Economics Bulletin

Volume 36, Issue 2

Dynamic relationship between tourism and economic growth in MERCOSUR countries: a nonlinear approach based on asymmetric time series models

Juan Gabriel Brida
Facultad de Ciencias Económicas y de Administración - Universidad de la República

Bibiana Lanzilotta
Facultad de Ciencias Económicas y de Administración - Universidad de la República

Fiorella Pizzolon
Facultad de Ciencias Económicas y de Administración - Universidad de la República

Abstract

Since 1995 the four MERCOSUR countries have gone through the path of economic integration; however, they have dissimilar situations in terms of economic growth and, particularly, in the degree of development of the tourism sector. Brida et al. (2015) analyzed the validity of the Tourism Led Growth Hypothesis (TLGH) for these countries and demonstrated that the relationship between tourism and economic growth is not linear for Argentina and Brazil. However, the authors did not specify the format of the nonlinearity. The present research moves in that direction and explores about the identity of these nonlinearities. The research is based on the methodology which combines the concepts of cointegration with the asymmetric adjustment thresholds. The results allow explaining the nonlinearity in the case of Brazil, which is modeled on the dynamics of the adjustment from transitory situations of disequilibrium between tourism and growth. It is shown that an M-TAR adjustment mechanism is which best describes this behavior.

A preliminary version of this paper was presented at the 6th Workshop "Tourism and Transport Economics: Tourists as Consumers, Visitors and Travelers", 16-18 September 2015, Guanajuato (Mexico).
Citation: Juan Gabriel Brida and Bibiana Lanzilotta and Fiorella Pizzolon, (2016) "Dynamic relationship between tourism and economic growth in MERCOSUR countries: a nonlinear approach based on asymmetric time series models", *Economics Bulletin*, Volume 36, Issue 2, pages 879-894
Contact: Juan Gabriel Brida - gbrida@ccee.edu.uy, Bibiana Lanzilotta - bibiana.lanzilotta@gmail.com, Fiorella Pizzolon - fiorella.pizzolon@gmail.com.
Submitted: March 14, 2016. **Published:** May 18, 2016.

1. Introduction

Tourism economic contribution has been widely studied in the literature and it is a subject of great interest from a policy perspective. Nowadays, there is a large consensus on the benefits that international tourism has on economic growth. The direct and indirect channels through which the positive effects of tourism on growth are transmitted are multiple; for example, by providing foreign exchange, by promoting the investments in infrastructure and human capital and by creating new jobs. Thus, tourism has an important role in increasing income and human capital, and in promoting efficiency and competitiveness (Blake et al., 2006). According to the World Tourism Organization (UNWTO, 2015), in 2014 international tourism created millions of jobs, accounting for one in 11 worldwide. At the same time, tourism promotes growth of physical capital and infrastructure expansion (construction of airports, ports, hotels and restaurants), which is a crucial condition for achieving competitiveness of tourism sector.

The tourism industry not only can increase foreign exchange income, but can also create employment opportunities. Tourism can be used to stimulate overall economic growth. Hence, the question of whether or not tourism can lead economic growth has become an important empirical issue. The tourism-led growth hypothesis (TLGH) is directly derived from the hypothesis that considers exports as a driver of economic growth. The "new theories of economic growth" (Balassa, 1978) suggest that both exports and tourism contribute positively to economic growth, either through improving the allocation of production factors, or by the expansion of resources. The TLGH aims to analyze the relationship between tourism and economic growth in both the short term and long term. The link may be of mutual determination or causality, from tourism to growth.

According to the recent review papers Castro-Nuño et al (2013), Pablo-Romero and Molina (2013) and Brida et al. (2016), there is strong empirical evidence in favor of the hypothesis of tourism driving economic growth in the long term. In the comprehensive review of the literature, they found that the TLGH was only rejected for the cases of Korea (Oh, 2005), Croatia (Payne and Mervar, 2010) and the United States (Tang and Jang, 2009). Despite of the broad support to the TLGH, the magnitude of the impulse and the direction of causality often change, preventing general conclusions. According to Brida and Pulina (2010), the most studied destinations are the Europeans (with a total of 18 articles), followed by Asia and the Pacific (11 articles) and American destinations (11 articles). In general, the studies focus on a single country, although there are some articles that analyze a group of economies (Holzner, 2011; Sequeira and Nunes, 2008; Po and Huang, 2008 and Lee and Chang, 2008).

Theoretical models that consider a causal relationship between economic growth and tourism are a recent phenomenon, and an issue that is still under-researched in the TLGH literature is the actual relationship between tourism specialization and economic growth. According to Po and Huang (2008), the linear models and the use of the Granger causality approach to investigate the causal relationship between tourism and economic growth in the TLGH literature led to three possible problems: (a) whether or not the yearly data were sufficient to represent the long-term relationship between the two; (b) the inability of the yearly data to eliminate the problems of short-term fluctuations due to business cycles and structural change; and (c) the failure to delineate countries with special features in terms of different causal relationships. Adamou and Clerides (2010) sustain that the model representing the relationship between tourism and economic growth may well be non-linear. Once a specialization threshold is reached, tourism may no longer contribute to growth, though it can still keep expanding as a sector. In a review of previous empirical studies about the relationship between tourism and economic growth, Brida et al. (2016) affirm that the assumption of a linear relationship between tourism growth and gross domestic product (GDP) growth, may lead to inaccurate inference. In fact, the possibility of nonlinearities in the TLGH has been generally ignored in the literature. Nevertheless, some studies introduced the nonlinearity hypothesis to explore the link between growth and tourism. For instance, Po and Huang (2008) and Chang et al. (2010) use cross sectional analysis to investigate a nonlinear relationship between tourism development and economic growth using a threshold variable (the degree of tourism specialization). Adamou and Clerides (2010) investigate the relationship between tourism specialization and economic growth allowing for a nonlinear relationship between them by including a squared term of the tourism variable in the regression. Moreover, a recent study applies the nonlinear time series analysis, developed by Enders and Siklos (2001), to the TLGH. Phiri (2015) examines cointegration and causal effects between tourism and economic growth in South Africa applying linear and nonlinear cointegration analysis. Regarding the nonlinear analysis, the author used four threshold models (TAR, c-TAR, M-TAR and c-M-TAR) and finds a bi-directional causality between tourist receipts and economic growth. Up to our knowledge, this is the only study that analyzes the TLGH applying the M-TAR nonlinear cointegration analysis; the majority of the Enders-Siklos applications are in the financial field.

Although the extensive literature that exists on the TLGH, articles that analyze the hypothesis for South American countries are scarce. It is worth noting the work of Brida and Risso (2009) and Gardella and Aguayo (2002) for Chile, Brida et al. (2009) for Colombia, Brida et al. (2010) for Uruguay and Brida et al. (2011) for the Brazilian economy. In a more general framework, Fayissa et al. (2011) investigate the impact of tourism on the economic growth for different Latin American countries by using panel data from 1990 to 2005. The paper shows that revenues from the tourism industry contribute positively to both the current level and the growth rate of the per capita GDP of the countries in the region, as do investments in physical and human capital. Similarly, Eugenio-Martin et al (2004) consider the relationship between tourism and economic growth for Latin American countries from 1985 to 1998, showing that the tourism sector increases economic growth of medium or low-income Latin American countries, though not necessarily for developed countries. In almost all of these cases, the methodology applied was a cointegration analysis, and causality (Granger causality) test. In general, the studies show the existence of a long-term equilibrium between GDP, tourism and real exchange rate.

More recently, Brida et al. (2015) applied a nonlinear methodology to test the TLGH. Based on the dissimilarities between MERCOSUR countries in term of economic structure, growth and tourism development, and their differences in the elasticity between tourism and economic, the authors analyzed the validity of the TLGH for the MERCOSUR countries. They concluded that the relationship between tourism and economic growth is not linear for Argentina and Brazil; however, they did not specify the format of the nonlinearity. The present research moves in that direction and explores about the identity of these nonlinearities. It is based on the methodology proposed by Enders and Siklos (2001), which combines the concepts of cointegration with the asymmetric adjustment thresholds. The results allow explaining the nonlinearity for Brazilian economy, which is modeled on the dynamics of the adjustment from transitory situations of disequilibrium between tourism and growth. It is shown that an M-TAR adjustment mechanism is which best describes this behavior.

The paper is organized as follows. The next section describes the empirical methodology. Section 3 presents the data and the results. Finally, conclusions are included in Section 4.

2. Empirical methodology

An important development in recent time series literature is the examination of nonlinear adjustment mechanism, and particularly, its extension to a multivariate context. Enders and Siklos (2001) developed a test for cointegration with asymmetric error correction. It consists on an extension to Engle-Granger testing strategy, permitting asymmetry in the adjustment toward equilibrium. They also demonstrate that under asymmetric departures from equilibrium, the Enders-Siklos test has better power and size properties over the Engle-Granger test.

Enders and Siklos generalized the Enders and Granger (1998) threshold autoregressive (TAR) and momentum-TAR (M-TAR) to a multivariate context. The basic TAR model allows the degree of autoregressive decay to depend on the state of the variable of interest. The M-TAR model allows a variable to display differing amounts of autoregressive decay depending on whether it is increasing or decreasing.

In contrast, the Engle-Granger (1987) and Johansen (1996) tests implicitly assume a linear adjustment mechanism. The point is that these cointegration tests and their extensions are miss-specified if the adjustment is asymmetric.

The basic threshold cointegration model can be easily explained by the following sequence.

a) Simple linear relation:

$$\Delta x_t = \pi x_{t-1} + v_t \tag{1}$$

where x_t is an (nx1) vector of random variables all integrated of degree 1, π is an (nxn) matrix, and v_t is an (nx1) vector of the normally distributed disturbances v_{it} that may be contemporaneously correlated.

b) Long run equilibrium relationship:

$$x_{1t} = \beta_0 + \beta_2 x_{2t} + \beta_3 x_{3t} + \cdots + \beta_n x_{nt} + \mu_t \tag{2}$$

where x_{it} are individual I(1) components of x_t, β_i are the estimated parameters, and μ_t is the disturbance term that may be serially correlated.

c) Modified second step of the Engle-Granger model:

$$\Delta\mu_t = I_t \rho_1 \mu_{t-1} + (1 - I_t)\rho_2 \mu_{t-1} + \varepsilon_t \tag{3}$$

where I_t is the Heaviside indicator function such that $I_t = \begin{cases} 1 \; if \; \mu_{t-1} \geq \tau \\ 0 \; if \; \mu_{t-1} < \tau \end{cases}$ and τ is the value of the threshold and $\{\varepsilon_t\}$ is a sequence of zero-mean, constant-variance iid random variables, such that ε_t is independent of $\mu_j, j < t$.

The necessary and sufficient conditions for the stationarity of $\{\mu_t\}$ is $\rho_1 < 0, \rho_2 < 0$ and $(1 + \rho_1)\,(1 + \rho_2) < 1$ (Petrucelli and Woolford, 1984). If these conditions are met, $\mu_t = 0$ can be considered the long-run equilibrium value of the system.

In general, the value of τ is unknown and needs to be estimated along with the values of ρ_1 and ρ_2. However, in a number of economic applications it seems natural to set $\tau = 0$, so that the cointegration vector coincides with the attractor.

Given the existence of a single cointegrating vector in the form of (2), the error correction model for any variable x_{it} can be written in the form:

$$\Delta x_{it} = \rho_{1.i} I_t \mu_{t-1} + \rho_{2.i}(1 - I_t)\mu_{t-1} + \cdots + v_{it} \tag{4}$$

where $\rho_{1.i}$ and $\rho_{2.i}$ are the speed of adjustment coefficients of Δx_{it}.

There are two important ways to modify the basic threshold cointegration model, described above. One way is to increase the order of equation (3), in order to better-capture the dynamic adjustment of $\Delta\mu_t$ toward its long-run equilibrium value.

Another alternative adjustment specification is to modify the Heaviside indicator function. Enders and Granger (1998) and Caner and Hansen (1998) suggested an alternative such that the threshold depends on the previous period´s change in μ_{t-1}:

$$M_t = \begin{cases} 1\ if\ \Delta\mu_{t-1} \geq \tau \\ 0\ if\ \Delta\mu_{t-1} < \tau \end{cases} \tag{5}$$

The M-TAR model is constructed using equations (2), (3) and (5). In this model, the $\{\mu_t\}$ series exhibits more "momentum" in one direction than in other. Note that it is also possible to use M_t in a dynamic model augmented by lagged changes in $\Delta\mu_t$.

In order to test for cointegration with TAR and M-TAR adjustment Enders and Siklos (2001) propose two *t* statistics for the null hypothesis $\rho_1 = 0$ and $\rho_2 = 0$ along with the F statistic for the joint hypothesis $\rho_1 = \rho_2 = 0$.

The largest of the individual *t* statistics is called t-Max, the smallest is called t-Min, and the F statistic is called Φ (Enders and Siklos). As Enders and Siklos (2001) stated, the necessary conditions for convergence are for ρ_1 and ρ_2 to be negative; t-Max statistic is a direct test of these conditions.

The Φ statistic is quite useful because it can have substantially more power than the t-Max statistic. But it can lead to a rejection of the null hypothesis of $\rho_1 = \rho_2 = 0$ when only one of the values is negative. So it should be used only in those cases in which the point estimates for ρ_1 and ρ_2 imply convergence. The t-Min statistic was found to have very little power, so it is not reported here.

3. Data and results

This paper explores about the identity of the nonlinearities present in the relationship between tourism and economic growth for two of the MERCOSUR countries: Argentina and Brazil.

The variables used in this paper are the same of Brida et al. (2015) and have the same sample. We use the variation of per capita gross domestic product (GDP) to measure economic growth, and we use tourist expenditure to measure tourism demand. We use quarterly data of per capita GDP in constant term and tourist expenditure -also in constant terms (from Balance Payments statistics). The description of all the variables and the sources of the data are presented in Table 1.

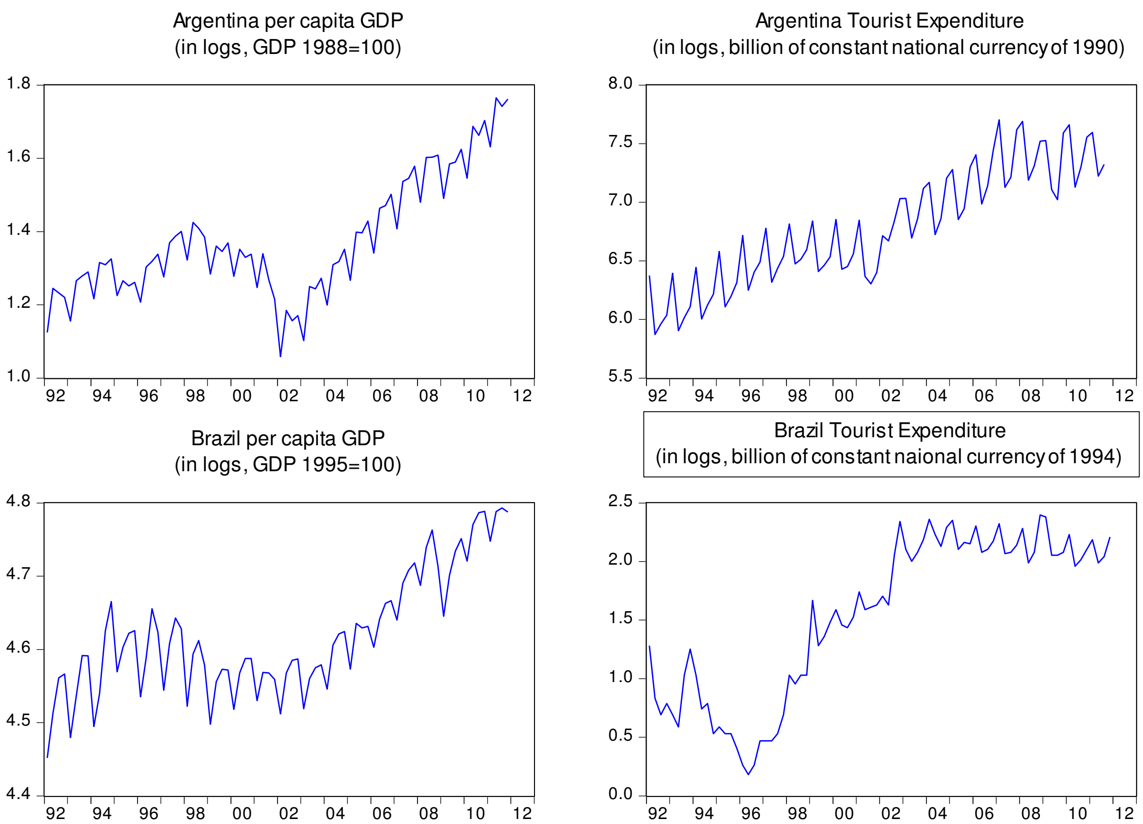
Table 1. Data: description and sources

Variables	Description	Source
Argentina		
GDP	Real per capita GDP respect to total population	INDEC
TE	International travel revenues at constant prices (from Balance of Payments)	INDEC
Brazil		
GDP	Real per capita GDP respect to total population	IPEA
TE	International travel revenues at constant prices (from Balance of Payments)	IPEA

INDEC: Instituto Nacional de Estadísticas y Censos; BCRA: Banco Central de la República Argentina; IPEA: Instituto de Pesquisa Econômica Aplicada; BCB: Banco Central do Brasil.

As it is shown in Brida et al. (2015), the series considered in this paper (Figure 1) are non stationary.

Figure 1. Argentina and Brazil: Per capita GDP and Tourist Expenditure



Sources: INDEC, BCRA, IPEA, BCB.

Unit root tests are reported in Table 2. According to Brida et al. (2015), the long-run relationship between tourism and economic growth may have some kind of non-linearity, at least for the major economies of Mercosur countries. Here, following Enders and Siklos (2001), we test two specifications to model these nonlinearities. We estimate two versions of cointegration with threshold adjustment models, a TAR model and an M-TAR model.

Table 2. Unit root tests

2.1 ADF and KPSS results

Country	Variable	Test specification	ADF	KPSS	Lags	Band Width
Argentina	LGDP	Trend and constant	-1.11	0.23***	5	6
	LTE	Trend and constant	-2.19	0.08	14	5
	Δ(Ln GDP)	Constant	-3.54***	0.15	4	14
	Δ(Ln TE)	Constant	-3.30**	0.09	12	13
Brazil	LGDP	Trend and constant	-0.82	0.26***	9	6
	LTE	Trend and constant	-2.93	0.15**	8	6
	Δ(Ln GDP)	Constant	-2.92**	0.19	9	14
	Δ(Ln TE)	No const, no trend	-4.48***	-	3	-

Note: LGDP: Logs of Per capita GDP, LTE: Logs of Tourism expenditure.

Source: Brida et al. (2015).

2.2 Non-parametric unit root test results

		Variables	No deterministic	Mean Adjusted	Trend Adjusted
Argentina	Level	GDP	0.31247	0.05048	0.01330
		Tourism	0.31997	0.08119	0.0015***
	First difference	GDP	0.00244***	0.00063***	0.00044***
		Tourism	0.00081***	0.00020***	0.00013***
Brazil	Level	GDP	0.33612	0.05106	0.01184
		Tourism	0.20537	0.08435	0.00950
	First difference	GDP	0.0024***	0.00040***	0.00037***
		Tourism	0.00252***	0.00133***	0.00126***

Source: Brida et al. (2015).

Following the Engle-Granger methodology (Engle and Granger, 1987), the estimated long-run equilibrium relationships (with standard deviation in parentheses) between tourism expenditure and per capita GDP for Argentina and Brazil are:

$$gdp_{arg_t} = \underset{(0.029)}{0.195} * te_{arg_t} + \underset{(0.1973)}{0.047} + \hat{\mu}_{\mathrm{arg}_t} \tag{6}$$

$$gdp_{bra_t} = \underset{(0.008)}{0.020} * te_{bra_t} + \underset{(0.013)}{4.589} + \hat{\mu}_{\mathrm{bra}_t} \tag{7}$$

where gdp_i is the logarithmic per capita GDP and te_i is the logarithmic tourist expenditure, with i=Argentina, Brazil.

Residuals of (6) and (7) were used to estimate a model of the form:

$$\Delta\hat{\mu}_{it} = \rho_1\hat{\mu}_{it-1} + \sum_{j-1}^{p}\gamma_{ij}\Delta\hat{\mu}_{it-j} + \varepsilon_{it} \tag{8}$$

The results are shown in the first two columns of Table 3. The *t* statistics of the coefficients of $\hat{\mu}_{it-1}$show that the significance is weak in the case of Argentina and that is clearly not-significant in the case of Brazil.

Table 3. Estimates of the short-run adjustment between tourist expenditure and per capita GDP, Argentina and Brazil (sample: 1990.01-2011.04, quarterly)

	E&G		Threshold (τ=0)		Threshold (τ est.)		Momentum (τ=0)		Momentum (τ est.)	
	Argentina (1)	Brazil (2)	Argentina (3)	Brazil (4)	Argentina (5)	Brazil (6)	Argentina (7)	Brazil (8)	Argentina (9)	Brazil (10)
ρ_1[a]	-0.055	-0.022	-0.638	-0.845	-0.829	-0.859	-0.612	-0.859	-0.719	-1.354
	(0.033)	(0.038)	(0.267)	(0.275)	(0.284)	(0.269)	(0.259)	(0.266)	(0.262)	(0.328)
ρ_2[a]	NA	NA	-0.486	-0.658	-0.442	-0.616	-0.489	-0.574	-0.413	-0.780
			(0.243)	(0.266)	(0.231)	(0.270)	(0.248)	(0.277)	(0.246)	(0.245)
τ[b]	NA	NA	0	0	0.024	-0.020	0	0	0.020	0.026
J	4	4	4	4	4	4	4	4	4	4
Φ[c]	NA	NA	3.106	4.730	4.302	5.091	3.026	5.311	3.780	7.949
$\rho_1=\rho_2$[d]	NA	NA	0.435	0.989	2.639	1.649	0.288	2.051	1.677	8.541
t-Max[e]	NA	NA	-2.002	-2.469	-1.908	-2.282	-1.972	-2.073	-1.680	-3.187

a. Estimated value of ρ_i with the standard deviation in parentheses,
b. τ: threshold value.
c. Sample values of ϕ, ϕ (M). Significant values in gray.
d. Sample F statistic for the joint hypothesis $\rho_1= \rho_2$. Significant values in gray.
e. t-Max y t-Max(*M*). Significant values in gray.
c.d.e. Simulated critical values for 10% significance level. Monte Carlo simulations: 1000.

Next, we estimated the residuals of equations (6) and (7) on the form of a TAR model with τ=0 (columns 3-4), a TAR model with τ estimated by data (columns 5-6 of Table 3), an M-TAR model with τ=0 (columns 7-8), and finally an M-TAR model with τ estimated by data (columns 9-10). For each estimated equation, we recorded the two *t* statistics for the null hypotheses $\rho_1 = 0$ and $\rho_2 = 0$ along with the *F* statistic for the joint hypothesis$\rho_1 = \rho_2 = 0$. The largest of the individual *t* statistics is called *t*-Max, the smallest is called *t*-Min, and the *F* statistic is called Φ. Recall that the necessary conditions for convergence are for ρ_1 and $\rho_2$to be negative; thus, the *t*-Max statistic is a direct test of these conditions. The Φ statistic can lead to a rejection of null hypothesis $\rho_1 = \rho_2 = 0$ when only one of the values is negative. However, as Enders and Siklos (2001) shown, the Φ statistic is quite useful because it can have substantially more power than the *t*-Max statistic. Nevertheless, the Φ statistic should be used only in those cases in which the point estimates for ρ_1 and ρ_2 imply convergence. The *t*-Min statistic was found to have very little power and is not reported here. All the other results are shown in Table 3. Results indicate that in all cases convergence condition is met ($\rho_1<0$, $\rho_2<0$ and $(1+\rho_1)(1+\rho_2)<1$)[1]. Additionally, for all TAR and M-TAR estimated models the statistic t-Max is significant, at 10% significance level. Nevertheless, as was explained in the previous section, this statistic has low power. Moreover, the Φ statistic is significant only for the estimates of M-TAR models for Brazil, both when τ (threshold) is imposed to be 0 and in the case when τ is estimated by the data. However, only in the last model, F statistic indicates that the null hypothesis of $\rho_1=\rho_2$ is rejected. So, strictly, only in this model the asymmetric adjustment take place. Therefore, the results show that in the case of Brazil there is cointegration between tourist expenditure and per capita GDP with asymmetric adjustment in the short run. Although Engle-Granger and TAR tests rejected the existence of cointegration, models that permit M-

[1] Condition for the stationarity of μ_t (Pettrucelli and Woolford, 1984).

TAR adjustment indicate that tourist expenditure and GDP are cointegrated. Therefore, for this country, TLGH is confirmed and the model can be written as:

$$\Delta\hat{\mu}_{brat} = -1.354 M_t \hat{\mu}_{brat-1} - 0.780(1 - M_t)\hat{\mu}_{brat-1} + \sum_{j-1}^{p} \gamma_{ij} \Delta\hat{\mu}_{brat-j} + \varepsilon_{brat}, \quad (9)$$

where

$$M_t = \begin{cases} 1 \; if \; \Delta\mu_{t-1} \geq 0.026 \\ 0 \; if \; \Delta\mu_{t-1} < 0.026 \end{cases}$$

Nevertheless in the case of Argentina, the evidence from the Engle-Granger test is weak in favor of cointegration. Additionally none of the non-linear models indicate the existence of a cointegration relationship. Appendix contains more details on the estimates of E&G, TAR and M-TAR models.

4. Final comments

This paper is based on the findings stated in Brida et al. (2015) and seeks to find the nonlinear way in the relationship between growth and tourism in the two largest MERCOSUR countries. Following Enders and Siklos (2001), cointegration models with asymmetric adjustment, cointegrated TAR models and cointegrated M-TAR models have been estimated. Results show that in the case of Brazil, a cointegrated M-TAR model is an appropriate way to model the non-linearity in this relationship. It is not the same case for Argentina, where none of these models seems to be appropriated to interpret the non-linearity present between tourism and economic growth. To conclude, following the results of Brida et al. (2015) concerning the nonlinear relationship between tourism and economic growth for Argentina and Brazil, this paper adds a way to specify the format of the nonlinearity in the case of Brazil by a cointegrated M-TAR model. However, no cointegrated TAR model or M-TAR model was found to appropriately model the nonlinearity in the case of Argentina. The results found in this paper are consistent with the previous ones. Yet, further research with specifications that introduces extra threshold variables or multi-equation models may provide more light on this topic.

References

Adamou, A., & Clerides, S. (2010). "Prospects and Limits of Tourism-Led Growth: The International Evidence". *Review of Economic Analysis* 3, 287–303.

Balassa, B. (1978), "Exports and economic growth: Further evidence". *Journal of Development Economics* 5: 181-189.

Blake, A.; Sinclair, T.M., and Campos Soria, J.A. (2006), "Tourism productivity. Evidence from the United Kingdom". *Annals of Tourism Research*, Vol. 33, No 4, p. 1099-1120.

Brida, J.G., and Risso, W.A. (2009), "Tourism as a factor of long-run economic growth: An empirical analysis for Chile". *European Journal of Tourism Research* 2(2): 178-185.

Brida, J.G., Pereyra, S.J., Risso, W.A., Such Devesa M.J. and Zapata Aguirrre S. (2009), "The tourism-led growth hypothesis: empirical evidence from Colombia". *Tourism: An International Multidisciplinary Journal of Tourism* 4(2): 13-27.

Brida, J.G., Lanzilotta, B., Lionetti, S. and Risso, W.A. (2010), "The tourism-led-growth hypothesis for Uruguay". *Tourism Economics* 16(3): 765-771.

Brida, J.G., and Pulina, M. (2010), "A literature review on the tourism-led-growth hypothesis," *Working Paper CRENoS 201017, Centre for North South Economic Research, University of Cagliari and Sassari, Sardinia.*

Brida, J.G.; Punzo, L. and Risso, W.A. (2011), "Tourism as a factor of growth-the case of Brazil". *Tourism Economics* 17(6): 1375 1386.

Brida, J.G.; Lanzilotta, B.; Pereyra, J. S. and Pizzolon, F. (2015), "A nonlinear approach to the tourism-led growth hypothesis: the case of the MERCOSUR". *Current Issues in Tourism*, 18 (7) pp. 647-666.

Brida, J.G., Cortes-Jiménez, I. and Pulina, M. (2016), "Has the TLGH been validated? A literature review". *Current Issues in Tourism* 19(5): 394-430.

Caner, M. and Hansen, B. (1998), “Threshold Autoregression With a Near Unit Root”. Working Paper, University of Wisconsin, Department of Economics.

Castro-Nuño, M., Molina-Toucedo, J. A., & Pablo-Romero, M. P. (2013), "Tourism and GDP: A Meta-analysis of Panel Data Studies". *Journal of Travel Research* 52(6): 745-758.

Chang, C.-L., Khamkaew, T. and McAleer, M. (2010), "A Panel Threshold Model of Tourism Specialization and Economic Development". *International Journal of Intelligent Technologies and Applied Statistics* 3(2): 159 – 186.

Enders, W. and Granger, C. (1998), "Unit-Root Test and Asymmetric Adjustment With an Example Using the Term Structure of Interest Rates", *Journal of Business Economic Statistics*, Vol. 16, p. 304-311.

Enders, W. and Siklos, P. (2001), "Cointegration and Thrshold Adjustment". *Journal of Business & Economic Statistics*, Vol. 19, p. 166-176.

Engle, R. and Granger, C. (1987), "Cointegration and Error Correction: Representation, Estimation and Testing". *Econometrica*, 55, 251-257.

Eugenio-Martin, J.L. , Martín Morales, N. and Scarpa, R. (2004), "Tourism and Economic Growth in Latin American Countries: A Panel Data Approach". FEEM Working Paper No. 26. 2004. Available at SSRN: http://ssrn.com/abstract=504482 or http://dx.doi.org/10.2139/ssrn.504482. (Accessed 02.04.20013)

Fayissa, B., Nsiah, C. and Tadesse, B. (2011), "Tourism and economic growth in Latin American countries – further empirical evidence". *Tourism Economics* 17(6): 1365–1373.

Gardella, R. and Aguayo, E. (2002), "Impacto económico del turismo en el Mercosur y Chile (1990-2000)". *Estudios Económicos de Desarrollo Internacional* 2(1): 27-49.

Holzner, M. (2011), "Tourism and economic development: The beach disease?" *Tourism Management* 32: 922 - 933.

Johansen, S. (1996), “Likelihood-based Inference in Cointegrated Vector Autoregressive Models” *Oxford University Press, Oxford.*

Lee, C.-C., and Chang, C-P. (2008), "Tourism development and economic growth: closer look to panels". *Tourism Management* 29: 180-192.

Oh, C-O (2005), "The contribution of tourism development to economic growth in the Korean economy". *Tourism Management* 26: 39-44.

Pablo-Romero, M. D. P., & Molina, J. A. (2013), "Tourism and economic growth: A review of empirical literature". *Tourism Management Perspectives* 8, 28-41.

Payne, J. and Mervar, A. (2010), "The tourism–growth nexus in Croatia". *Tourism Economics* 16(4):1089–1094.

Pettrucelli, J. and Wollford, S. (1984), A Threshold AR(1) Model. *Journal of Applied Probability* 21, 270-286.

Phiri, A. (2015), "Tourism and economic growth in South Africa: Evidence from linear and nonlinear cointegration frameworks". *MPRA Paper* No. 65000.

Po, W. and Huang, B. (2008), "Tourism development and economic growth – a nonlinear approach". Physica A 387: 5535–5542.

Sequeira, T. N. and Nunes, P. M. (2008), "Does tourism influence economic growth? A dynamic panel data approach". *Applied Economics* 40: 2431–2441.

Tang, H.C-H. and Jang, S.S. (2009), "The tourism-economy causality in the United Stastes: A sub-industry level examination". *Tourism Management* 30: 553-558.

UNTWO (2015), "UNTWO Annual Report 2014 ", http://dtxtq4w60xqpw.cloudfront.net/sites/all/files/pdf/unwto_annual_report_2014.pdf .

Appendix: Estimates: E&G, TAR and M-TAR models

Argentina

Dependent Variable: D(RES_ARG)
Method: Least Squares
Sample (adjusted): 1993Q2 2011Q3
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RES_ARG(-1)	-0.054805	0.033337	-1.643959	0.1052
D(RES_ARG(-1))	0.272169	0.115764	2.351071	0.0219
D(RES_ARG(-2))	-0.067806	0.123508	-0.549002	0.5849
D(RES_ARG(-3))	0.247513	0.117708	2.102771	0.0395
D(RES_ARG(-4))	0.165689	0.118036	1.403714	0.1653
D(SEAS1)	-0.112913	0.017504	-6.450842	0.0000
D(SEAS2)	0.075828	0.017582	4.312845	0.0001
D(SEAS3)	0.003621	0.018205	0.198888	0.8430
D(FE>=200201)	-0.080466	0.026213	-3.069735	0.0032
D(FE=200301)	0.046009	0.022079	2.083841	0.0412
D(FE=200302)	0.040769	0.022250	1.832313	0.0716

R-squared	0.962655	Mean dependent var	0.005467
Adjusted R-squared	0.956727	S.D. dependent var	0.119975
S.E. of regression	0.024957	Akaike info criterion	-4.406918
Sum squared resid	0.039241	Schwarz criterion	-4.064422
Log likelihood	174.0560	Hannan-Quinn criter.	-4.270292
Durbin-Watson stat	2.198378		

Endogenous variables:
D(RES_ARG) RES_ARG(-1)
Exogenous variable(s): D(SEAS1) D(SEAS2) D(SEAS3) D(FE>=200201) D(FE=200301) D(FE=200302)
Method: Threshold (tau is defined by user)
Lags (defined by user): 4
Sample (adjusted): 1993Q3 2011Q3
Included observations: 73 after adjustments

Variable	Coefficient	Std. Error
Above Threshold	-0.637897	0.267347
Below Threshold	-0.486028	0.242786
Differenced Residuals(t-1)	-0.355782	0.222347
Differenced Residuals(t-2)	-0.496137	0.204098
Differenced Residuals(t-3)	-0.249057	0.168423
Differenced Residuals(t-4)	-0.071051	0.125035
Threshold value (tau):	0.000000	
F-equal:	0.435474	(2.447140)*
T-max value:	-2.001876	(-1.888960)*
F-joint (Phi):	3.106151	(4.891551)*

**Simulated critical values for 10% significance level.*

Number of simulations: 1000

Endogenous variables:
D(RES_ARG) RES_ARG(-1)
Exogenous variable(s): D(SEAS1) D(SEAS2) D(SEAS3) D(FE>=200201) D(FE=200301) D(FE=200302)
Method: Threshold (tau is determined by data)
Lags (defined by user): 4
Sample (adjusted): 1993Q3 2011Q3
Included observations: 73 after adjustments

Variable	Coefficient	Std. Error
Above Threshold	-0.829548	0.283739
Below Threshold	-0.441703	0.231458
Differenced Residuals(t-1)	-0.341020	0.218663
Differenced Residuals(t-2)	-0.496493	0.200180
Differenced Residuals(t-3)	-0.262404	0.165623
Differenced Residuals(t-4)	-0.074887	0.123061
Threshold value (tau):	0.023536	
F-equal:	2.638708	(5.340442)*
T-max value:	-1.908346	(-1.650069)*
F-joint (Phi):	4.302137	(5.918847)*

**Simulated critical values for 10% significance level.*
Number of simulations: 1000

Endogenous variables:
D(RES_ARG) RES_ARG(-1)
Exogenous variable(s): D(SEAS1) D(SEAS2) D(SEAS3) D(FE>=200201) D(FE=200301) D(FE=200302)
Method: Momentum (tau is defined by user)
Lags (defined by user): 4
Sample (adjusted): 1993Q3 2011Q3
Included observations: 73 after adjustments

Variable	Coefficient	Std. Error
Above Threshold	-0.612354	0.259927
Below Threshold	-0.489577	0.248240
Differenced Residuals(t-1)	-0.365525	0.221854
Differenced Residuals(t-2)	-0.503363	0.203707
Differenced Residuals(t-3)	-0.254635	0.168416
Differenced Residuals(t-4)	-0.069182	0.125142
Threshold value (tau):	0.000000	
F-equal:	0.288024	(2.601040)*
T-max value:	-1.972191	(-1.727143)*
F-joint (Phi):	3.026110	(5.334770)*

**Simulated critical values for 10% significance level.*
Number of simulations: 1000

Endogenous variables:
D(RES_ARG) RES_ARG(-1)
Exogenous variable(s): D(SEAS1) D(SEAS2) D(SEAS3) D(FE>=200201)
D(FE=200301) D(FE=200302)
Method: Momentum (tau is determined by data)
Lags (defined by user): 4
Sample (adjusted): 1993Q3 2011Q3
Included observations: 73 after adjustments

Variable	Coefficient	Std. Error
Above Threshold	-0.718516	0.261658
Below Threshold	-0.413290	0.245949
Differenced Residuals(t-1)	-0.388965	0.220135
Differenced Residuals(t-2)	-0.535693	0.202576
Differenced Residuals(t-3)	-0.280801	0.167950
Differenced Residuals(t-4)	-0.071514	0.123882
Threshold value (tau):	0.020234	
F-equal:	1.676822	(6.695404)*
T-max value:	-1.680389	(-1.379663)*
F-joint (Phi):	3.779994	(6.915877)*

*Simulated critical values for 10% significance level.
Number of simulations: 1000

Brazil

Dependent Variable: D(RES_BRA)
Method: Least Squares
Included observations: 95 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RES_BRA(-1)	-0.021626	0.038418	-0.562897	0.5750
D(RES_BRA(-1))	-0.107382	0.100933	-1.063890	0.2904
D(RES_BRA(-2))	-0.215865	0.098683	-2.187457	0.0315
D(RES_BRA(-3))	-0.205550	0.092445	-2.223472	0.0288
D(RES_BRA(-4))	0.257477	0.094967	2.711240	0.0081
D(SEAS1)	-0.029137	0.005550	-5.250377	0.0000
D(SEAS2)	0.008823	0.005501	1.603884	0.1124
D(SEAS3)	0.014598	0.005600	2.606797	0.0108
D(FE>=199002)	-0.101067	0.023751	-4.255356	0.0001
D(FE>=199403)	0.051024	0.022839	2.234092	0.0281

R-squared	0.840675	Mean dependent var	0.001393
Adjusted R-squared	0.823805	S.D. dependent var	0.052813
S.E. of regression	0.022168	Akaike info criterion	-4.680990
Sum squared resid	0.041773	Schwarz criterion	-4.412161

Log likelihood	232.3470	Hannan-Quinn criter.	-4.572363
Durbin-Watson stat	1.931521		

Endogenous variables: D(RES_BRA)
RES_BRA(-1)
Exogenous variable(s): D(SEAS1) D(SEAS2) D(SEAS3) D(FE>=199002)
D(FE>=199403)
Method: Threshold (tau is defined by user)
Lags (defined by user): 4
Sample (adjusted): 1988Q3 2011Q4
Included observations: 94 after adjustments

Variable	Coefficient	Std. Error
Above Threshold	-0.845039	0.275430
Below Threshold	-0.657824	0.266377
Differenced Residuals(t-1)	-0.321283	0.232873
Differenced Residuals(t-2)	-0.468651	0.188211
Differenced Residuals(t-3)	-0.549879	0.141841
Differenced Residuals(t-4)	-0.230913	0.099493
Threshold value (tau):	0.000000	
F-equal:	0.988962	(2.428457)*
T-max value:	-2.469523	(-1.944148)*
F-joint (Phi):	4.729883	(5.158371)*

**Simulated critical values for 10% significance level.*
Number of simulations: 1000

Endogenous variables: D(RES_BRA)
RES_BRA(-1)
Exogenous variable(s): D(SEAS1) D(SEAS2) D(SEAS3) D(FE>=199002)
D(FE>=199403)
Method: Threshold (tau is determined by data)
Lags (defined by user): 4
Sample (adjusted): 1988Q3 2011Q4
Included observations: 94 after adjustments

Variable	Coefficient	Std. Error
Above Threshold	-0.858564	0.269538
Below Threshold	-0.616404	0.270077
Differenced Residuals(t-1)	-0.322069	0.231375
Differenced Residuals(t-2)	-0.472119	0.186390
Differenced Residuals(t-3)	-0.550614	0.140514
Differenced Residuals(t-4)	-0.233203	0.098531
Threshold value (tau):	-0.020471	
F-equal:	1.649057	(5.624972)*
T-max value:	-2.282323	(-1.670957)*
F-joint (Phi):	5.091348	(5.842750)*

**Simulated critical values for 10% significance level.*
Number of simulations: 1000

Endogenous variables: D(RES_BRA)
RES_BRA(-1)
Exogenous variable(s): D(SEAS1) D(SEAS2) D(SEAS3) D(FE>=199002)
D(FE>=199403)
Method: Momentum (tau is defined by user)
Lags (defined by user): 4
Sample (adjusted): 1988Q3 2011Q4
Included observations: 94 after adjustments

Variable	Coefficient	Std. Error
Above Threshold	-0.858594	0.265813
Below Threshold	-0.574438	0.277025
Differenced Residuals(t-1)	-0.328973	0.230377
Differenced Residuals(t-2)	-0.450542	0.187775
Differenced Residuals(t-3)	-0.539451	0.141070
Differenced Residuals(t-4)	-0.220808	0.099339
Threshold value (tau):	0.000000	
F-equal:	2.050592	(2.720225)*
T-max value:	-2.073597	(-1.743767)*
F-joint (Phi):	5.311226	(5.147267)*

**Simulated critical values for 10% significance level.*
Number of simulations: 1000

Endogenous variables: D(RES_BRA)
RES_BRA(-1)
Exogenous variable(s): D(SEAS1) D(SEAS2) D(SEAS3) D(FE>=199002)
D(FE>=199403)
Method: Momentum (tau is determined by data)
Lags (defined by user): 4
Sample (adjusted): 1988Q3 2011Q4
Included observations: 94 after adjustments

Variable	Coefficient	Std. Error
Above Threshold	-1.354607	0.327824
Below Threshold	-0.780064	0.244800
Differenced Residuals(t-1)	-0.104989	0.238851
Differenced Residuals(t-2)	-0.325017	0.189274
Differenced Residuals(t-3)	-0.438422	0.142967
Differenced Residuals(t-4)	-0.165230	0.098964
Threshold value (tau):	0.026340	
F-equal:	7.948667	(6.500172)*
T-max value:	-3.186530	(-1.467748)*
F-joint (Phi):	8.540981	(6.874985)*

**Simulated critical values for 10% significance level.*
Number of simulations: 1000