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Empirical assessment of the tourism-led growth hypothesis: the case of the "Tirol-Südtirol-Trentino" Europaregion

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Abstract. The use of cointegration tests has become very popular in the empirical analysis of the tourism-led growth hypothesis (TLGH). It was first introduced in the tourism economics literature by Balaguer and Cantavella-Jordà (2002) and then popularized by many researches which tried to assess the causal long-run relationship between international tourism and economic growth. The vast majority of these studies analyzed countries where tourism is one of the most important sector of the national economy and, in most cases, the TLGH has been validated. With respect to previous contributions to the literature, this paper investigates the TLGH for subnational transfrontier economies, namely the three administrative areas forming the "Tirol-Südtirol-Trentino" Europaregion. The direct comparison amongst the results for across-the-border regions which have a similar international tourism market provides new insights in the understanding of tourism-led growth hypothesis.

Some key words and phrases: economic growth; tourism development; Johansen cointegration test; Granger causality.

1. Introduction

On the basis of the widely accepted theoretical arguments which support the so-called *export-led growth hypothesis* (ELGH) (see e.g. Balassa, 1985 and Bhagwati, 1988), and according to the idea that international tourism may be regarded as a form of invisible export, Balaguer and Cantavella-Jordà (2002) formulated the *tourism-led growth hypothesis* (TLGH). This stylized fact states "*the existence of various arguments for which tourism would become a main determinant of overall long-run economic growth*" (Balaguer and Cantavella-Jordà, 2002). In its original formulation, the TLGH was supported by three main general arguments. The first refers to the fact that international tourism may significantly contribute to the financial resources that allow an economy to import more than to export (McKinnon, 1964). Secondly, international tourism may make the local tourist firms more efficient because of the competition with their counterparts operating in other international tourist areas (Bhagwati and Srinivasan, 1979; Krueger, 1980). In third place, the expansion of tourism sector could increase the opportunities for local tourist firms to exploit economies of scale (Helpman and Krugman, 1985).

In more recent theoretical developments, other justifications to the TLGH have also been suggested. One is that tourism may also have an important role in stimulating investments in new infrastructures and human capital. Physical capital functional to tourism activities such as airports, harbours, hotels and restaurants, can also positively affect productivity and trade (Sakai, 2009). Human capital is one of the most important production factor in tourism and then such economic sector can be an important source of creation of new employment. Furthermore, human capital includes knowledge, education and professional capabilities, that are factors which can boost efficiency and competitiveness (Blake et al., 2006). Another important justification relates to the propensity of tourism to stimulate other economic sectors by direct, indirect or induced effects. An increase of tourism expenditure can indeed produce an increase of the activities of the related industries, and the global variation will be greater than the injection of the initial expenditure (Spurr, 2009).

Enhanced by a growing interest in the economic literature in the role that tourism has on economic growth, within the last decade there has been a proliferation of empirical studies, primarily based on linear models for time series data, trying to validate the TLGH for many different economies. A comprehensive summary review of the findings of these studies can be found in Brida and Pulina (2010), where it is shown that TLGH has been validated in 7 out of 8 examined South American countries, 6 out of 8 European destinations, 8 out of 10 Asian and Pacific destinations and 2 out of 3 countries from Africa and Middle East. Most of these studies have used annual time series data at national level and have analyzed countries where tourism is one of the most important sector of the national economy.

In this paper we assess the TLGH for three across-the-border regions at NUTS-2 level between Italy and Austria, namely: Italian Trentino, Italian South Tirol and Austrian Tirol. These three neighboring subnational administrative units share some strongly similar cultural, social and economic characteristics and, above all, they have a common mountain-based tourism sector. Moreover, they stipulated an outline convention on transfrontier cooperation called “Tirol-Südtirol-Trentino Europaregion”.

The contribution of this paper to the extensive literature about TLGH lies in the fact that it is one of the few studies which analyzes subnational economies and, as far as we know, it is the first attempting to assess a direct comparison amongst transfrontier regions. We argue that further comprehension of the phenomena characterizing the TLGH can be gained by investigating the regional dimension since, contrarily to other economic sectors, tourism has an impact which is relatively stronger at the local, rather than national, scale (Sgro and Hazari, 1995).

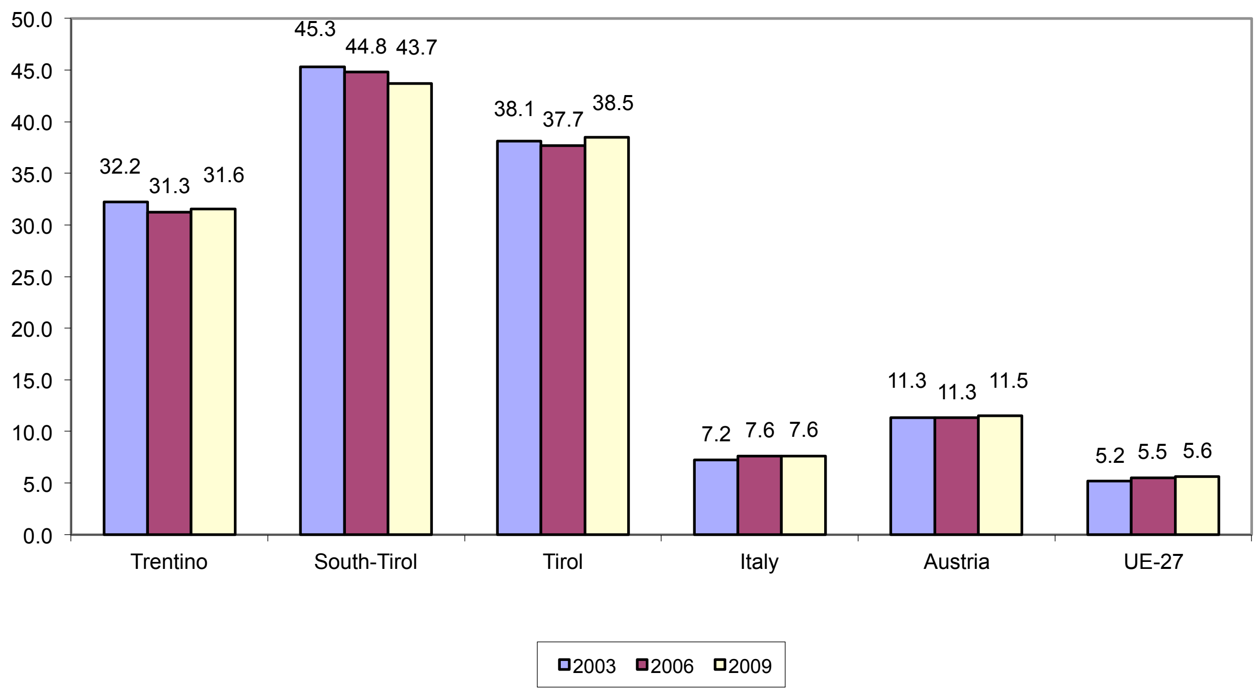
The structure of the paper is the following. In Section 2 we measure the relative size of the tourism market in the three regions of the “Tirol-Südtirol-Trentino” Europaregion and motivate the purpose of assessing the TLGH. Section 3 presents the econometric methodological framework we employ to empirically validate the TLGH. Section 4 will be devoted to show the empirical results for each of the three regions. Finally, Section 5 contains the discussion of the results and some concluding remarks and directions for future developments in this field.

2. The tourism sector in the “Tirol-Südtirol-Trentino” Europaregion

Validating the TLGH for the "Tirol-Südtirol-Trentino" Europaregion is relevant since, as we will show in this Section, the dimension of tourism sector in its three regions is relatively very large if compared with the corresponding national and international territorial contexts (namely Italy, Austria and European Union). To prove this assertion, we rely on the Eurostat's regional tourism database[1] about the number of bed-places and the nights spent by tourists in collective tourist accommodation establishments.

The quantitative entity of the supply side of a tourism market can be approximately measured by the number of tourist bed-places per inhabitant. The chart in Figure 1 shows that all the three administrative units that are parts of the "Tirol-Südtirol-Trentino" Europaregion are provided with a number of bed-places per 100 inhabitants which is considerably higher in comparison with their national and supranational territories. In 2009, for example, Trentino, South-Tirol and Tirol collect, respectively, about 32, 44 and 39 bed-places per 100 inhabitants; while Italy, Austria and European Union are provided with only about 8, 12 and 6 bed-places per 100 inhabitants, respectively.

Figure 1. Number of tourist bed-places per 100 inhabitants in the regions of "Tirol-Südtirol-Trentino" Europaregion and in Italy, Austria and European Union. Years 2003-2006-2009.

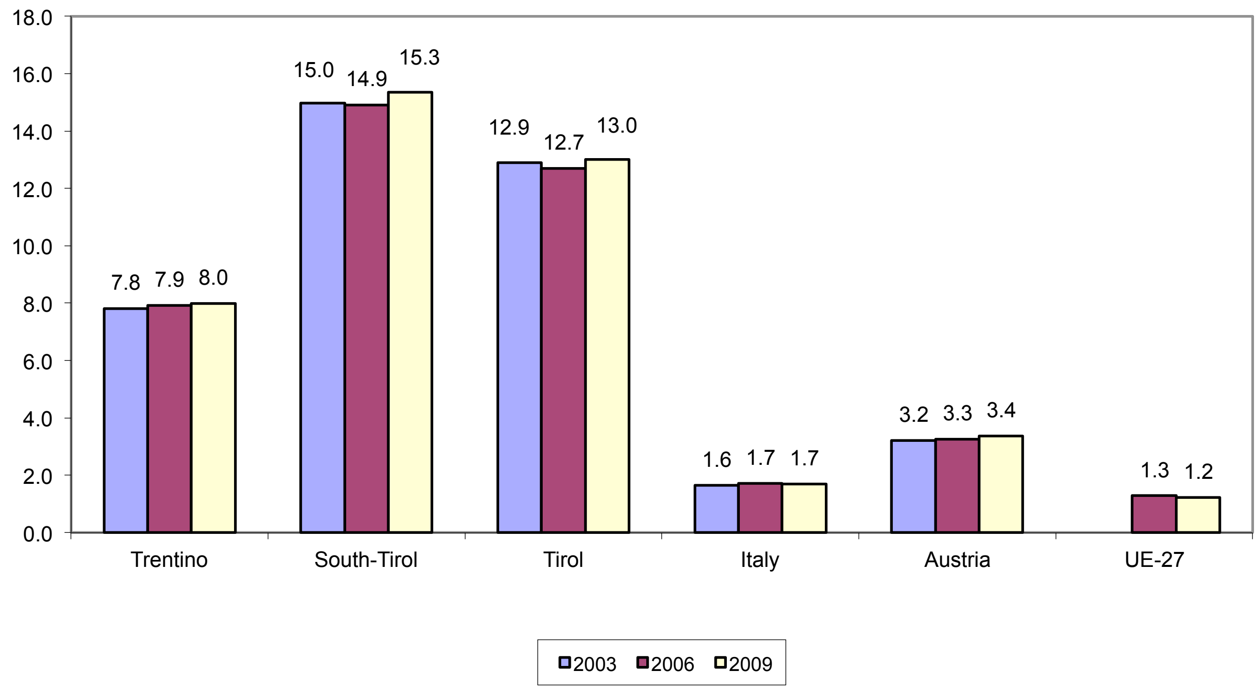


On the other hand, to measure the demand of tourism in the area we refer to the *tourist function rate* (Defert, 1967), given as the ratio between the tourist nights spent and the number of inhabitants multiplied by 365 (the days of the year). If this statistical measure is then multiplied by 100, it can be interpreted as the average number of tourists per 100 inhabitants residing in the area in the course of the year, and hence it allows to make comparisons between tourist flows within different territories. The values of the tourist function rate for the "Tirol-Südtirol-Trentino" Europaregion and for Italy, Austria and European Union are depicted in Figure 2, which shows that, even from the demand side of tourism market, the three transfrontier regions under study constitutes an area with a high tourist intensity. In 2009, for example, the tourist flows within Trentino, South-Tirol and Tirol

[1] http://epp.eurostat.ec.europa.eu

(with an annual average of about 8 to 15 tourists per 100 inhabitants) have been relatively more consistent than the ones within Italy, Austria and European Union (with an annual average of about 1 to 3 tourists per 100 inhabitants).

Figure 2. Tourist function rate for the regions of "Tirol-Südtirol-Trentino" Europaregion and for Italy, Austria and European Union. Years 2003-2006-2009.



It therefore emerges, from a temporal evolution perspective and in terms of territorial comparison, that the tourism sector of this interregional area can have a significant impact on the local economy and, according to the TLGH, may represent a potential strategic factor of growth. The validity of TLGH for the regions of South-Tirol, Tirol and Trentino will then be investigated in the next Section.

3. Validating the TLGH for "Tirol-Südtirol-Trentino" Europaregion

Validating empirically the TLGH, that is measuring the strength of the causation relationship from tourism activity to economic growth, is not straightforward. There is a methodological problem due to the fact that economic theory provides equally plausible justification even for the opposite causation, which implies that tourism cannot be assumed as an exogenous variable. In other words, the presence of statistically significant association between tourism and economic growth cannot be forthrightly interpreted as the existence of causality. To tackle this problem, in the literature it has become very popular to rely on the concept of Granger causality in the context of linear time series analysis (see, among many others, Balaguer and Cantavella-Jordà, 2002; Dritsakis, 2004; Nowak et al., 2007; Brida and Monterubbianesi, 2010). The same methodological approach is here followed to assess, individually, the impact of tourism sector on the growth of the local economies of South-Tyrol, Trentino and Tyrol.

3.1 Data

For all the three regions – South-Tyrol, Trentino and Tyrol respectively – data employed in this study are annual time series, from 1980 to 2009, of regional real gross domestic product (*GDP*), number of international tourists visiting the region (*T*) and the relative price index (*RP*) between the region and Germany. The first variable represents the economic growth occurred in the region, the second measures the volume of tourism activity and the third mimics a sort of virtual regional exchange rate which is included as a proxy variable of external competitiveness. Since, for all the three regions, tourists from Germany are relatively the most numerous amongst the foreign tourists, we use German tourist arrivals and *RP* between Germany and the region as indicators of international tourists and external competitiveness.
The time series for South-Tyrol and Trentino have been constructed using the data made available by the local official institute of statistics, respectively ASTAT and the Statistics Agency of the Province of Trento. For Tyrol, the source of data is Statistik Austria. Since the time series of the level of prices in Tyrol was not available we used, as a proxy, the level of prices in the whole Austria.

3.2 Methodological Framework

In order to detect causality between tourism and economic growth we refer to the methodological framework proposed by Granger (1988), which is based on a "weak" concept of causality (Granger, 1969). According to the perspective of Granger causality, it is stated that one variable causes a second variable if this second variable can be better predicted by using all available information on it and the past history of the first variable than without using the past history of the first variable. Therefore, this particular notion of causality relates with prediction and not necessarily with actual predetermination (Ahmad, 2001).
With the aim of applying this framework to our problem, we model the relationship amongst the three variables of interest – *GDP*, *T* and *RP* – by the means of a Vector Error Correction Model (VECM) specification:

$$\Delta Y_t = \mu + \Pi Y_{t-1} + \sum_{i=1}^{i=k-1} \Gamma_i \Delta Y_{t-1} + \varepsilon_t \qquad (1)$$

where Y = (ln*GDP*, ln*T*, ln*RP*) is a vector containing the variables in their logarithmic transformation, so that the model coefficients can be interpreted as elasticities; μ is a vector of constant terms and ε_t is the usual error term which allows to control for omitted factors left out by the deterministic part of the model. The matrix Π conveys information about the long-run relationship between the Y variables. The rank of Π expresses the number of cointegrating relations, that is the number of linearly independent and stationary linear combinations of the variables. The presence of cointegration amongst time series variables is due to common stochastic trends which imply convergence to a long-run equilibrium state, meaning that a stable long-run relationship amongst the variables exists (Banerjee et al., 1993).

As it is well known, in the context of time series analysis a test of stationarity is important to set up the estimation of the proper model. The first step is therefore to apply unit root tests to study the stationarity of time series. In case of non-stationarity, we apply the Johansen cointegration test (Johansen, 1988; Johansen and Juselius, 1990) in order to detect long-run relationships in the data. Then weak exogeneity and, finally, a modified version of the Granger causality test are applied in order to analyze causality between the variables.

4. Empirical results

4.1 South-Tyrol

In this paragraph, for the purpose of illustrating the estimation procedure in detail, we will focus on the case of South-Tyrol, while for the other two regions we will only report the empirical results in the next paragraphs. First of all, to set the model as in Equation (1) and perform the cointegration test, it is necessary to study preliminary the stationarity of the time series and identify their order of integration by using unit root tests, such as the augmented Dickey–Fuller (ADF) (Dickey and Fuller, 1979) and the KPSS (Kwiatkowski et al., 1992). These two tests are complementary: ADF has the null hypothesis of non-stationarity, while KPSS has the null hypothesis of stationarity and hence is more conservative. Table 1, 2 and 3 show unit root tests for the variables in levels, first differences and second differences, respectively, for the case of South-Tyrol.

Table 1. Unit root tests results: levels. (South-Tyrol)

Variable	ln*GDP*		ln*T*		ln*RP*	
Unit root tests	ADF	KPSS	ADF	KPSS	ADF	KPSS
Trend, constant	– 0.03	0.34[a]	– 2.81	0.13[b]	– 5.38	0.24[a]
Constant	– 1.93	1.54[a]	– 0.65	1.42	– 3.81[a]	0.94[a]
Without trend, constant	4.33		2.26		0.32	

[a] Null hypothesis rejection at 5%.
[b] Null hypothesis rejection at 10%.

Table 2. Unit root tests results: first differences. (South-Tyrol)

Variable	Δ(ln*GDP*)		Δ(ln*T*)		Δ(ln*RP*)	
Unit root tests	ADF	KPSS	ADF	KPSS	ADF	KPSS
Trend, constant	– 3.92[a]	0.13[b]	– 4.29[a]	0.04	– 2.22	0.31[a]
Constant	– 3.24[a]	0.31	– 4.32[a]	0.09	4.00[a]	1.10[a]
Without trend, constant	– 1.65[b]		– 3.51[a]		–4.21[a]	

[a] Null hypothesis rejection at 5%.
[b] Null hypothesis rejection at 10%.

According to the tests results, ln*GDP* and ln*T* variables are integrated processes of first order, *I*(1), while ln*RP* is of order *I*(2). Therefore, we have to detect for the presence of a cointegrating relationship amongst ln*GDP*, ln*T* and Δ(ln*RP*), which may be interpreted as a sort of local relative inflation. Banerjee et al. (1993) argue that testing for cointegration is searching for a statistical equilibrium between variables that tend to grow over time. The discrepancy of this equilibrium can be modeled using the VECM specification (Equation (1)) where, rather than taking ln*RP*, we employ Δ(ln*RP*).

Table 3. Unit root tests results: second differences. (South-Tyrol)

Variable	Δ (Δ(ln*RP*))	
Unit root tests	ADF	KPSS
Trend, constant	– 5.28[a]	0.04
Constant	– 4.24[a]	0.27
Without trend, constant	– 3.66[a]	

[a] Null hypothesis rejection at 5%.

The estimated coefficients of the VECM indicate how the variables come back to the equilibrium after suffering a shock. In order to define the optimal VECM, we rely on the minimum AIC-criterion, suggesting a lag length of one. To determine the number of cointegrating equations, the Johansen maximum likelihood method provides both trace and maximum eigenvalue statistics. It can be noted, in Table 4, that for South-Tyrol both statistics detect the existence of one significant cointegrating vector.

Table 4. Unrestricted cointegration rank test with no deterministic trend for ln*GDP*, ln*T* and Δ(ln*RP*) variables. (South-Tyrol)

Hypothesized no. of CE	Eigenvalue	Trace statistics	5% Critical value	*p*-value**
None*	0.580	40.51	35.07	0.0109
At most 1	0.378	17.09	20.16	0.1304
At most 2	0.147	4.28	9.14	0.3839

* denotes rejection of the hypothesis at the 0.05 level; **MacKinnon, Haug, and Michelis (1999) *p*-values.
Note: Trace test indicates 1 cointegrating equation(s) at the 0.05 level.

After that a long-run equilibrium relationship amongst the variables has been detected, in order to avoid misinterpretation in the meaning of the estimated parameters, exogeneity need to be tested (McCallum, 1984). Following Johansen and Juselius (1990) and Johansen (1995), weak exogeneity in the cointegrating equations can be tested applying zero-restrictions on the relevant rows of the so called *loading matrix* α, which is the matrix such that $\Pi = \alpha\beta'$ and that contains the weights attached to the cointegrating relationships in the single equations of the VECM (Lütkepohl, 2006). The null hypothesis of this test is of weak exogeneity and hence a likelihood ratio test statistics on the single parameter associated with variable ln*T* of 1.9695 with a *p*-value of 0.1605 indicates that ln*T* is exogenous. Similarly, a likelihood ratio test statistics on the single parameter associated with variable Δ(ln*RP*) of 0.4733 with a *p*-value of 0.4915 indicates that also Δ(ln*RP*) is exogenous. Even the null hypothesis of joint weak exogeneity of ln*T* and Δ(ln*RP*) cannot be rejected since the likelihood ratio test statistics is equal to 3.0196 with a *p*-value of 0.2210. These results allow us to draw inference and define the estimated long-run equilibrium in South-Tyrol after testing weak exogeneity of $\ln T$ and $\Delta(\ln RP)$:

$$\ln GDP_t = 4.16 + 0.36 \ln T_t - 3.31 \Delta(\ln RP)_t \qquad (2)$$

As can be noted, the elasticity of $\ln GDP$ with respect to international tourist arrivals is positive and equal to 0.36.

The existence of a significant stable long-run relation between $\ln T$ and $\ln GDP$ is a necessary but not sufficient condition for causality between the two variables. In other words, we still need to determine which variable is the cause and which is the effect. According to Granger (1988), we can state that $\ln T$ does not cause $\ln GDP$ if, in the equation of the VECM where $\ln GDP$ is the response variable, the regression parameters associated with $\ln T$ are jointly insignificant. Therefore, testing the proper zero-restrictions on the parameters of the single equations of the estimated model of Equation (1) allows to detect the direction of causality amongst the three variables; see Table 5 for the results for the case of South-Tyrol.

Table 5. Granger causality test. (South-Tyrol)

Null hypothesis	F-statistic	p-value
$\ln T$ does not Granger-cause $\ln GDP$	16.702	0.0000[a]
$\ln GDP$ does not Granger-cause $\ln T$	1.310	0.2891
$\Delta(\ln RP)$ does not Granger-cause $\ln GDP$	16.319	0.0000[a]
$\ln GDP$ does not Granger-cause $\Delta(\ln RP)$	1.430	0.2598
$\Delta(\ln RP)$ does not Granger-cause $\ln T$	0.634	0.5395
$\ln T$ does not Granger-cause $\Delta(\ln RP)$	0.126	0.8822

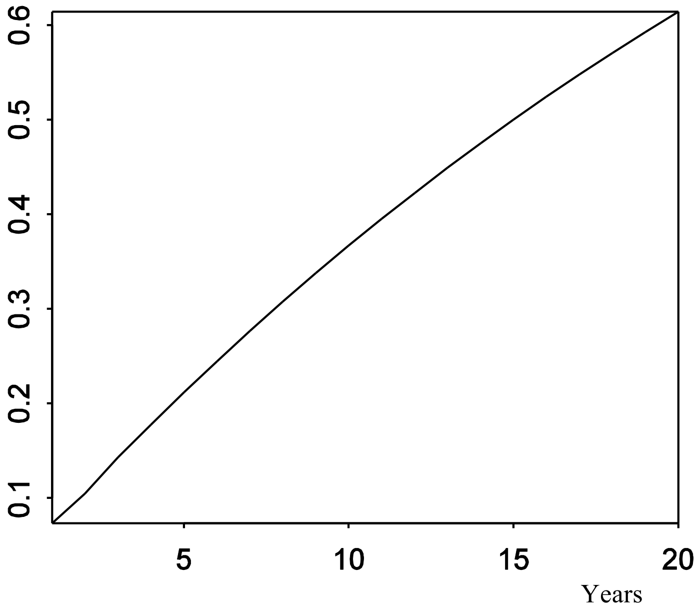
[a] Null hypothesis rejection at 5%.

Apparently, the null hypothesis that international tourism does not Granger cause real *GDP* is decisively rejected; while, on the other hand, the null hypothesis that the real *GDP* does not Granger cause international tourism cannot be rejected. Thus, there exists unidirectional Granger causality from international tourism to real *GDP*. This can then be interpreted as empirical evidence of the TLGH. Also the local relative inflation, say $\Delta(RP)$, has a significant impact on the real *GDP*, so that the estimated elasticity of real *GDP* with respect to $\ln T$, equal to 0.36, measures the net effect of international tourism to economic growth. More precisely, it means that an increase in tourism arrivals by 100% produces an increment of 36% of the real output of South-Tyrol.

To identify the ideal time-span of the impact of tourism we also compute the impulse response function (see e.g. Lütkepohl, 2006) which shows, ceteris paribus, how *GDP* reacts over time after a positive shock in the number of foreign tourists (Figure 3).

Precisely, the graph in Figure 3 cumulates the effects of $\ln T$ on $\ln GDP$ through the years (1, 2, . . .) and hence depicts the cumulated impact of a unit change in $\ln T$ on the variable $\ln GDP$ at each year. These results are in line with previous studies which analyzed the role of tourism in the local economy of South-Tyrol (see Brida and Risso, 2010).

Figure 3. Impulse response function of ln*GDP* to ln*T*. South-Tyrol



4.2 Trentino

In this paragraph the results for Trentino are synthetically presented. Table 6, 7 and 8 show the results for the unit root tests, from which emerges that ln*GDP* and ln*T* are *I*(1) and ln*RP* is *I*(2) implying, in turn, that a proper VECM to test cointegration should employ variables ln*GDP*, ln*T* and Δ(ln*RP*).

Table 6. Unit root tests results: levels. (Trentino)

Variable	ln*GDP*		ln*T*		ln*RP*	
Unit root tests	ADF	KPSS	ADF	KPSS	ADF	KPSS
Trend, constant	– 1.12	0.29[a]	– 1.78	0.14[b]	– 4.29[a]	0.25[a]
Constant	– 1.94	1.51[a]	– 1.03	1.54[a]	– 4.20[a]	0.92[a]
Without trend, constant	1.21		3.43		– 0.23	

[a] Null hypothesis rejection at 5%.

[b] Null hypothesis rejection at 10%.

Table 7. Unit root tests results: first differences. (Trentino)

Variable	Δ(ln*GDP*)		Δ(ln*T*)		Δ(ln*RP*)	
Unit root tests	ADF	KPSS	ADF	KPSS	ADF	KPSS
Trend, constant	– 3.22[b]	0.08	– 3.69[a]	0.11	– 2.29	0.29[a]
Constant	– 2.40	0.29	– 3.74[a]	0.12	– 2.56	1.16[a]
Without trend, constant	– 1.60		– 2.53[a]		– 3.18[a]	

[a] Null hypothesis rejection at 5%.

[b] Null hypothesis rejection at 10%.

Table 8. Unit root tests results: second differences. (Trentino)

Variable	Δ (Δ(ln*RP*))	
Unit root tests	ADF	KPSS
Trend, constant	– 4.80[a]	0.05
Constant	– 4.04[a]	0.25
Without trend, constant	– 3.38[a]	

[a] Null hypothesis rejection at 5%.

Turning now to the investigation of an equilibrium relation amongst the variables, Table 9 summarizes the results of the Johansen's cointegration tests that provide evidence in favor of a stable long-run linear relationship.

Table 9. Unrestricted cointegration rank test with no deterministic trend for ln*GDP*, ln*T* and Δ(ln*RP*) variables. (Trentino)

Hypothesized no. of CE	Eigenvalue	Trace statistics	5% Critical value	*p*-value**
None*	0.515	39.01	35.07	0.0169
At most 1	0.337	19.46	20.16	0.0629
At most 2	0.266	8.35	9.14	0.0717

* denotes rejection of the hypothesis at the 0.05 level; **MacKinnon, Haug, and Michelis (1999) *p*-values.
Note: Trace test indicates 1 cointegrating equation(s) at the 0.05 level.

Weak exogeneity of the variables is then tested: ln*T* and Δ(ln*RP*) can be considered as jointly exogeneous since the likelihood ratio test statistics is 2.95 with a *p*-value of 0.2289. Therefore, the estimated long-run equilibrium in Trentino after testing weak exogeneity is the following:

$$\ln GDP_t = 5.94 + 0.25 \ln T_t - 1.82\Delta(\ln RP)_t \quad (3)$$

We are then in the position to test for the presence of Granger causality (Table 10).

Table 10. Granger causality test. (Trentino)

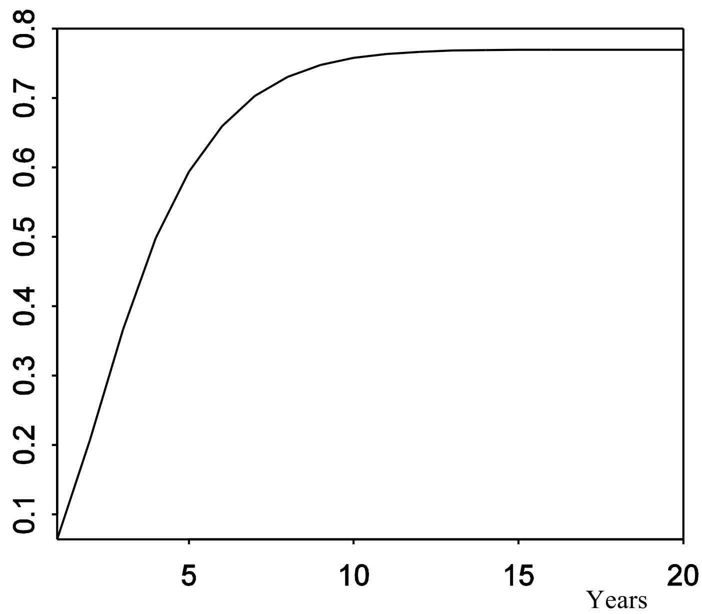
Null hypothesis	*F*-statistic	*p*-value
ln*T* does not Granger-cause ln*GDP*	10.783	0.0005[a]
ln*GDP* does not Granger-cause ln*T*	2.298	0.1231
Δ(ln*RP*) does not Granger-cause ln*GDP*	11.662	0.0003[a]
ln*GDP* does not Granger-cause Δ(ln*RP*)	0.249	0.7815
Δ(ln*RP*) does not Granger-cause ln*T*	1.359	0.2768
ln*T* does not Granger-cause Δ(ln*RP*)	0.203	0.8176

[a] Null hypothesis rejection at 5%.

The null hypothesis that international tourism does not Granger cause real *GDP* is rejected, thus validating the TLGH for Trentino. In particular, since the elasticity of ln*GDP* with respect to ln*T* is

positive and equal to 0.25, an increase in tourism arrivals by 100% may potentially produce an increment of 25% of the local total output.
Finally, the graph of the estimated impulse response function (Figure 4) displays that a positive shock in the number of foreign tourists induces *GDP* to grow for almost ten years until the impact is absorbed.

Figure 4. Impulse response function of ln*GDP* to ln*T*. Trentino



4.3 Tyrol

The same methodological approach used to verify the validity of the TLGH for South-Tyrol and Trentino is also applied here to the case of Tyrol. Tables 11, 12 and 13 show the results for the unit root tests; Table 14 summarizes the conclusion of the cointegration tests.

Table 11. Unit root tests results: levels. (Tyrol)

Variable	ln*GDP*		ln*T*		ln*RP*	
Unit root tests	ADF	KPSS	ADF	KPSS	ADF	KPSS
Trend, constant	– 2.10	0.16[a]	– 3.06	0.13[b]	– 3.34[b]	0.14[b]
Constant	– 0.72	1.35[a]	– 1.25	0.82[a]	– 2.21	1.01[a]
Without trend, constant	1.16		1.06		0.62	

[a] Null hypothesis rejection at 5%.
[b] Null hypothesis rejection at 10%.

Table 12. Unit root tests results: first differences. (Tyrol)

Variable	Δ(ln*GDP*)		Δ(ln*T*)		Δ(ln*RP*)	
Unit root tests	ADF	KPSS	ADF	KPSS	ADF	KPSS
Trend, constant	– 3.53[a]	0.09	– 3.40[a]	0.08	– 2.46	0.13[b]
Constant	– 3.62[a]	0.09	– 3.57[a]	0.10	– 2.32	0.25
Without trend, constant	– 3.34[a]		– 2.73[a]		– 2.00[a]	

[a] Null hypothesis rejection at 5%.
[b] Null hypothesis rejection at 10%.

Table 13. Unit root tests results: second differences. (Tyrol)

Variable	Δ (Δ(ln*RP*))	
Unit root tests	ADF	KPSS
Trend, constant	– 4.80[a]	0.05
Constant	– 4.04[a]	0.25
Without trend, constant	– 3.38[a]	

[a] Null hypothesis rejection at 5%.

Table 14. Unrestricted cointegration rank test with no deterministic trend for ln*GDP*, ln*T* and Δ(ln*RP*) variables. (Tyrol)

Hypothesized no. of CE	Eigenvalue	Trace statistics	5% Critical value	*p*-value**
None*	0.432	27.44	35.07	0.2707
At most 1	0.281	12.75	20.16	0.3927
At most 2	0.149	4.18	9.14	0.3975

* denotes rejection of the hypothesis at the 0.05 level; **MacKinnon, Haug, and Michelis (1999) *p*-values.
Note: Trace test indicates 1 cointegrating equation(s) at the 0.05 level.

Unlike the cases of South-Tyrol and Trentino, the cointegration tests for Tyrol show that no cointegration exists between real *GDP*, international tourist arrivals and local relative inflation since the null hypothesis of no cointegration relations cannot be rejected. As a consequence, there is no convergence of the three variables to a long run equilibrium, and hence no actual causation exists between international tourist arrivals and real *GDP*, implying that the TLGH are not validated for the local economy of Tyrol.

5. Discussion and concluding remarks

This paper attempted to validate the well-known stylized fact of the tourism-led growth hypothesis (TLGH) for South-Tyrol, Trentino and Tyrol, three across-the-border regions located in Italy and Austria which have stipulated an outline convention on transfrontier cooperation called "Tirol-Südtirol-Trentino Europaregion". State-of-the-art time series econometric methods have been applied for the purpose. Results suggested that the TLGH holds for South-Tyrol and Trentino since significant unidirectional causality exists between international tourism and growth of their local economies. The impact of increases in tourism demand is however stronger in South-Tyrol (with an estimated elasticity of real output of 0.36) than in Trentino (with an estimated elasticity of real output of 0.25) and is also temporally more persistent in the first region (as suggested by the analysis of the impulse response function). This empirical evidence is consistent with the fact that the tourism sector in South-Tyrol is relatively bigger than in Trentino. Quite surprisingly, in contrast, the TLGH has not been validated for Tyrol since no significant cointegrating relation has been found between the time series of tourism demand and the time series of local real *GDP*. This result is unexpected because the tourism sector of Tyrol is very similar (as characterized by the same mountain-based tourist activities) to that of the other two regions and it is undeniably not smaller (as evidenced in Section 2). An interesting issue is then open for future studies. We suggests two possible explanations for the lack of evidence in favor of the TLGH in Tyrol. The economy of Tyrol is more complex and variegated and probably less dependent on tourism sector than the economies of Trentino and South-Tyrol. Therefore, on one hand, it may be that the system of simultaneous linear equations we used is too simplified to properly represent the relationship between tourism and economic growth. On the other hand, it may be that the TLGH is not valid for economies that are not strictly dependent on tourism sector even if they have a large one. As a matter of fact, the vast majority of empirical studies that confirmed the validity of the TLGH have analyzed highly tourism-oriented economies. We then argue that advancements in the study of the TLGH from both a theoretical and a methodological perspective may be accomplished by using nonlinear cointegration methods (see e.g. Park and Phillips, 2001; de Jong,2002) and analyzing economies where tourism, although important, does not necessarily represents the main strategic factor of growth.

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