The Validity of the Tourism-Led Growth Hypothesis for Thailand

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Abstract

Previous empirical studies have mainly applied linear cointegration analysis to find the relationship between tourism receipts and real GDP in the long run. However, some studies fail to find this relationship due to its complex nature. This paper explores the validity of the tourism-led growth hypothesis for Thailand using quarterly data from 2006 to 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. Nevertheless, the results from short-run dynamics reveal that this long-run linear relationship is not stable because any deviation from the long-run equilibrium will not be corrected. The possibility of a nonlinear long-run relationship is also examined by using threshold cointegration tests. The estimated MTAR model indicates the existence of nonlinear cointegration without asymmetric adjustment towards the long-run equilibrium. In a causality sense, the main finding suggests that there is long-run causality running from tourism receipts to real GDP in the higher regime or above the threshold level. On the contrary, short-run causality running from tourism receipts to real GDP is observed in the lower regime or below the threshold value. The overall results seem to suggest that the tourism-led growth hypothesis holds for Thailand.

Keywords: Tourism indicator, real GDP, structural breaks, threshold cointegration, causality
JEL Classification: C22, F14

1. Introduction

Besides the export-led growth hypothesis (Balassa, 1978, 1985), the tourism-led growth hypothesis has been widely explored by many researchers. The export-led growth hypothesis posits that exports can stimulate economic growth. Similarly, many researchers claim that tourism is a long-run economic growth factor while few researchers find that tourism does not cause economic growth in some countries. There is strong evidence in favor of the tourism-led growth hypothesis (Clancy,1999; Balaguer and Cantavella-Jorda, 2002; Dritsakis,2004; Gunduz and Hatemi-J, 2005; Carrera et al.. 2008; Pablo-Romero and Molina, 2013; Jalil 2013; Tang and Fan, 2013; Surugio and Surugio, 2013; Balcilar et al., 2014; Tang,2015; Ertugrul and Mangir, 2015). Most of these researchers contend that the international tourism industry helps explain growth by examining the role of tourism in the long-run economic development using bivariate and multivariate frameworks. Some empirical studies find that economic growth is sensitive to a persistent expansion of

international tourism in both the short run and long run. Therefore, the tourism-led growth hypothesis holds for most economies, which seem to be major tourist destinations. However, some empirical studies fail to find evidence indicating that tourism drives GDP growth (e. g., Oh, 2005; Lee 2008; Katircioglue, 2009, 2010). In general, these studies find evidence that does not support the export-led growth hypothesis. Therefore, the validity of the tourism-led growth hypothesis seems to be somewhat inconclusive. The contradictory results from previous studies depend on using linear cointegration tests and causality analysis. On the contrary, some studies find evidence supporting the growth-led tourism hypothesis (Katircioglue, 2010; Aslam, 2014, among others). Different techniques are also used to test the validity of the tourism-led growth hypothesis. Arslanturk and Balcilar (2011) use the rolling window and time-varying coefficient estimation method to analyze the Granger causality test in Turkey for the 1993-2006 period. They find that tourism receipts have positively predictive content for a sub-sample period, but not for the whole sample period. Using panel data of 19 island economies to examine the contribution of tourism to economic growth, Seetanah (2011) finds that tourism significantly contributes to economic growth. Furthermore, the results from causality analysis show that there is bidirectional causality between tourism and growth in these island economies. Tugcu (2014) employs a panel causality analysis for the case of the Mediterranean region. The results show that the direction of causality between tourism and growth depends on the country group and tourism indicator. While no causality is found in African countries, bidirectional causation between tourism and growth is found in Asian and European countries. In most studies, the methods applied are linear cointegration and Granger causality, and panel causality tests. In most cases, these studies show evidence of both short- and long-run relationships between real GDP and tourism indicators. Moreover, some studies include real exchange rate as one of the explanatory variables when the dependent variable is the number of tourist arrivals.

Recently, nonlinear cointegration tests for the long-run relationship between tourism and GDP have been gaining popularity due to the failure of linear cointegration tests in detecting this long-run relationship in some previous studies. Po and Huang (2008) employ cross-sectional data for 88 countries to examine a nonlinear relationship between tourism and economic growth. They find that there exists a significantly positive tourism-growth nexus when tourism revenue from international tourists is below a certain threshold value in some countries and above a threshold value in other countries. According to Wang (2012), the tourism-growth nexus seems to be complex and nonlinear. Wu et al. (2016) find that growth-tourism causality is bidirectional, nonlinear, time- and country- varying in both the short run and the long run. Phiri (2016) uses both linear and nonlinear cointegration tests and finds evidence that supports the tourism-led growth hypothesis for South Africa under the linear cointegration analysis, i.e. there is a positive long-run relationship between tourism receipts and output. Moreover, the results from the nonlinear framework show bidirectional causality between tourism receipts and economic growth. The results from the linear framework also support the growth-led tourism hypothesis, but the nonlinear framework shows no causality between tourist arrivals and economic growth. Kumar and Stauvermann (2016) find that both linear and nonlinear frameworks can capture a significantly positive long-run relationship between tourism and economic growth in Sri Lanka. Brida et al. (2015) use nonlinear

techniques to examine the tourism-led growth hypothesis for four South American countries. They find that the relationship between tourism and economic growth is nonlinear in only two countries (Argentina and Brazil). By examining the nonlinear long-run relationship between tourism receipts and output, Brida et al. (2016) investigate the validity of the tourism-led growth hypothesis for Argentina and Brazil using threshold cointegration techniques. They find that the tourism-led growth hypothesis holds only in the case of Brazil. Chiu and Yeh (2017) find evidence showing a strong nonlinear relationship between tourism and economic growth in cross-section data. It should be noted that evidence from more recent studies tends to suggest that the tourism-GDP nexus is nonlinear.

Tourism receipts have become one of the main sources of foreign exchange earnings for Thailand and other emerging market economies. In addition, tourism development can create employment opportunities in the tourism sector. Therefore, the tourism industry has been gradually more important to the Thai economy. Although the receipts from merchandise exports are the leading source of foreign exchange earnings, tourism receipts have become the second main source of foreign exchange earnings. The growing importance of tourism can enhance economic growth for the Thai economy. According to the 2018 International Monetary Fund (IMF) news on country focus, Thailand's economic growth is improving recently. In a large part, tourism and manufacturing exports have contributed to the growth of the country. Most international tourists visiting Thailand are from Asia and Europe because the country is their favorite tourist destination. A boom in tourism can be a key driver of growth and the large current account surplus. Even though the gain from tourism has concentrated in few tourist hotspots, tourism has benefited other sectors of the country as well.

Empirically, the notion that tourism expansion has a positive impact on economic growth has been widely explored. However, some previous empirical studies fail to support this notion. The main motivation of conducting this study is to use recently developed econometric techniques to examine the validity of the tourism-led growth hypothesis for Thailand, which is considered a favorite international tourists' destination in Southeast Asia. Some previous studies that fail to find cointegration between variables in the model rely on standard tests of cointegration in general. Since the standard tests assume that cointegrating equations are time-invariant, the rejection of cointegration might be due to either a shift in the cointegrating equations or the presence of a nonlinear long-run relationship or both. This paper attempts to investigate whether tourism leads to economic growth by using the recently available quarterly data from 2006 to 2017. In other words, the paper examines the validity of the tourism-led growth hypothesis for Thailand. To answer this empirical question, 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 contribution of this paper to the existing literature is that it provides evidence showing that the significantly positive long-run relationship between tourism receipts and real GDP is nonlinear when the lagged residual series is above the threshold value. This finding lends supportive evidence 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 the last section.

2. Data and Empirical Methodology

This section presents the data, an empirical model, and the estimation methods that are used in the analysis.

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 the 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 the consumer price index. The chain volume measured series of real GDP is obtained from the database of the National Economic and Social Development Board. All series are transformed into logarithmic series.

Some previous studies use the number of international tourist arrivals as a tourism indicator of tourism variable (e.g., Katircioglue, 2009, among others). However, tourism receipts of a country are expenditures by international tourists. These receipts should be more important in testing the validity of the tourism-led growth hypothesis than the number of tourist arrivals. In other words, tourism receipts can be a good measure of the country's tourist demand (Brida et al. 2015, and Brida et al., 2016). In addition, foreign tourists from different regions tend to spend different amounts of foreign currencies, and thus they are not homogeneous. Tourism receipts are widely used as a proxy of tourism activity (Gunduz and Hatami-J, 2005).

2.2 Empirical Methodology

Since the long-run relationship between tourism receipts and real GDP can be either linear, nonlinear, or both, two types of tests for cointegration used are (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 Unknown Breakpoint

An empirical model used in this study is the model used by Brida et al. (2016), but the residual-based test for cointegration is different. The Gregory-Hansen cointegration test is employed to estimate the long-run equilibrium relationship, which is expressed as:

$$gdp_t = \alpha_0 + \beta_1 D_t + \beta_2 tr_t + e_t \quad (1)$$

where gdp_t is the log of real GDP, and tr_t is the log of real international tourism receipts, and e_t 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 residual-based cointegration test.

To test for cointegration between real GDP and tourism receipts, the test for a unit root in the estimated residual (e_t) is performed by the following equation:

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

where k is the optimal lag order. Eq. (2) is the Augmented Dickey-Fuller (ADF) test. The t-statistic of the coefficient of 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, if 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 that there is symmetric adjustment towards long-run equilibrium. However, this test is misspecified when this adjustment is asymmetric. The symmetric adjustment under short-run dynamics using error correction mechanism (ECM) is expressed as:

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

The lag order, k, can be determined by using the appropriate information criterion. The joint 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 with an absolute value of less than one, indicates that any deviation from the long-run equilibrium will be corrected. Moreover, a long-run causality can be observed (Granger, 1988). On the contrary, the insignificance of λ reveals that the long-run relationship is not stable. Even though a linear cointegrating 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 towards the long-run equilibrium.

2.2.2 Nonlinear Cointegration Tests with Asymmetric Adjustment

The models that take into account asymmetric adjustment mechanisms are recently developed for cointegration tests. These are modified models of the residual-based tests for cointegration. The two models are known as the threshold autoregressive (TAR) and the momentum threshold autoregressive (MTAR) models developed by Enders and Granger (1998) and Enders and Siklos (2001). These two models are nonlinear extensions of the residual-based framework. The nonlinear cointegration function of the TAR model is specified as:

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

where Δ is the 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 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 with the absolute values of less than one, 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 circumstances, the value of τ might be set to zero so that the cointegrating vector coincides with the attractor.

For the 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. The necessary and sufficient conditions are the same as those of the TAR model.

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 Z_t is I_t for the TAR and M_t for the MTAR, $(1-Z_t)$ is $(1-I_t)$ for the TAR, and $(1-M_t)$ for the MTAR. The significance of coefficients λ_1 and λ_2 indicates the existence of asymmetric adjustment toward the long-run equilibrium. In a causality sense, the significance of one of φ_i indicates short-run causality (Granger 1988).

3. Empirical Results

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 two series. The time-series property of the data allows for conducting both linear and nonlinear cointegration tests.

3.1 Unit Root Tests

Among various conventional unit root testing procedures, the augmented Dickey and Fuller (ADF) tests are used to test for the 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% level.

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

The results reported in Table 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 the breakpoint unit root tests proposed by Zivot and Andrews (1992), which are concerning with 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***	0.000
tr	2010Q4	-2.020	0.981
Δtr	2010Q2	-4.956***	0.000

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 unknown structural breaks indicate one breakpoint for each series. However, the breakpoints for all series are different. The structural break seems to occur after the 2008 global economic crisis. The results in Table 2 also indicate that the two series are also I(1) series.

3.2 Residual-Based Cointegration Test

The results of the Gregory-Hansen cointegration test reveal that the break date is 2009Q1, which might be resulted from the impact of the 2008 global economic crisis, and the t-statistic obtained from the ADF procedure with 2 lags is -4.79, which is larger than the critical value of -4.61 at the 5% 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 3. The coefficient of the dummy

variable is statistically insignificant, but the coefficients of intercept and tourism receipts are also significant. The Gregory-Hansen ADF procedure takes into account the impact of the 2008 global economic crisis, but the crisis does not seem to exert any 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 0.26%.

Table 3
The long-run relationship between tourism receipts and real GDP, 2006Q1-2017Q4.
Dependent variable: gdp_t

Variable	Coefficient	Std. Error	t-statistic	p-value
tr_t	0.260***	0.014	18.291	0.000
D_t	-0.002	0.016	0.107	0.919
Intercept	6.234***	0.077	81.291	0.000
Adj. R^2 = 0.928, F = 291.712				

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

The existence of the long-run relationship between the two variables allows for the analysis of short-run dynamics. With a moderate sample size for the analysis, the symmetric ECM that passes the serial correlation test should be selected. The optimal lag length for the ECM selected by SIC is 1. The results from the estimated symmetric ECM are reported in Table 4. The model includes the impact of the breakpoint to examine whether the break might affect the short-run dynamics. The standard ECM implicitly assumes that the adjustment process to equilibrium is symmetric. The insignificance of the coefficient of the error correction term implies that any deviation from the long-run equilibrium will not be corrected. This indicates that the long-run relationship is not stable. The break does not significantly affect the short-run relationship.

Table 4
Short-run dynamics, 2006Q1-2017Q4.
Dependent variable: Δgdp_t

Variable	Coefficient	Standard Error	t-statistic	p-value
$\hat{e}_{t-1}$	-0.175	0.139	-1.259	0.215
Δgdp_{t-1}	-0.147	0.153	-0.962	0.342
Δtr_{t-1}	-0.070	0.055	-1.285	0.206
D_t	0.015	0.011	1.341	0.187
Intercept	0.117	0.087	1.342	0.187
Adjusted R^2 = 0.001, F = 1.001				
Serial correlation test: $\chi^2_{(2)}$ = 2.870 (p-value = 0.238)				

Note: The $\chi^2_{(2)}$ statistic is used to test for serial correlation of the residuals.

The estimated ECM reported in Table 4 does not exhibit the serial correlation up to 2 lags because the null hypothesis of no serial correlation is not rejected at the 5% level of significance. The results of causality tests suggested by Granger (1988) show that 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 = 1.652 with p-value = 0.206, which

leads to an acceptance of the null hypothesis of no short-run causality running from tourism receipts to economic growth. Moreover, the coefficient of the error correction term ($\hat{e}_{t-1}$) has the correct sign with the absolute value of less than one but is not statistically significant. This evidence indicates the absence of long-run causality running from tourism receipts is to real GDP, i.e., the F statistic = 1.585 with p-value = 0.215 leads to acceptance of no long-run causality. Because of the evidence of an unstable long-run equilibrium relationship, it is necessary to examine the possibility of nonlinear cointegration between tourism receipts and real GDP using alternative approaches, both the TAR and the MTAR models as mentioned in the previous section. This is due to the fact that the tourism-growth nexus can be complex and nonlinear in nature (Wang, 2012).

3.3 Nonlinear Cointegration Tests and Asymmetric Adjustment

The TAR and the MTAR models mentioned above can be used to test for nonlinear cointegration and asymmetric adjustment towards 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 models with endogenously determined thresholds are reported in Table 5.

Table 5
Estimated results of TAR and MTAR models, 2006Q1-2017Q4.

Parameters	Models	
	TAR	MTAR
ρ_1	-0.464 (0.207)	-0.348 (0.203)
ρ_2	-0.739 (0.224)	-0.877 (0.220)
κ	1	1
Threshold value	0.019	0.002
t-Max	-2,244 [-1.979]	-1.714 [-2.022]
Φ	7.068 [7.530]	8.739 [8.173]
F ($\rho_1=\rho_2$)	0.946 [5.892]	3.516 [8.031]

Note: Standard error is in parenthesis. κ is the number of lags of differenced residuals determined by SIC. The threshold values are endogenously determined. The numbers in the bracket are the 5% critical values. The critical values for the Φ statistic are determined by 1,000 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 rho coefficients of the upper and lower regimes in both the TAR and the MTAR models are negative and their absolute values are smaller than one. Recall that the negative values of these coefficients meet the requirement of necessary conditions for convergence if the absolute values of both coefficients are less than one. 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 by simulations suggested by Enders and Siklos (2001). The Φ statistic or the F-statistic for the null

hypothesis that $\rho_1=\rho_2=0$, leads to an acceptance of the null hypothesis of no cointegration at the 5% level in the TAR model. However, the largest t-statistic called t-Max statistic is greater than the 5% critical value. Even though the t-Max statistic 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 from the estimate of the TAR model because the Φ statistic is smaller than the 5% critical value. In addition, the test statistic for the null hypothesis that $\rho_1=\rho_2$ cannot be rejected. Therefore, asymmetric adjustment towards long-run equilibrium is not found under the TAR model. However, the estimated MTAR model gives more convincing results. The estimated coefficients, ρ_1 and ρ_2, are negative and take the absolute value of less than one. The results also indicate that the 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 for the MTAR model. 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 towards long-run equilibrium.

Since the presence of nonlinear cointegration without asymmetric adjustment is found by the estimated MTAR model, the estimates of TECMs from Eqs. (6) and (7) should be estimated to explore how different the short-run adjustments in the higher and lower regimes are. The results are reported in Table 6. The parsimonious ECMs obtained from the estimated MTAR model pass the first-order serial correlation test because the null hypothesis of no serial correlation is not rejected at the 5% level of significance.

Table 6
Results from the Estimates of ECMs from the MTAR Model.

	Higher regime	Lower regime
	Δgdp_t	Δgdp_t
$\hat{e}_{t-1}$	-0.962**	0.057
	(0.404)	(0.323)
Δgdp_{t-1}	-0.236	-0.465
	(0.233)	(0.212)
Δtr_{t-1}	0.074	0.124**
	(0.052)	(0.056)
Intercept	0.003	0.009
	(0.008)	(0.007)
Adjusted R^2	0.168	0.183
F-Statistic	4.019***	1.883*
$\chi^2_{(1)}$	1.799	3.267
	[p-value=0.180]	[p-value=0.071]
% of observations	43	57

Note: Standard error in parenthesis. ***, **and *indicates significance at the 1%, 5% and 10% levels, respectively. The statistic $\chi^2_{(1)}$ is used to test for first-order serial correlation.

The results in Table 6 show that the coefficient of the error correction term ($\hat{e}_{t-1}$) for the higher regime is statistically significant at the 5% level while this coefficient is insignificant for the lower regime. In addition, this coefficient has an incorrect sign in the lower regime. The results reveal that there will be no short-run adjustment to the long-run equilibrium in the lower regime, but the adjustment towards long-run equilibrium occurs in the higher regime. This evidence confirms the absence of asymmetric adjustment found in threshold cointegration analysis reported in Table 5. For the higher regime, any deviation from the long-run relationship will be corrected. Therefore, a stable long-run relationship between GDP and tourism receipts is observed only in the regime that is above the threshold value. Since the number of observations is 43% in the higher regime while the number of observations in the lower regime is 57%, the combined effects lead to the presence of an unstable long-run relationship reported in Table 3. In other words, there is a threshold effect in the data. Therefore, the symmetric ECM cannot detect a stable long-run relationship.

The estimated ECMs allow for both short-run and long-run causality (Granger, 1988). Using the Wald coefficient restrictions tests, the results show that there is long-run causality running from tourism receipts to real GDP in the higher regime only because the Wald F test gives the F-statistic = 5.684 with p-value = 0.022, which leads to a rejection of the null hypothesis at the 5% level of significance. For the lower regime, the Wald F-test gives the F-statistic = 0.031 with p-value = 0.860, which is not statistically significant. Therefore, there is no long-run causality running from tourism receipts to real GDP in the lower regime. In other words, the short-run adjustment towards long-run equilibrium occurs only when the lagged residuals are larger than the threshold value. In addition, the Wald F test for the coefficients of changes in tourism receipts in the higher regime gives the F-statistic = 1.429 with p-value = 0.160, and thus the test rejects the existence of the short-run causality running from tourism receipts to real GDP. However, there seems to be short-run causality running from tourism receipts to GDP in the lower regime because the Wald F = 4.810 with p-value = 0.034 leads to a rejection of the null hypothesis of no short-run causality at the 5% level of significance. It should be noted that the results of short-run dynamics from the MTAR model reported in Table 7 are different from the results reported in Table 5 because the ECM in Table 5 includes all observations while the ECMs reported in Table 7 are separated into the higher and lower regimes.

The main finding in this paper supports the validity of the tourism-led growth hypothesis under the threshold cointegration analysis for the MTAR model, which is contrary to the finding by Oh (2005) for South Korea, Lee (2008) for Singapore, and Katircioglue (2009) for Turkey. However, the finding is in line with other studies, such as those of Blaguer and Cantavellar-Jorda (2002) for Spain, Dritsakis (2004) for Greece, Carrera et al. (2008) for Mexico, Ertugrul and Mangir (2015) for Turkey, Brida et al. (2015) for Argentina and Brazil, and Brida et al. (2016) for Brazil.

The evidence on a nonlinear long-run relationship between tourism receipts and real GDP for Thailand is found without asymmetric adjustments toward the long-run equilibrium should be further clarified. Usually, asymmetric adjustments for two regimes imply that the

speed of adjustment in one regime should be faster than the speed of adjustment in the other regime. However, the finding in this paper shows that there is only one regime adjustment, i.e., the adjustment toward the long-run equilibrium occurs only in the higher regime. Therefore, the tourism receipts-GDP nexus in Thailand seems to have a threshold effect. The finding suggests that real tourism receipts can stimulate real GDP such that the Thai economy can benefit from the expansion of the tourism industry.

4. Conclusions

The validity of the tourism-led growth hypothesis has been widely explored by many researchers using different linear cointegration techniques. However, the long-run relationship between real GDP and tourism receipts that cannot be detected by linear cointegration tests 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 linearity 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 the residual-based cointegration test, which allows for an unknown structural shift. The results show the existence of the linear long-run relationship between real GDP and tourism receipts. However, the short-run dynamics suggest that the linear long-run relationship between tourism receipts and GDP is not stable. Since there might be a nonlinear long-run relationship between the two variables, nonlinear cointegration tests are also performed. One of the important findings from the 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 higher regime. In the sense of Granger causality, short-run causality running from tourism receipts is not found. However, there is long-run causality running from tourism receipts to real GDP when the lagged residuals are above the threshold value. Nevertheless, short-run causality is evidence in the lower regime when the lagged residual series is below the threshold level. The overall results give evidence indicating that the tourism-GDP nexus is nonlinear.

The policy implication based upon the results from this study is that sustainable development of tourism seems to be necessary since it can be one of the main factors affecting real GDP and thus the economic growth of the country in the long run. However, environmental preservation is also important.

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