WORKING PAPER SERIES

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Ulrich Gunter, M. Graziano Ceddia, Bernhard Tröster

MODUL University Working Paper No. 1

January 2015

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Ulrich Gunter[†] M. Graziano Ceddia[‡] Bernhard Tröster[§]

January 12, 2015

Abstract

Using annual data for the period 1995–2012 for seven Central American and Caribbean countries, six different open-economy growth models that allow for international (eco-) tourism are estimated using panel-data estimation techniques. The main result of the investigation is that not only international tourist arrivals per capita have a highly significant impact on real GDP per capita but also that five different sustainability indicators interacted with international tourism have a positive impact on economic development in addition to international tourism. Furthermore, quantile regression shows that lower and medium income deciles in particular benefit most from international (eco-) tourism. The results are complemented by very similar estimation results for a set of 12 Central American and Caribbean countries using two sustainability indicators only, thus corroborating the validity of the specification. In addition, control variables are also generally significant and feature the algebraic signs as expected from economic theory.

Keywords: international ecotourism, sustainability indicators, real GDP per capita, Central America and the Caribbean, panel-data analysis, quantile regression.

*The authors would like to thank Alexandra Ganglmair-Wooliscroft, Peter Hietz, Dagmar Lund-Durlacher, and Egon Smeral for helpful comments and suggestions for improvement.

[†]Corresponding author: MODUL University Vienna, Department of Tourism and Service Management, Vienna, Austria, Am Kahlenberg 1, A-1190 Vienna, Austria, Phone: +43 (1) 320 3555 411, Fax: +43 (1) 320 3555 903, Email: ulrich.gunter@modul.ac.at.

[‡]European Commission, Joint Research Centre (JRC), Institute for Environment and Sustainability, Ispra, Italy, and MODUL University Vienna, Department of Public Governance and Sustainable Development, Vienna, Austria.

[§]Austrian Foundation for Development Research (ÖFSE), Vienna, Austria.

1 Introduction

Since the 1980s, Costa Rica has been successful in transforming from a predominantly agriculture-based economy to an industry- and service-based economy with foreign-exchange earnings from high-tech manufacturing and tourism exports continuously outweighing traditional agricultural exports such as coffee, bananas, and pineapples since the 1990s, whereby tourism has ranked first most of the time (see Miller , 2012, p. 79). Supported by international development assistance, notably by the U.S. Agency for International Development (USAID), the World Bank, and the International Monetary Fund (IMF), an ecotourism industry fostering entrepreneurship within local and rural communities related to visits of Costa Rica's natural destinations has been established since the mid-1980s. The establishment of this ecotourism industry was one crucial element (also to halt deforestation) of a bundle of so-called structural adjustment programs such as the promotion of international trade and foreign direct investment (so-called export-oriented industrialization, also in the tourism industry), the privatization of government-owned companies, and cutbacks in government expenditure that made Costa Rica a testing ground for policies in line with the Washington Consensus, which had to be accepted by the Costa Rican government in order to be able to reduce its exuberant international debt accumulated in the previous decades (see Honey, 2008, p. 162).

Besides its competitive advantage of hosting 5% of world's biodiversity on only 0.035% of its surface (see Honey, 2008, p. 160) and successful international marketing campaigns that helped to raise destination awareness, to increase destination attractiveness and eventually to create the brand *Costa Rica*, certain structural features that are unique to Costa Rica compared to its neighbors also helped to attract international money and visitors alike and thus to develop and sustain an ecotourism industry, which mainly revolves around the large number of (tiered) protected areas in the country, all starting with Costa Rica's national park system.[1] This resulted in the highest real gross domestic product (GDP) per capita levels of all Central American countries besides Panama (see Figure 1 in Section 3), which will be used as a proxy for economic development in the present study.

Structural differences across countries notwithstanding, the hypothesis of the present article is that ecotourism can make a positive contribution to economic development among other factors also for other

[1] Among these are a long democratic tradition, the rule of law (binding and executed conservation and preservation laws), the absence of (civil) unrest (abolition of the military in the late-1940s), high standards in education (including English language skills) and in social security (including public health services), a broad and affluent middle class, ecological consciousness as a new integral part of Costa Ricans' mentality, as well as being welcoming towards international travelers. Most of these structural characteristics were also responsible for the success of high-tech manufacturing in the country (see Honey, 2008, pp. 160–161).

countries in the Central American and Caribbean region. Since it is safe to assume that sovereign countries are able to decide upon their development model to a certain extent, the focus will be on the independent countries in Central America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama) and the Caribbean (Antigua and Barbuda, Bahamas, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, and Trinidad and Tobago) only, depending on data availability. Pertaining to the Caribbean, conventional tourism has long been an important contributor to GDP generation (varying between 20% and 80% across countries), employment (varying between 25% and 90%), as well as foreign exchange earnings (varying between 20% and 85% across countries) (see Bangwayo-Skeete and Skeete , 2015; Oxford Economics , 2010).

Provided that the structural differences across countries (e.g. differences in history, society, political and economic systems, etc.) are taken into account, the countries are still sufficiently similar (e.g. similarities in sizes of area, economy, and population, as well as geographical, environmental, and climatic proximity) to justify the recommendation of a common development element, i.e. the establishment of an ecotourism industry, the further development of an existing one, or the shift from conventional tourism to more sustainable tourism practices, within more holistic development strategies that ought to be fine-tuned to the countries' development needs. By explicitly focusing on fostering ecotourism – if carried out properly, i.e. *true* or *deep* ecotourism instead of *shallow* ecotourism, where so-called *greenwashing* marketing strategies are used only to attract more visitors to actual mass tourism destinations (see e.g. Acott et al. , 1998; Blamey , 1997) – also the detrimental impacts of conventional (mass) tourism on the environment and society can be mitigated (for an overview and discussion of these detrimental impacts see e.g. Mowforth and Munt , 2009, pp. 84–96).

A popular definition of ecotourism was provided by Honey (2008, pp. 32–33): "*Properly defined, then, ecotourism is travel to fragile, pristine, and usually protected areas that strives to be low impact and (often) small scale. It helps educate the traveler, provides funds for conservation, directly benefits the economic development and political empowerment of local communities, and fosters respect for different cultures and for human rights.*" Now the question remains how this definition can be translated into indicators. In general, sustainability indicators are widely used as assessment tools for ecotourism as a concept for sustainability implementation by both tourism researchers and the tourism industry (see Schianetz and Kavanagh , 2008). However, there is not only *one* sustainability indicator that has been proposed by scientific experts and/or been employed by policy makers. Surveying eleven case studies, Tanguay et al. (2013) collect a total of 507 individual expert-recognized sustainability indicators that have been proposed in the literature, e.g. including the ones proposed in the Guidebook by the World

Tourism Organization (see UNWTO , 2004).

Given their ready availability for a large number of countries including the ones of interest in the present study, the Environmental Sustainability Index (ESI), the Environmental Performance Index (EPI, which is the later refinement of the former), as well as the Travel and Tourism Competitiveness Index (TTCI) are employed in the present study. ESI and other (early) types of tourism competitiveness indices (notably the Tourism Competitiveness Monitor by the World Travel and Tourism Council, WTTC) have also become popular in the sustainable tourism literature (see Pulido Fernández and Sánchez Rivero , 2009). In addition, Bojanic (2011) finds a high and statistically significant positive correlation in terms of Pearson's r (0.775) between tourism performance (as measured by high TTCI scores) and environmental performance (as measured by high EPI scores) across countries, thereby corroborating the usefulness of these three sustainability indicators for measuring the eco component of tourism (see Section 2 for further information on these composite indices).

Since ESI is available for the year 2005 only, EPI for the years 2000 to 2010 only, and TTCI for the years 2008, 2009 and 2011 only, as well as to ensure comparability across indicators, country averages of these indicators are employed. Pertaining to the above ecotourism definition by Honey (2008), all three composite indices when interacted with international tourism fulfill parts of this definition. While ESI and EPI put more emphasis on ecosystem vitality besides the vitality of humans, thus addressing the low-impact objective, the TTCI is more people- but also more industry-focused without neglecting the importance of the natural environment. High scores in some pillars of the latter, such as human resources, cultural resources, policy rules and regulations, safety and security, health and hygiene, but also the infrastructure indicators, can be interpreted as means for fostering the economic development and empowerment of local communities objective of the above ecotourism definition, since not only (international) tourists but also the local population is intended to benefit from these.

These somewhat complex composite indices are complemented by the simple measures of terrestrial protected areas (in % of total land area) as well as of terrestrial and marine protected areas (in % of total territorial area), which accommodate the first part of the ecotourism definition by Honey (2008) when interacted with international tourism, i.e. travel to natural and protected destinations, and are available for even more countries than ESI, EPI, or TTCI. Despite their simplicity, also these sustainability indicators are particularly useful for measuring the eco component of international tourism, as could recently be shown by Ferraro and Hanauer (2014): according to these authors, almost two thirds of the poverty reduction associated with the system of protected areas in Costa Rica can be attributed to tourism activities.

Of course, not all aspects of ecotourism according to the definition of Honey (2008) can be covered by all sustainability indicators to the same extent. However, many of the 20 *"issues of sustainable development in tourism"* identified in the survey study by Tanguay et al. (2013) are reflected simultaneously by the chosen indicators, thus providing additional evidence for their usefulness.[2] It should be noted that this list of five competing sustainability indicators employed in the present study, while having shown its usefulness in the ecotourism literature (in particular ESI, EPI, and TTCI), does not claim to be exhaustive (see e.g. Singh et al. , 2009, for an overview of different sustainability assessment methodologies).

Using annual data for the period 1995–2012 for seven Central American and Caribbean countries (Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua, and Panama), six different open-economy growth models that allow for international (eco-) tourism are estimated using panel-data estimation techniques. The main result of the investigation is that not only international tourist arrivals per capita have a highly significant impact on the log of real GDP per capita (as proxy for economic development), thus yielding evidence for the tourism-led growth hypothesis (TLGH) for Central America and the Caribbean, but also that five different sustainability indicators interacted with international tourism (ESI, EPI, TTCI, percentage of terrestrial protected areas, as well as percentage of terrestrial and marine protected areas) used to proxy the eco component of international tourism have a positive impact on economic development in addition to international tourism for any realization of the tourism variable.

Furthermore, quantile regression that was pioneered by Buchinsky (1998) shows that lower and medium income deciles in particular benefit most from international (eco-) tourism. This alternative regression technique is employed to mitigate the shortcomings of real GDP per capita as a purely monetary economic development measure of the *average* inhabitant of a country. The results are complemented by very similar estimation results using international tourism only and interacted with the percentage of terrestrial protected areas and the percentage of terrestrial and marine protected areas for a set of 12 Central American and Caribbean countries (the seven countries mentioned above plus Belize, Dominica, Grenada, St. Lucia, as well as St. Vincent and the Grenadines, for which ESI, EPI, and TTCI were not available), thus corroborating the validity of the specification. In addition, the control variables are also generally significant and feature the algebraic signs as expected from economic theory.

The contribution of the present paper is the following. To the best of the authors' knowledge, this is the first attempt to combine panel data analysis with a new suggestion of how to measure ecotourism for Central America and the Caribbean and to assess its contribution to economic development. Given the success story of ecotourism in Costa Rica, the policy implication of the present paper is that establishing

[2] The 20 issues are in detail: ecosystem, water, atmosphere, energy, waste, landscapes and nuisances, resilience and risk, security and safety, health, satisfaction, public participation, culture, accessibility, investments, promotion of ecotourism, economic vitality, employment, marketing, reputation, as well as traffic (see Tanguay et al. , 2013).

or fostering an ecotourism industry or moving to more sustainable tourism practices could be one element to facilitate economic development in the entire region when embedded in a more holistic development strategy targeted to the countries' specific development needs even though structural differences across countries persist.

The structure of the remainder of this paper is as follows: Section 2 briefly reviews the current state of the literature, Section 3 presents the variables used for estimation, Section 4 briefly outlines the theoretical model and the estimation methodology, Section 5 presents and discusses the estimation results, and Section 6 draws some conclusions.

2 Literature Review

In the tourism economic literature, a positive impact of (international) tourism on GDP (usually measured in terms of GDP growth rates or in terms of GDP per capita (growth rates)) as a measure for economic development can be frequently found. Moreover, GDP growth rates of tourism-dependent economies are higher than the world average and it has been shown that the tourism industry is complementary to other industries in a country rather than crowding other industries out (see Holzner , 2011, for a panel study of 134 countries over the period from 1970 to 2007). It could be derived theoretically in a model of endogenous economic growth in an open economy that international tourism through the channels of importation of foreign capital and consumption of non-tradable goods by international tourists on location ensures a steady-state equilibrium and balanced economic growth (see Albaladejo Pina and Martínez-García , 2013). Moreover, Marsiglio (2014) recently found within a theoretical model that environmentally-minded international tourism can assure both economic growth and an increase in environmental quality in small island countries by creating an incentive to engage in environmental protection activities on the part of residents.

Similar to Holzner (2011), care must be taken in empirical applications to mitigate issues of reverse causality. To mitigate endogeneity concerns, (eco-) tourism and all other explanatory variables will be lagged by one period in the present study. In principle, it may also be the case that higher economic growth leads to more income from tourism or that the relationship between the two variables is bidirectional for the same period, which can also be found in the literature for some (groups of) countries (see, e.g. Chatziantoniou et al. , 2013, for an overview of recent studies).

For Latin America and the Caribbean in particular, various authors, e.g. Schubert and Brida (2011) for

Antigua and Barbuda, Brida et al. (2011) for Brazil, Clancy (1999); Carrera et al. (2008) for Mexico, Croes and Vanegas (2008) for Nicaragua, Brida et al. (2010) for Uruguay, Eugenio-Martín et al. (2004) for a panel of low- and medium-income Latin American and Caribbean countries and Fayissa et al. (2011) for a panel of more heterogeneous Latin American countries, find evidence for a significant and positive impact of international tourism on GDP (growth), or, in other words, for the TLGH for Latin America and the Caribbean (see Chatziantoniou et al. , 2013).

What, however, has been quite underresearched so far is the impact of ecotourism on economic development resulting in only a very limited number of studies published on this topic. Using the number of (endangered) birds species as proxies for (endangered) biodiversity under the assumption that a high degree of biodiversity in its role as comparative advantage fosters sustainable tourism in a country, Freytag and Vietze (2013) find evidence for both OECD and non-OECD countries that their biodiversity indicator had a positive impact on economic growth for the year 2003. Divino and McAleer (2009) model and forecast sustainable tourism demand to and for the Brazilian states of Amazonas and Pará by assuming that tourists visiting these two states can be deemed sustainable. The drawbacks of these two studies, however, are that they focus on one dimension of the data only (cross section and time series, respectively) rather than taking advantage of both dimensions and that the employed concepts of eco- or sustainable tourism are quite limited.

Therefore, both a different estimation approach (panel data analysis) and different measures for ecotourism (interaction of international tourism and different (environmental) sustainability indicators that have been widely used elsewhere in the literature) are proposed for the following reasons. First, the use of panel data analysis permits controlling for both temporal dynamics and unobservable country-specific effects that capture otherwise not measurable structural differences across countries. Second, it is assumed that in order to measure the impact of ecotourism properly, the joint effect – or interaction – of international tourist arrivals per capita and (environmental) sustainability indicators on real GDP per capita should be estimated. The normalization by the population of each country of international tourist arrivals is introduced to allow for the capacity limitation of tourism for the countries' societies and ecosystems, which is also one of the objectives of the ecotourism definition, i.e. (often) small scale, as introduced in Section 1.

The first indicator, ESI, was developed jointly by the Yale Centre for Environmental Law and Policy (YCELP) of Yale University, the Centre of International Earth Science Information Network of Columbia University, the World Economic Forum (WEF) and the European Commission Joint Research Centre. ESI includes measures related to environmental, socio-economic, as well as institutional factors characterizing sustainability at the country level. It is available for 2005 only (see `www.yale.edu/esi`). ESI is calculated based on 21 indicators of environmental sustainability that can be grouped into the following five categories: environmental systems, reducing environmental stress, reducing human vulnerability to environmental stresses, societal and institutional capacity to respond to environmental challenges, and global stewardship (see Esty et al. , 2005, p. 1).

The second indicator, EPI, is based on a refinement of the previous one and is calculated based on 22 indicators that are grouped into two categories: the effect of environmental degradation on human health (with a weight of 30% based on the three policy categories environmental burden of decease, air pollution (effects on humans), water (effects on humans)) as well as ecosystem vitality (with a weight of 70% based on the seven policy categories air pollution (effects on ecosystems), water (effects on ecosystems), biodiversity and habitat, agriculture, forestry, fisheries, climate change), and is available between 2000 and 2010 at the country level for the present sample (see YCELP , 2012).

The third indicator, TTCI, was first published in the Travel and Tourism Competitiveness Report by the WEF in 2007. The calculation of the TTCI underwent a refinement in 2008 and since then it has been calculated in a comparable way, thus for the present sample observations are available for the years 2008, 2009, and 2011. The TTCI is calculated based on 14 pillars, i.e. indicators, which are grouped into three subindices (Subindex A: T&T Regulatory Framework, with the indices policy rules and regulations, environmental sustainability, safety and security, health and hygiene, as well as prioritization of travel and tourism; Subindex B: T&T Business Environment and Infrastructure, with the indices air transport infrastructure, ground transport infrastructure, tourism infrastructure, information and communications technology infrastructure, as well as price competitiveness in travel and tourism industry; Subindex C: T&T Human, Cultural and Natural Resources, with the indices human resources, affinity for travel and tourism, natural resources, as well as cultural resources (see WEF , 2013)).

While real GDP per capita (even if income deciles are accounted for through quantile regression) may still appear limited, the positive economic development occurrences associated with ecotourism that have been identified in the literature, such as a diversification of a country's foreign-exchange basis, less dependence on agricultural exports (volatile world demand and world market prices, low income and high price elasticities, supply shocks, etc.), less dependence on trade restrictions, generation of employment, income, and entrepreneurial activity in local and rural communities (also on the part of lower-skilled labor, women, youth, and underutilized minorities), etc. should eventually be associated with higher domestic GDP levels as long as economic leakages abroad can be minimized (see Miller , 2012, pp. 16–20).

3 Data

Annual data were available for the period 1995–2012 for seven Central American and Caribbean countries (Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua, and Panama). In terms of the time-series dimension, the sample is limited by the availability of international tourist arrivals data (from 1995 onward) and, in terms of the cross-sectional dimension, the sample is limited by the availability of ESI, EPI and TTCI values (for the above seven countries only). In order to make subsequent estimation results more robust, the estimation with terrestrial (and maritime) protected areas as sustainability indicator is repeated for a larger set of 12 Central American and Caribbean countries for which these variables were also available: in addition to the seven countries mentioned above, these are Belize, Dominica, Grenada, St. Lucia, as well as St. Vincent and the Grenadines.

As can be seen from the scatterplot in Figure 1, the interaction term of international tourist arrivals per capita and TTCI (lagged by one period) with the log of real GDP per capita are highly positively cross-correlated for all countries, which corroborates the initial idea of a positive contribution of ecotourism to economic development. What can also be seen from this graph, however, is that differences across countries are present, which again corroborates the use of panel data analysis (the other sustainability indicators deliver similar correlation patterns and corresponding scatterplots are available on request).

[Figure 1 about here.]

In order to preclude an omitted variable bias, not only the effect of international (eco-) tourism on the log of real GDP per capita (expected sign: +) should be quantified but also the typical long-run drivers of economic development previously identified in the theoretical and empirical literature (expected signs from economic theory are given in parentheses, whereby "±" denotes an ambiguous expected sign; see e.g. Barro , 2000, for typical drivers): gross fixed capital formation (in % of GDP) is used as a proxy for physical capital formation (+), general government final consumption expenditure (in % of GDP) is employed to measure non-investment-related government spending (−), mean years of schooling of adults are used to proxy the overall educational level and human capital formation (+), the fertility rate (total births per woman) is included to allow for the demographic-economic paradox in line with the demographic transition model (i.e. less economically developed countries are often characterized by considerably higher birth rates than more developed ones, see e.g. Montgomery , 2014) (−), the inflation rate (GDP deflator, in % p.a.) is used to measure the internal stability of a country's currency (−), and terms of trade growth (export price index over import price index, in % p.a.) to measure how many imported goods a country can afford in terms of its exported goods (+).

In addition (see Fayissa et al. , 2011), net inflows of foreign direct investment (in % of GDP) is used as a proxy for an economy's openness and attractiveness from an international investor's perspective which, however, can also be a sign of dependence on international capital markets (±), net official development assistance received (in % of GDP) is employed to proxy a country's foreign aid received for (economic) development which, however, can also be sign of dependence on international aid donors (±). Complementing this list, personal remittances received (in % of GDP) are added since, for many developing countries, the continuous flow of savings from relatives living and working abroad is an important contributor to domestic income generation (in particular in countries where financial markets are less developed, see Giuliano and Ruiz-Arranz , 2009) which, however, can also be a sign of underdevelopment of the domestic economy (±), as well as total external debt stocks (in % of GDP) since (exuberant) international indebtedness may hinder economic development (−).

Finally, to allow for structural differences across countries beyond the use of country-specific effects in the regression equations, three Worldwide Governance Indicators from the World Bank are employed: the Voice and Accountability Indicator, to proxy for the perceived level of democracy, freedom of expression, association, and media (+), the Government Effectiveness Indicator, to proxy for the perceived quality of public and civil services and the commitment of governments to the implementation of announced policies (+), as well as the Control of Corruption Indicator, to proxy for the perceived extent to which public power is not used to serve private (vested) interests (+). Different governance indicators have also be used, e.g. by Barro (2000).

Most variables are taken from the World Development Indicators (WDI) database of the World Bank. For more details on variable description, their source, as well as descriptive statistics (mean, standard deviation, minimum, and maximum) see Table 1. Since all variables are either normalized (e.g. by GDP or population), are given in growth rates, or are bound index values, also the presence of unit roots and spurious regression relationships is very unlikely.

[Table 1 about here.]

4 Methodology

The economic model underlying the following analysis is a standard empirical neoclassical growth model (see Barro , 1991, 1997, 2000; Barro and Sala-i-Martin , 1992; Mankiw et al. , 1992). These papers investigate the possibility of (conditional) convergence of economic growth, i.e. the question whether initially poor entities (usually countries) grow faster than initially rich entities, and quantify the impact of the driving forces of economic growth that were previously identified theoretically. This empirical model class has also been successfully applied to panels of Latin American countries to quantify the contribution of international tourism to real GDP per capita (growth) besides other key explanatory variables that determine economic development in the long run (see Eugenio-Martín et al. , 2004; Fayissa et al. , 2011).

In econometric terms, when there is both a time-series and a cross-sectional dimension of the data and the issue of convergence to a steady-state growth path is not of interest, the type of regression model that needs to be estimated is a static one-way panel model, which reads as follows (for more details on panel data estimation see e.g. Baltagi , 2013, for a standard reference):

$$\ln y_{i,t} = \alpha + \beta' \cdot X_{i,t-1} + u_i + e_{i,t}, \quad i = 1, \cdots, N, \quad t = 1, \cdots, T, \tag{1}$$

where $\ln y_{i,t}$ for country i ($i = 1, \cdots, N$) at time point t ($t = 1, \cdots, T$) denotes the dependent variable (the natural logarithm of real GDP per capita: *LN_RGDP_CAP*), $X_{i,t-1}$ the K explanatory variables (international tourist arrivals per capita (interacted with the sustainability indicators) and the control variables), and e_{it} the idiosyncratic error term assumed to be independently and identically distributed (i.i.d.): $e_{it} \sim N(0, \sigma_e^2)$. α in Eq. 1 represents the global intercept, β' the K regression coefficients of the explanatory variables, and u_i the country-specific effects.

All explanatory variables are lagged by one period to mitigate reverse causality concerns. Moreover, having the dependent variable in natural logarithm and the explanatory variables in levels (so-called log-lin model) allows a convenient interpretation of the estimated regression coefficients (or, more precisely, the partial derivative of the estimated panel regression equation with respect to the explanatory variable of interest) as (approximate) elasticities, i.e. as the per cent response of the dependent variable to a 1% increase of one of the K explanatory variables. In total, six different models are estimated: one with international tourist arrivals only (Model 1), one with international tourist arrivals interacted with terrestrial protected areas (Model 2), one with international tourist arrivals interacted with terrestrial and maritime protected areas (Model 3), one with international tourist arrivals interacted with country-average ESI (Model 4), one with international tourist arrivals interacted with country-average EPI (Model 5), and one with international tourist arrivals interacted with country-average TTCI (Model 6). All subsequently reported calculations are performed with Stata Version 11.

In order to correctly specify the regression model, some preliminary statistical tests have to be conducted. The Wooldridge test for autocorrelation in panel data rejects the null hypothesis of no first order autocorrelation in the idiosyncratic error terms at the 1% level (see Drukker , 2003; Wooldridge , 2002). A Wald test for groupwise heteroskedasticity also rejects the null hypothesis of homoskedasticity of the idiosyncratic error variances at the 1% level (see Baum , 2001; Greene , 2000). Given autocorrelation and heteroskedasticity within panels, a more general assumption about the distribution of the error term has to be made and thus a robust estimate of the variance-covariance matrix will be employed hereinafter (see e.g. Hoechle , 2007, for an overview of robust estimators for panel data estimation).

It now needs to be determined which specification of the country-specific effects – fixed (i.e. as a fixed parameter) or random (i.e. as an i.i.d. random variable) – better describes the data, for which the Hausman test is employed (see Hausman , 1978). Under the null hypothesis of the Hausman test, the random-effects estimator is efficient, yet it is inconsistent under the alternative hypothesis. Since the Hausman test statistic is statistically significant at the 1% level, and thus the null hypothesis of the Hausman test rejected, it is concluded that the country-specific effects should be treated as fixed (detailed test results are available on request).

5 Results

Taking a look at Table 2, it can be seen that the overall goodness of fit of Models 1 to 6 is very promising since all coefficients of determination are sufficiently high. Also, most of the traditional drivers of real GDP per capita (the control variables) are statistically significant and, if so, they generally posses the sign as expected from economic theory as presented in Section 3, including *INT_DEBT_GDP* (significant for Model 6 only). *FDI_GDP* makes a positive contribution to economic development as has *ASS_GDP* (significant for Model 1 only), thus the positive contribution of these variables outweighs a potential negative impact. *EFF* and *CORC* do not feature the expected positive sign. One tentative explanation for this result could be that high indicator values could also be a sign for overregulation, which could in turn have a detrimental effect on economic activity. Only *GFC_GDP*, *FERT*, and *REMIT_GDP* are not statistically significant across models. Along with *EFF*, *SCHOOL* has the highest contribution to *LN_RGDP_CAP* in modulus, thereby underlining the importance of human capital formation for economic development.

[Table 2 about here.]

Concerning the impact of *TOUR_CAP* alone (Model 1), the estimated coefficient (approximate elasticity) has the expected positive sign and is highly statistically significant (at the 1% level), thereby providing evidence of the validity of the TLGH for Central America and the Caribbean. Also the impact of the interaction terms of *TOUR_CAP* with the respective sustainability indicators (Models 2 to 6) is positive and statistically significant at the 1% level, which is already a promising sign of the validity of the central hypothesis of this article. Concerning the contribution of the single sustainability indicators in addition to international tourism, a closer look has to be taken at the formula of the partial derivative of the estimated regression equation relative to the respective sustainability indicator:

$$\frac{\partial LN\_RGDP\_CAP_t}{\partial IND_{t-1}} = \hat{\beta}_{TOUR\_CAP\_IND} \cdot TOUR\_CAP_{t-1}, \quad (2)$$

where *IND* in Eq. 2 denotes one of the six indicators (*TERR*, *TERR_MAR*, *ESI_AV*, *EPI_AV*, *TTCI_AV*) and $\hat{\beta}_{TOUR\_CAP\_IND}$ the estimated regression coefficient obtained from Table 2. Since the values of *TOUR_CAP* are always positive and also the values of the coefficient estimates (linearly increasing functions in *TOUR_CAP* only), the additional impact from sustainability on economic development is also always positive. Evaluating the impact of sustainability at the average value of *TOUR_CAP*, which is approximately 19.07 (see Table 1), the following contributions of sustainability can be quantified for each model:[3]

- Model 2 (*TERR*): 0.0114,
- Model 3 (*TERR_MAR*): 0.0114,
- Model 4 (*ESI_AV*): 0.0038,
- Model 5 (*EPI_AV*): 0.0038,
- Model 6 (*TTCI_AV*): 0.0553.

The indicator couples *TERR* plus *TERR_MAR* and *ESI_AV* plus *EPI_AV*, respectively, are characterized by numerically identical contributions to real GDP per capita, thus generally measuring very similar aspects. The reason why TTCI is characterized by the highest contribution before terrestrial (and maritime)

[3]It should be noted that according to the Frisch-Waugh-Lovell theorem, numerically identical coefficient estimates are obtained regardless of whether or not fixed-effects estimation is carried out "directly" by applying ordinary least squares to unpurged variables including country dummies (least squares dummy variables estimation), or if it is carried out "indirectly" by first purging the country dummies from the data, as it was done here (see Baltagi , 2013, pp. 14–15). This is the reason why the unpurged average of the variable *TOUR_CAP* can be evaluated at this point in order to quantify the additional effects of the sustainability indicators.

protected areas and ESI and EPI may be due to it being the most tourism-related sustainability indicator. The on-top contributions of TTCI as well as of terrestrial (and maritime) protected areas evaluated at the average value of *TOUR_CAP* thus possess magnitudes almost as large as the most important significant real GDP per capita drivers such as *SCHOOL*, *VOICE*, *EFF*, and *CORC* (the latter three indicators emphasizing the contribution of good governance to economic development).

Despite ESI and EPI being widely used in the sustainable tourism literature (see Section 1), one more normative policy recommendation of the present analysis could be that, in order to assess the eco component in international tourism more holistically for Central America and the Caribbean, the TTCI should be preferred over the competing sustainability indicators since its importance notwithstanding it not only focuses on ecosystem vitality, but also more on the societal and economical pillars of sustainable development.

Following Buchinsky (1998); Fayissa et al. (2011); Koenker and Bassett (1978), quantile regression is employed to alleviate the limitations of real GDP per capita as a purely monetary economic development measure of the *average* inhabitant of a country. In doing so, it is investigated which income deciles benefit more from international tourist arrivals per capita (interacted with the sustainability indicators). More specifically, the conditional deciles of *LN_RGDP_CAP* given the explanatory variables are of interest, thus simultaneous quantile (decile) regression with 1,000 bootstrap replications each (to obtain the estimates of the variance-covariance matrices) is employed (StataCorp , 2009).

Figure 2 displays the coefficient estimates based on quantile regression for Models 1 to 6, i.e. for *TOUR_CAP* alone as well as interacted with one of the six sustainability indicators (*TERR*, *TERR_MAR*, *ESI_AV*, *EPI_AV*, *TTCI_AV*; detailed estimation results are available on request). Concerning international tourist arrivals alone, it was possible to replicate the results obtained by Fayissa et al. (2011), i.e. that lower and medium income deciles benefit most from international tourism. Concerning international tourist arrivals interacted with the five sustainability indicators, a similar picture could be obtained since also international ecotourism, no matter how it is measured, benefits low and medium income deciles more than it benefits high income deciles. Similar to fixed-effects panel regression, the magnitude of the positive effect of the eco component of international tourism on the log of real GDP per capita is the greatest when *TTCI_AV* is employed as sustainability indicator.

These results are most likely due to the nature of the (eco-) tourism industry, which offers a variety of diverse (entry-level) employment opportunities for lower-skilled labor that require different skill sets and working hours and offer different working conditions and wages (see Lacher and Oh , 2012; Szivas et al. , 2003). In general, the (eco-) tourism industry, with its numerous and valuable entry-level positions, is therefore attractive for the local population and adds to domestic income generation in the lower and medium income deciles, or, in other words, reduces poverty and income inequality (see Blake et al. , 2008; Lacher and Oh , 2012).

[Figure 2 about here.]

Finally, Table 3 replicates the estimation of Models 1 to 3 for a larger set of 12 Central American and Caribbean countries for which *TOUR_CAP*, *TERR*, *TERR_MAR* were also available: in addition to the seven original countries (Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua, and Panama) these are Belize, Dominica, Grenada, St. Lucia, as well as St. Vincent and the Grenadines.

Concerning the control variables, *GFCF_GDP*, *TOT_GR*, *INT_DEBT_GDP*, *EFF*, and *CORC* become insignificant. However, *GFC_GDP* and *FERT* become significant for this larger set of countries and feature the expected signs from economic theory. *REMIT_GDP* features a negative sign. Thus, a high degree of dependence on personal remittances from abroad, by which many economically underdeveloped countries are characterized, is detrimental to economic development. The overall goodness of fit of Models 1 to 3 is also promising.

Concerning the impact of international (eco-) tourism, the results for *TOUR_CAP* alone, as well as interacted with *TERR* or *TERR_MAR*, are in line with the results previously obtained. In all three cases, the estimated coefficients possess the expected positive signs, and are statistically significant and therefore also the additional impact from sustainability on economic development, evaluated e.g. at the average value of *TOUR_CAP* for the larger sample, is always positive. In general, the results for the set of 12 countries corroborate the previous findings for seven countries only.

[Table 3 about here.]

6 Conclusion

In general, the results of the present paper are very promising since ecotourism, no matter how it is measured, provides an additional impact on economic development as proxied by real GDP per capita for both a smaller and a larger set of Central American and Caribbean countries, in particular for lower and medium income deciles and irrespective of structural differences across countries. Also, the control variables almost always behave as expected and the models are as such correctly specified, thus allowing testing and embedding the central hypothesis in a more comprehensive empirical model of economic growth. However, the present article does not claim that Costa Rica's history, which is very unique compared to its Central American neighbors, can simply be replicated by its structurally different neighbors, such as Nicaragua, for instance. It only shows that one element that was beneficial to Costa Rica's (economic) development, i.e. the development of an ecotourism industry, could also be a beneficial part of country-specific development strategies for the entire region.

Nonetheless, not all elements of the popular ecotourism definition provided by Honey (2008) presented in Section 1 could be covered (simultaneously) by all the employed sustainability indicators. While the normalization of international tourist arrivals by population considers the capacity limitation of tourism for the countries' societies and ecosystems, and the use of real GDP per capita, as a proxy, the economic development part of the definition for all six estimated models, the two protected area indicators focus more on the aspect of the definition of ecotourism as travel to natural and protected areas, ESI and EPI focus more on the low impact, i.e. (often) small scale, aspect of the definition, and TTCI more on the economic development and empowerment of local communities aspect.

What, however, is very difficult if not impossible to measure with all these indicators, albeit being of equal importance, is the learning effect on travelers themselves, i.e. to what extent it fosters respect for different cultures and for human rights on the part of the traveler. The (simplifying) assumption made here is that travelers deliberately deciding to go on an (probably more expensive) ecotourism trip are already willing to be educated. In order to be able to measure education of the traveler in terms of an increase in ecologically conscious *behavior* rather than in ecologically conscious *attitudes*, surveys have to be conducted and evaluated for which appropriate questionnaires have to first be designed (see e.g. Wooliscroft et al. , 2014). A deliberate design of the questionnaires is indispensable in order to avoid measuring ecologically conscious attitudes only, since the so-called *attitude-behavior gap* on the part of "sustainable" travelers seems to be prevalent as was recently confirmed in the literature (see Juvan and Dolnicar , 2014). Concerning the money that directly goes into conservation, this element of the ecotourism definition can be considered as a secondary effect since in order for an ecotourism destination to be viable, putting sufficient money into conservation is indispensable at the end of the day.

Pertaining to ecotourism's *"poster child"* (Honey, 2008, p. 160), also not all endeavors Costa Rica has undertaken in terms of ecotourism development should be taken as a role models. By evaluating qualitative interviews conducted in Costa Rica, Stem et al. (2003) find mixed opinions on the part of the interviewees on the contribution of Costa Rica's ecotourism as a conservation and community development tool. In a more recent panel study, Blackman et al. (2014) find that Costa Rica's Blue Flag beach certification program caused environmental damage and spurred luxury hotel development given that tourism operators expected private benefits from becoming certified. Thus, also Costa Rica took a long time to become the ecotourism destination it is known as today. These negative experiences Costa Rica has had with some of its ecotourism efforts and the lessons learnt from these can also be useful for other Central American and Caribbean countries' own ecotourism development endeavors.

Future research could, for example, deal with the following two aspects: firstly, a more holistic development measure could be employed to underline the findings with real GDP per capita. Candidate measures are in wide supply and, apart from general development measures such as the Human Development Index (HDI) or the Millennium Development Indicators (MDI), there are also suggestions in favor of more specific economic wellbeing measures such as the Index of Sustainable Economic Welfare (ISEW) or the Genuine Progress Indicator (GPI), to name just a few (see van der Kerk and Manuel , 2010, for an overview). However, an issue with these measures usually is that data are not continuously available for a broad range of countries (thus entailing a lot of computational work before they can finally be employed for the countries of interest); and, secondly, a dynamic panel specification could also be estimated, with which not only the presumably dynamic nature of the relationship between the endogenous and the explanatory variables could be better captured, but also the issue of convergence to a steady-state growth path could be investigated, and long-run, i.e. steady-state, and short-run contributions of the explanatory variables to economic development could be quantified separately.

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Table 1: Variables and descriptive statistics (7 countries)

Variables	Description	Source		Mean	Std. Dev.	Min.	Max.
Dependent variable:							
LN_RGDP_CAP	Natural logarithm of real GDP per capita (constant 2005 USD)	World Bank: World Development Indicators (WDI)	`data.worldbank.org`	7.85	0.55	6.85	8.92
Explanatory variables:							
TOUR_CAP	International tourist arrivals per capita	World Bank: World Development Indicators (WDI)	`data.worldbank.org`	19.07	12.07	4.09	46.27
TERR	Terrestrial protected areas (in % of total land area)	World Bank: World Development Indicators (WDI)	`data.worldbank.org`	17.97	10.04	1.09	36.84
TERR_MAR	Terrestrial and marine protected areas (in % of total territorial area)	World Bank: World Development Indicators (WDI)	`data.worldbank.org`	20.82	10.25	0.44	36.72
ESI_AV	Environmental Sustainability Index (ESI) (country average)	Yale Center for Environmental Law and Policy (YCELP)	`www.yale.edu/esi`	49.49	6.24	43.70	59.60
EPI_AV	Environmental Performance Index (EPI) (country average)	Yale Center for Environmental Law and Policy (YCELP)	`epi.yale.edu`	55.43	6.01	50.15	68.33
TTCI_AV	Travel and Tourism Competitiveness Index (TTCI) (country average)	World Economic Forum (WEF)	see WEF (2013)	3.93	0.30	3.53	4.40
GFCF_GDP	Gross fixed capital formation (in % of GDP)	World Bank: World Development Indicators (WDI)	`data.worldbank.org`	20.23	4.53	13.32	33.67
GFC_GDP	General government final consumption expenditure (in % of GDP)	World Bank: World Development Indicators (WDI)	`data.worldbank.org`	10.57	3.30	4.58	18.70
SCHOOL	Mean years of schooling of adults	United Nations Development Programme (UNDP)	`hdr.undp.org/en/data`	6.26	1.67	3.45	9.40
FERT	Fertility rate (total births per woman)	World Bank: World Development Indicators (WDI)	`data.worldbank.org`	3.13	0.81	1.83	5.24
INFLA	Inflation rate (GDP deflator, in % p.a.)	World Bank: World Development Indicators (WDI)	`data.worldbank.org`	7.71	6.75	−4.08	45.19
TOT_GR	Terms of trade growth (export price index over import price index, in % p.a.)	World Bank: World Development Indicators (WDI)	`data.worldbank.org`	2.08	54.43	−57.99	576.06
FDI_GDP	Net inflows of foreign direct investment (in % of GDP)	World Bank: World Development Indicators (WDI)	`data.worldbank.org`	4.19	2.85	−0.05	17.13
ASS_GDP	Net official development assistance received (in % of GDP)	World Bank: World Development Indicators (WDI)	`data.worldbank.org`	7.28	5.68	0.14	21.41
REMIT_GDP	Personal remittances received (in % of GDP)	World Bank: World Development Indicators (WDI)	`data.worldbank.org`	3.24	4.83	−0.68	21.61
INT_DEBT_GDP	Total external debt stocks (in % of GDP)	World Bank: World Development Indicators (WDI)	`data.worldbank.org`	51.03	36.51	19.01	252.87
VOICE	Voice and Accountability Indicator	World Bank: The Worldwide Governance Indicators	`www.govindicators.org`	0.10	0.47	−0.56	1.17
EFF	Government Effectiveness Indicator	World Bank: The Worldwide Governance Indicators	`www.govindicators.org`	−0.36	0.39	−1.01	0.36
CORC	Control of Corruption Indicator	World Bank: The Worldwide Governance Indicators	`www.govindicators.org`	−0.43	0.47	−1.11	0.78

It should be noted that missing values for the variables *SCHOOL, VOICE, EFF, CORC* have been obtained by interpolation since they were missing for some points in time for some of the countries. Since those variables stay relatively constant over time and vary a lot more between countries than within countries, this step can be justified.

Table 2: Panel estimation results (Models 1 to 6 for 7 countries)

Explanatory variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
TOUR_CAP (-1)	0.0126***					
TOUR_CAP x TERR (-1)		0.0006***				
TOUR_CAP x TERR_MAR (-1)			0.0006***			
TOUR_CAP x ESI_AV (-1)				0.0002***		
TOUR_CAP x EPI_AV (-1)					0.0002***	
TOUR_CAP x TTCI_AV (-1)						0.0029***
GFCF_GDP (-1)	0.0024*	0.0047	0.0028*	0.0027*	0.0030	0.0023*
GFC_GDP (-1)	−0.0012	−0.0016	−0.0024	−0.0013	−0.0018	−0.0022
SCHOOL (-1)	0.1141***	0.1681***	0.1542***	0.1359***	0.1364***	0.1221***
FERT (-1)	0.0219	0.0601	0.0788	0.0182	0.0237	0.0180
INFLA (-1)	−0.0023***	−0.0025***	−0.0026***	−0.0021***	−0.0022***	−0.0022***
TOT_GR (-1)	0.0001**	0.0000**	0.0000**	0.0000**	0.0000**	0.0000**
FDI_GDP (-1)	0.0035*	0.0045***	0.0033**	0.0038**	0.0039**	0.0035*
ASS_GDP (-1)	0.0030*	0.0050	0.0036	0.0033	0.0031	0.0028
REMIT_GDP (-1)	−0.0001	0.0008	0.0026	0.0007	0.0007	0.0005
INT_DEBT_GDP (-1)	−0.0004	0.0002	0.0002	−0.0003	−0.0003	−0.0004*
VOICE (-1)	0.0551*	0.0726	0.0358	0.0625*	0.0724**	0.0527*
EFF (-1)	−0.1911**	−0.1131*	−0.0733	−0.2041**	−0.2123**	−0.1899**
CORC (-1)	−0.0437*	−0.0313	−0.0228	−0.0584**	−0.0492*	−0.0451*
INTERCEPT	6.7074***	6.2449***	6.2939***	6.5918***	6.5714***	6.6950***
No. of obs.	117	117	117	117	117	117
No. of countries	7	7	7	7	7	7
R^2 within	0.9335	0.9106	0.9350	0.9332	0.9305	0.9364
R^2 between	0.5775	0.4288	0.4759	0.5298	0.5454	0.598
R^2 overall	0.5651	0.4434	0.4868	0.5296	0.5444	0.5884

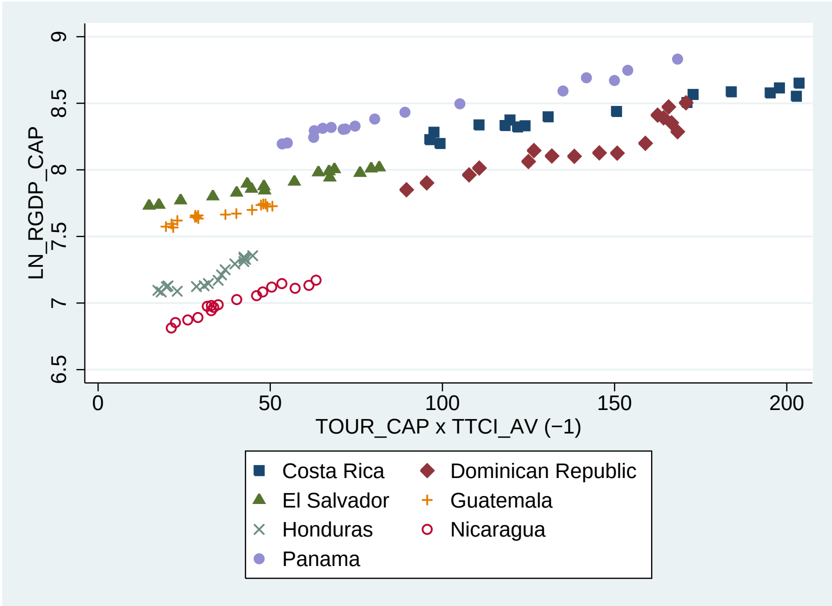
Source: own calculations using Stata Version 11 by applying a one-way static fixed effects estimator with a robust estimate of the variance-covariance matrix. Dependent variable: *LN_RGDP_CAP*. All explanatory variables are lagged by one period which is denoted by (-1). (***) denotes statistical significance at the 1%, (**) at the 5% level, and (*) at the 10% level.

Table 3: Panel estimation results (Models 1 to 3 for 12 countries)

Explanatory variables	Model 1	Model 2	Model 3
TOUR_CAP (-1)	0.0053*		
TOUR_CAP x TERR (-1)		0.0003***	
TOUR_CAP x TERR_MAR (-1)			0.0003**
GFCF_GDP (-1)	0.0000	0.0007	0.0005
GFC_GDP (-1)	−0.0122**	−0.0137***	−0.0168***
SCHOOL (-1)	0.0784	0.1040*	0.0978*
FERT (-1)	−0.2141***	−0.1827***	−0.1853***
INFLA (-1)	−0.0019***	−0.0019***	−0.0020***
TOT_GR (-1)	0.0000	0.0000	0.0000
FDI_GDP (-1)	0.0024**	0.0018*	0.0007
ASS_GDP (-1)	0.0040*	0.0034*	0.0010
REMIT_GDP (-1)	−0.0099**	−0.0102**	−0.0099**
INT_DEBT_GDP (-1)	−0.0005	−0.0005	−0.0004
VOICE (-1)	0.0391	0.0764**	0.0642*
EFF (-1)	−0.0202	0.0195	0.0436
CORC (-1)	−0.0348	−0.0446	−0.0434
INTERCEPT	8.0905***	7.8895***	8.1015***
No. of obs.	199	199	199
No. of countries	12	12	12
R^2 within	0.7784	0.7892	0.7830
R^2 between	0.7008	0.6420	0.5744
R^2 overall	0.7067	0.6506	0.5925

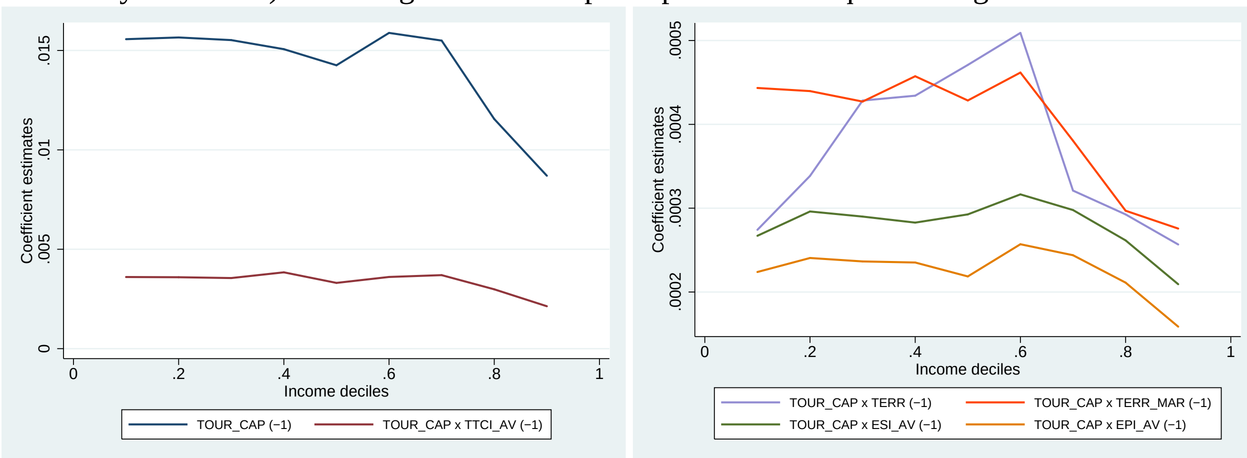
Source: own calculations using Stata Version 11 by applying a one-way static fixed effects estimator with a robust estimate of the variance-covariance matrix. Dependent variable: *LN_RGDP_CAP*. All explanatory variables are lagged by one period which is denoted by (-1). (***) denotes statistical significance at the 1%, (**) at the 5% level, and (*) at the 10% level.

Figure 1: Cross-correlation of the interaction term of international tourist arrivals per capita and TTCI (lagged by one period) with the log of real GDP per capita per country



Source: World Bank: World Development Indicators (WDI), World Economic Forum (WEF), and own calculations.

Figure 2: Estimated effects of international tourist arrivals (lagged by one period and interacted with sustainability indicators) on the log of real GDP per capita based on quantile regression



Source: own calculations using Stata Version 11 by applying quantile regression. Dependent variable: *LN_RGDP_CAP*. All explanatory variables are lagged by one period.