of asymmetric adjustment and nonlinear cointegration using alternative models, TAR and MTAR.

3.3 Nonlinear Cointegration Tests and Asymmetric Adjustment

The TAR and MTAR models mentioned above can be used to test for nonlinear cointegration and asymmetric adjustment to the long-run equilibrium. The residual series obtained from the estimated residual-based cointegration test with the determined structural break of Eq. (1) can be utilized. The threshold values are determined by the data. The estimated TAR and MTAR with endogenously determined thresholds are reported in Table 6.

Table 6
Estimated results of TAR and MTAR models, 2006Q1-2017Q4.

Parameters	Models	
	TAR	MTAR
ρ_1	-0.464 (0.162)	-0.348**(0.038)
ρ_2	-0.739***(0.009)	-0.877**(0.041)
Threshold value	0.019	0.002
t-Max	-2,244** [-2.048]	-1.714 [-2.103]
Φ	7.068 [7.327]	8.739**[8.668]
F (ρ_1=ρ_2)	0.946 [6.377]	3.516 [7.968]
κ	1	1
SIC	-2.833	-2.827

Note: p-value in parenthesis. ***, **and * indicate significance at the 1%, 5%and 10% level, respectively. κ is the number of lag of differenced residuals. The threshold values are endogenously determined. The numbers in bracket are the 5% critical values. The critical value for the Φ statistic is determined by 1000 numbers of simulations.

For threshold cointegration models specified in Eqs. (4) and (5), the threshold value is 0.019 for the TAR model and 0.002 for the MTAR model. The estimated coefficients, ρ_1 and ρ_2, are reported in columns 2 and 3. The coefficients of the upper and lower regimes in the TAR model are smaller than one. However, the coefficient of the higher regime is not statistically significant. Recall that these significantly negative values of these coefficients meet the requirement of necessary condition for convergence if both coefficients are significant. In testing for nonlinear cointegration, the F-test for TAR and MTAR models has a non-standard distribution due to the presence of nuisance parameters that are only identified by the alternative hypothesis. Therefore, the test critical values must be computed (Hansen and Seo, 2002). The Φ statistic, the F-statistic for the null hypothesis that ρ_1=ρ_2=0, leads to an acception of the null hypothesis of no cointegration at the 5 percent level in the TAR model because the computed F is smaller than the 5% critical value. Even though the largest of the individual t statistic called t-Max rejects the null hypothesis of no threshold cointegration, Enders and Siklos (2001) show that the Φ statistic is quite more useful because it has substantially more power than the t-Max statistic. Therefore, it can be concluded that there is no threshold cointegration. In addition, the test-statistic for the null hypothesis that $\rho_1=\rho_2$ cannot be rejected. Therefore, asymmetric adjustment to the long-run equilibrium is not found under the TAR model. The estimated MTAR model gives more convincing results. The estimated coefficients, ρ_1 and ρ_2, are statistically significant. The results also indicate that convergence condition is met, i. e., $\rho_1<0$. $\rho_2<0$ and $(1+\rho_1)(1+\rho_2)<1$. According to Pettrucelli and Woolford (1984), this convergence condition is the condition for the stationarity of the residual series. Even though the t-Max statistic leads to an acceptance of the null hypothesis of no threshold cointegration, the Φ statistic leads to a rejection of the null hypothesis. Thus, nonlinear cointegration between real GDP and tourism receipts is observed in the estimated MTAR model. However, the test-statistic for the null hypothesis that $\rho_1=\rho_2$ cannot be rejected at the 5% level of significance. This indicates the absence of asymmetric adjustment toward long-run equilibrium.

Since the presence of nonlinear cointegration without asymmetric adjustment is found by the estimated MTAR model, the estimates of ECMs from Eqs. (6) and (7) should be estimated to explore how differently the short-run adjustments in the higher and lower regimes are. The results are reported in Table 7. The appropriate ECMs are obtained from the estimated MTAR model pass the first-order serial correlation test by Ljung-Box Q(1) statistics.

Table 7
Results from the Estimates of ECMs from the MTAR Model.

	Higher regime	Lower regime
	Δgdp_t	Δgdp_t
Intercept	0.007	0.012*
	(0.008)	(0.007)
$\hat{e}_{t-1}$	-0.241*	-0.430**
	(0.148)	(0.167)
Δgdp_{t-1}	-0.334	-0.440**
	(0.230)	(0.212)
Δtr_{t-1}	0.104**	0.132**
	(0.050)	(0.166)
Adjusted R^2	0.115	0.183
F-Statistic	2.924**	4.370***
Q(1)	0.749	0.101
	[p-value=0.387]	[p-value=0.781]

Note: Standard error in parenthesis. ***, **and *indicates significance at the 1%, 5% and 10%, respectively. The statistic Q(1) is used to test for first-order serial correlation.

The results in Table 7 show that the coefficient of the error correction term ($\hat{e}_{t-1}$) for the higher regime is not significant at the 5% level while this coefficient is significant at the 5% level for the lower regime. The results reveal that there will be no short-run adjustment to the long-run equilibrium in the higher regime, but the adjustment to long-run equilibrium occurs in the lower regime. This evidence confirms the absence of asymmetric adjustment found in threshold cointegration analysis reported in Table 6. For the lower regime, any deviation from the long-run relationship will be corrected. Therefore, there is long-run causality running from tourism receipts to real GDP is found in the lower regime only because the Wald F test gives the F-statistic = 6.613 with p-value = 0.014. For the higher regime, the Wald F-test gives the F-statistic = 2.833 with p-value = 0.099), which is not significant at the 5% level. Therefore, there is no long-run relationship running from tourism receipts to real GDP in the higher regime. In other words, the short-run adjustment towards the long-run equilibrium occurs only when the lagged residuals are smaller than the threshold value. In addition, the joint Wald F test for the coefficients of changes in tourism receipts gives the F-statistic = 7.686 with p-value = 0.008, and thus the test cannot reject the existence of the short-run causality running from tourism receipts to real GDP. The results of short-run dynamics from MTAR model reported in Table 7 are different from the results from reported in Table 5 because the short-run dynamics in the lower regime includes fewer observations.

The main finding in this paper supports the validity of the tourism-led growth hypothesis, which is contrary to the finding by Oh (2005) for South Korea. However, the finding is line with other studies, such as those of Blaguer and Cantavellar-Jorda (2002) for Spain, Nikolaos (2004) for Greece, Carrear et al. (2008) for Mexico, Ertugrul and Mangir (2015) for Turkey, and Brida et al. (2016) for Brazil.

4. Concluding Remarks

The validity of the tourism-led growth hypothesis has been quite widely explored by many researchers using conventional or linear cointegration techniques. However, the long-run relationship between real GDP and tourism receipt that cannot be detected by any linear cointegration test might indicate the possibility of a nonlinear relationship between the two variables. In this paper, both linear and threshold cointegration tests become relevant in that the tests allow for both linearilty and nonlinearity in the underlying data generating process of variables. Quarterly data available from the first quarter of 2006 to the fourth quarter of 2017 are used in the analysis. The data are first applied to linear contegration test, which allows for unknown structural break. The results show the existence of linear long-run relationship between real GDP and tourism receipts. In addition, long-run causality running from tourism receipts to real GDP is observed. Since there might be a nonlinear long-run relationship between the two variables, nonlinear cointegration tests are also performed. One of the important finding from MTAR model is the presence of a nonlinear long-run relationship between real GDP and tourism receipts for Thailand. Even though the adjustment toward long-run equilibrium is not asymmetric, but the adjustment toward the long-run equilibrium occurs in the lower regime. Furthermore, there are both short-run and long-run causation running from tourism receipts to real GDP when the residuals are below the threshold value. Based upon the results from this study, sustainable development of tourism seems to be necessary since it can be one of the main factors affecting real GDP and thus economic growth of the country. However, environmental preserving is also important.

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