JENA ECONOMIC RESEARCH PAPERS

2010 – 008

Can nature promote development? The role of sustainable tourism for economic growth

by

Andreas Freytag
Christoph Vietze

www.jenecon.de

ISSN 1864-7057

The JENA ECONOMIC RESEARCH PAPERS is a joint publication of the Friedrich Schiller University and the Max Planck Institute of Economics, Jena, Germany. For editorial correspondence please contact markus.pasche@uni-jena.de.

Impressum:

Friedrich Schiller University Jena
Carl-Zeiss-Str. 3
D-07743 Jena
www.uni-jena.de

Max Planck Institute of Economics
Kahlaische Str. 10
D-07745 Jena
www.econ.mpg.de

© by the author.

"CAN NATURE PROMOTE DEVELOPMENT?

THE ROLE OF SUSTAINABLE TOURISM FOR ECONOMIC GROWTH"*

Andreas Freytag (A.freytag@wiwi.uni-jena.de) is Professor of Economic Policy at the Friedrich-Schiller-University in Jena, Chair for Economic Policy

Christoph Vietze (Christoph.Vietze@uni-jena.de) is a Researcher in Economic Policy at the Friedrich-Schiller-University in Jena, Chair for Economic Policy

Corresponding Author: Andreas Freytag
Postal address: Friedrich-Schiller University Jena
Department of Economics
Chair for Economic Policy
Carl-Zeiss-Str. 3
D-07743 Jena, Germany

Telephone: +49 · 3641 · 94 32 51
Telefax: +49 · 3641 · 94 32 52
E-Mail: a.freytag@wiwi.uni-jena.de
Internet: http://www.wiwi.uni-jena.de/vw2

Abstract:

We analyze whether biodiversity is enhancing the development process in developing countries (DCs) via increasing tourism receipts in a trade based endogenous growth framework. The underlying assumption is that a rich biodiversity – only if used sustainably – provides a comparative advantage in tourism for most DCs. The main empirical findings are that biodiversity while being significantly and positively correlated with inbound tourism receipts in DCs, has no significant relation with tourist arrivals. This can be interpreted as an indicator that mass tourism is not influenced by biodiversity whereas individual tourism (as the superior good) is. Consequently, we are able to show empirical a positive influence of sustainable tourism on economic growth. Therefore, it may be a promising development strategy to invest in biodiversity and attract high budget tourists.

JEL-Classification: F18, Q26

Key words: tourism, economic growth, sustainable development, biodiversity conservation, cross country analysis

* The authors are indebted for helpful suggestions on earlier versions to Martin Abel, Joachim Ahrens, Bianka Dettmer, Sarah Al Doyaili, Helmut Karl, Christina Klose, Jens Krüger, Nils Laub, Martin Paldam, Gernot Pehnelt and Simon Renaud, participants at the Public Choice Society Meeting 2006 in New Orleans, at the Ruhr Graduate School Seminar 2006 and at the Agrarökonomische Seminar of the University of Göttingen in 2007. All remaining errors are the authors' responsibility.

1. Introduction

International trade in tourism has become an important source of revenues for developing countries (World Tourism Organization 2008). This trend is feeding hopes that the development process can be enhanced without taking the same route as industrialized countries, i.e. via leap-frogging. A huge literature is supporting this view. At the same time, environmentalists fear that increasing tourism destroys significant parts of the environment and reduces biodiversity in developing countries. A worsening environmental quality may be adverse to economic growth; at least in the long run. This concern has increasingly been taken into consideration in development economics. We also consider it by discussing the question of how and to what extent biodiversity can be interpreted as an input for sustainable growth.

Applying a trade based growth-model, we discuss the chance to use biodiversity as a driver of development, thereby overcoming the trade-off between economic and ecological aspects. Based on earlier work by Freytag and Vietze (2009), which shows that (1) biodiversity is constituting a comparative advantage in tourism, that (2) the degree of endangered biodiversity is negatively affecting absolute inbound tourism receipts and that (3) the degree of biodiversity is positively affecting these receipts, we analyze how these results change when we focus on tourism arrivals rather than tourism receipts. This difference may be crucial as both the data for receipts and arrivals do not distinguish between sustainable (individual) and mass tourism. However, we can assume that spending in tourism is faster responding to income rises of potential tourists than the number of arrivals, i.e. their increasing income in countries of origin does not increase the number of arrivals to the same extent as the receipts in the destination countries. Arrivals thereby rather mirror mass tourism, where receipts can be a proxy for sustainable tourism. Hence, the latter is treated as a superior good, whereas mass tourism is not.

The remainder of this paper is organized as follows. After a literature review about the effects of tourism on growth, we first theoretically and in a second step empirically analyze how tourism can affect economic growth via biodiversity. Cautious policy conclusions round off the paper.

2. Tourism, Environment and Economic Development: The Literature

In developing countries, international tourism may well become a relevant factor for economic development. Two conditions seem crucial for this expectation to materialize: first, this development depends on a "terms of trade effect" as long as demand (and prices) increase by a higher rate than world income. In other words, caused by a low elasticity of substitution (Lanza et al. 2003; Brau et al. 2003) tourism is beneficial for growth if the international terms of trade move in favor of tourism services. This is especially the case if tourism is a superior or luxury good, such that consumers' demand increases strongly with rising income (income elasticity of demand higher than one) (Lim 1997; Brau et al. 2003, pp. 16; Divisekera 2003; Eilat and Einav 2004, pp. 1325). Second, to allow for sustainable growth, tourism suppliers should take notice of the environment, as it has been shown to be an important input for tourism services. Nature is a directly influencing factor for the demand for tourism, as it is discussed in a number of theoretical papers (e.g. Nijkamp 1998; Muir-Leresche and Nelson 2000; Ashley and Elliott 2003; Creaco and Querini 2003; Valente, 2005). Some empirical papers have confirmed this view (e.g. Zhang and Jensen 2005; Freytag and Vietze 2009). The latter provide empirical evidence that biodiversity[1] *per se*, i.e. the number of different species in a given situation, contributes to tourism revenues by enhancing the attractiveness of an area to tourists. This is a highly relevant outcome not only for ecological purposes but also for economic development, and further supports the view that the alleged trade-off between the economy and the environment is not a natural companion of development. As it may be assumed that developing countries are relatively rich in biodiversity, it can be an important precondition for a growing tourism industry, which then contributes to sustainable development in these countries. A rich biodiversity may provide a comparative advantage for tourism in the developing world.

On the same token, economic growth, trade and especially tourism may also have a negative impact on biodiversity (e.g. Nijkamp 1998; Berno and Bricker 2001; Neto 2003). As trade and tourism – in particular through the introduction of damaging invasive exotic species – can affect the local biodiversity negatively there may be

[1] Biodiversity is differentiated in the standard literature into ecological, organism and genetic diversity (Heywood 1995). Although our variable introduced below ($BIRDS$) relates to organism diversity, we would favor a more general concept of biodiversity covering the three subcategories. This is however very difficult to measure and to quantify.

rebound effects for a nature based tourism industry (e.g. Kanellakis 1975; McAusland and Costello 2004; Polasky et al. 2004; Freytag and Vietze 2009).[2] Thus, if it can be shown that biodiversity is beneficial for tourism and economic development, it is sensible to invest into biodiversity or create incentives to protect biodiversity.

Given that these conditions are met, tourism is likely to stimulate additional economic activity because tourists demand a number of goods and services: e.g. food, accommodation, transportation, entertainment and local handcrafts as souvenirs. Since the tourism sector is labor intensive, an increase in employment can be expected (Nijkamp 1998; Sinclair 1998; Deloitte & Touch et al. 1999; Neto 2003, pp. 4ff). Another indirect effect is that international tourism may push the political leaders in the country of destination to establish good governance, grant more civil rights or open the country for international trade. These assumed effects are particularly relevant for developing countries (DCs), which often have high rates of unemployment, "problematic" governments and difficulties to enter international trade.

Recent studies empirically investigate the effects of tourism on economic growth. Using the number of UN World Heritage Sites as an instrument for tourism, Arezki et al. (2009) show positive effects of tourism on economic growth. They do not concentrate on developing countries. Differently, Brau et al. (2003) analyze if specializing in tourism is an appropriate growth strategy for DCs. They assess the relative growth performance of 14 "tourism countries" within a sample of 143 countries, observed during the period 1980-95. Using standard OLS cross-country growth regressions, they show that the tourism countries grew significantly faster than all the other sub-groups considered in their analysis (OECD, Oil, DC, small countries). Moreover, Brau et al. (2003) find that other growth factors – low base value of per capita GDP, high saving/investment propensities or high openness to trade – do not significantly contribute to the positive performance of the tourism countries, concluding that tourism specialization is an independent determinant for economic growth. Confirming this result, Eugenio-Martin et al. (2004) examine the impact of tourism on economic growth with an analysis based on a panel data approach focusing on Latin American countries between 1985 and 1998. They

[2] For general empirical assessments of the relation between biodiversity and economic welfare see Naidoo and Adomowicz (2001); Asufu-Adjaye (2003); Barbier and Bulte (2004); Lomborg (2004) as well as Freytag et al. (2009).

estimate the relationship between economic growth and an increase in the number of tourist arrivals per capita conditional on main macroeconomic variables. The findings show that the tourism sector is a driver of economic growth in medium or low-income countries, though not necessarily in developed countries (Eugenio-Martin et al. 2004, pp. 5-11). Unlike in our analysis below, none of these studies differentiates between sustainable and unsustainable tourism. Hence, they do not discuss long-run effects of tourism. Thus, even given the positive correlation between tourism and short-run growth, mass tourism may not be a growth factor in the long-run. In the following two sections we particularly discuss this problem.

3. Trade in Tourism and Economic Development: The Theory

Much of the recent growth literature points to the positive role the more innovative sectors plays in explaining economic growth. If considering countries in autarchy, the more innovative sector growths faster in the long-run. If trade induces different countries to specialize in sectors with different dynamic potentials, and technological spillovers across sectors and countries are not strong enough, then uneven growth will normally be obtained (Grossman and Helpman 1991; Aghion and Howitt 1998). How can policy contribute to a sustainable growth setting via tourism specialization?

To explain the ability of tourism for economic growth in detail, we use and adjust a model that is derived from a series of papers by Brau et al. (2003); Lanza et al. (2003); Lanza and Pigliaru (1994, 2000). These are based on Lucas' (1988) two sector endogenous growth model. Consider a world formed of two small countries, country T (relative rich of biodiversity B) and country M (relative rich of human capital L). Each country is characterized by a two sector economy producing manufactures and tourism with human capital (L) as given factor of production. Only the production of tourism requires biodiversity (B) as additional input. The assumption of biodiversity being a factor of production is not standard in the literature (e.g. Brander and Taylor 1997, 1998; Hannesson 2000; Polasky et al. 2004; Smulders et al. 2004). Nevertheless, it seems highly plausible to treat biodiversity as factor rather than as product: First, tourists consume services such as recreation and sightseeing. Nature is an input to provide these services. Second, given that property rights are assigned correctly, biodiversity can be analytically treated like any given factor of production.

According to Lucas (1988), the accumulation of human capital via learning by doing is the only engine of growth. The technology to produce the M-and the T-good respectively is:

(1) $y_M = h_M L_M$

and

(2) $y_T = b h_T L_T$,

where h_i ($i = M, T$) is the level of used human capital. Human capital determines the labor productivity of the respective labor force $L_{M,T}$ allocated to the sector. While human capital – with the productivity rate h_i – will be "regenerated" (and accumulated) instantly via learning by doing, the production of tourism T requires an regenerative input, the natural resource biodiversity B with the productivity rate b and the fixed maximum endowment of $\overline{B}$ $\left(B \leq \overline{B}\right)$[3]**.** It takes time to regenerate biodiversity. Yet, if a species is completely extinct it cannot be recovered (Asufu-Adjaye 2003, p. 182). As shown in equation (2), to produce tourism T each worker must be endowed with a quantity b of B. The value of b is exogenous and depends on whether property rights are assigned on biodiversity B. This has important implications for the long-run use of this factor, in particular as a market for biodiversity does not exist without political support. If property rights are not assigned correctly, the factor price of B is zero and nature will be overused. Country T then faces a typical problem of a common property. In this case it is impossible to exclude producers from the (unsustainable) utilization of biodiversity, but they compete for biodiversity B. Thus, the assignment of biodiversity property rights plays a major role for the factor price and factor use. Now, to simplify, in the next steps we assume that $b = 1$.

The potential for learning by doing in the respective sector γ_i is constant. We assume in our model that manufacturing as "high technology" is the high skilled sector, so that $\gamma_M > \gamma_T$. This assumption seems to be plausible, as the tourism sector

[3] There is of course a natural steady decline of the number of species. But these decline rates are – first – very small and not relevant in the short-run; and matter – second – mainly for taxa like mosses, insects and molluscs and not for "tourism relevant taxa" like vascular plants, birds or mammals (Lomborg 2004, pp. 249-257). To simplify the model we assume a fixed endowment of biodiversity.

is especially low-skill labor intensive (Nijkamp 1998; Sinclair 1998; Deloitte & Touch et al. 1999; Neto 2003, p. 4ff).[4] While all companies in the same sector generate the same knowledge accumulation, there are no intersectoral spillovers. This assumption is in accordance with empirical findings. Moretti (2004) finds by using three alternative measures of economic distance – input/output flows, technological specialization, and patent citations – that spillovers between industries that are economically close are larger than spillovers between industries that are economically distant in terms of human capital intensity of the respective industry. This relates to our model with tourism as part of the "simple service industry" versus manufacturing as human capital intensive industry. In each period, with knowledge accumulations driven by learning by doing, increases in h_i are proportional to the sector's labour force. That means that factor movement into one sector leads to a proportional increase of human capital in the respective sector:

$$\frac{\dot{h}_i}{h_i} = \gamma_i L_i . \tag{3}$$

The endowment of the factors biodiversity B and human capital L plays a crucial role in determining the comparative advantages of the respective country. The two goods are produced with different factor intensities. Manufactures M are produced relatively human capital L intensively, while the production of tourism T requires relative more biodiversity B. In autarky, both countries produce both goods and reach a social optimum under different factor and goods price relations. Next, assume that these countries engage in international trade.[5] While countries with low endowment of biodiversity $\overline{B}$ face a constraint in the amount of labor, they can allocate in the tourism sector T (e.g. countries with $\overline{B} < 1$ cannot allocate the whole labor force to T), countries with larger $\overline{B}$ do not. With respect to the mechanism of relative price in autarchy, countries with a larger labor force, subjected to their biodiversity endowment $L_T\left(\overline{B}\right)$, will tend to develop a comparative advantage in T. For countries with smaller $L_T\left(\overline{B}\right)$ the opposite holds. International trade will force the individuals in both countries to specialize according their comparative advantages.

[4] By supposing tourism as high skill sector, it is also possible to construct economic growth theoretically in the standard model by Lucas (1988). However, it is our aim to show economic growth via tourism as option for (currently) low-skill labor abundant DCs.

[5] To simplify we do not consider trade-induced habitat effects (e.g. Smulders et al. 2004).

Thus, country T focuses on the production of tourism, while country M produces relative more manufactures. The trade implications of this model are the following: country T exports tourism services. In exchange for the consumption of tourism, the citizens of country M export manufactures.

As the production of manufactures requires only human capital L_M, international trade will force all countries to specialize completely according to their comparative advantages, so that the growth rate of a country is then:

(4) $$\frac{\dot{y}_i}{y_i} = \gamma_i .$$

Hence, as $\gamma_M > \gamma_T$, the growth rate in countries specialized in M is higher than in tourism countries.

Next, international trade also affects the *terms of trade* ($p \equiv {p_T}/{p_M}$), between the two countries. In particular, assuming that preferences are homothetic and identical everywhere, the terms of trade p move at a constant rate in favor of the slowly growing good tourism T; exactly counterbalancing the growth differential between the two countries. So, it can be expected that in the long-run the tourism country grows with the same rate as industrialized countries (in terms of model if $\sigma = 1$), with σ being the elasticity of substitution[6]. With a constant elasticity of substitution, ${\dot{p}}/{p}$ as the rate of change of the price p (p defined as $p \equiv {p_T}/{p_M}$) is equal to $\left({\dot{y}_M}/{y_M} - {\dot{y}_T}/{y_T} \right)\sigma^{-1}$.[7] With complete specialization, under consideration of (4) it follows that

(5) $$\frac{\dot{p}}{p} = \frac{\gamma_M - \gamma_T}{\sigma} > 0 ,$$

---

[6] The elasticity of substitution is definite at $\sigma = -\frac{d\left(\frac{Y_M}{Y_T}\right)}{d\left(\frac{p_T}{p_M}\right)} * \frac{\frac{p_T}{p_M}}{\frac{Y_M}{Y_T}}$. Intuitively σ explains how a consumer's relative choice over consumption items changes as their relative prices change. Or in other words, if the relative prices change at one per cent, by how many per cent changes the consumer's relative choice over consumption.

which refers to a growth rate of the tourism country of

(6) $$\frac{\dot{y}_T}{y_T} = \gamma_T + \frac{\dot{p}}{p}.$$

All equations above refer to long-run growth rates in presence of the assumed constant b. Now we consider that at a certain point in time in the tourism specialized country T not the maximum endowment of biodiversity $\overline{B}$ is used, from what follows that $b < \overline{b}$. Thereby $\overline{b} \equiv \overline{B}/L$ is the upper bound of biodiversity per unit of labor, if country T is completely specialized in T. If the tourism sector in this country expands, the rate of utilization of its biodiversity B increases too. The short-term growth rate of the tourism economy $\dot{y}_{T_S}/y_{T_S}$ in terms of the manufacturing good M ($_S$ stands for short-term) is now

(7) $$\frac{\dot{y}_{T_S}}{y_{T_S}} = \gamma_T + \frac{\dot{p}}{p} + \frac{\dot{b}}{b}.$$

As explained more precisely below, in the long-run tourism specialization is harmful (beneficial) for growth if σ is greater (smaller) than one. Comparing with equation (5), manufacturing is the sector with higher growth rates as the elasticity of substitution is $\sigma > 1$. Nevertheless, it is possible that the country specialized in tourism T can growth faster and therefore convergence to the manufacturing country M. Which mechanisms can lead to this result?

In the long-run, the biodiversity utilization growth rate $\dot{b}/b$ approaches to zero once the upper bound of biodiversity per unit of labor $\overline{b}$ is reached. Hence, the growth rate $\dot{y}_{T_S}/y_{T_S}$ can only be observed in the short-run. If a new tourism site (or country) will be developed with unsustainable (mass-) tourism, where at the stating point in time the biodiversity B is not used, a higher short-term growth rate $\dot{y}_{T_S}/y_{T_S} > \dot{y}_M/y_M$ is possible. In that case the rate of utilization of biodiversity ($\dot{b}/b > 0$) increases significantly during this period, from what follows that

[7] For an exact mathematical derivation of this equation see Lanza et al. 2003, pp. 317.

(8) $$\frac{\dot{y}_{T_S}}{y_{T_S}} = \gamma_T + \frac{\dot{p}}{p} + \frac{\dot{b}}{b} > \frac{\dot{y}_M}{y_M} > \frac{\dot{y}_T}{y_T} = \gamma_T + \frac{\dot{p}}{p}$$

is feasible. It can be seen that the short term growth rate $\dot{y}_{T_S} / y_{T_S} = \gamma_T + \dot{p}/p + \dot{b}/b$ of the country specialized in tourism T *can* be greater than the growth rate $\dot{y}_M / y_M$ of the country which produces manufacturing goods M. Even if $\sigma > 1$ so that $\frac{\dot{p}}{p} < \gamma_M - \gamma_T$, the terms of trade effect cannot outweigh the productivity differential. With an unsustainable over-utilization of biodiversity B, this growth can only be observed in the short-run until the biodiversity utilization growth rate $\dot{b}/b$ tends to become zero when the upper bound of biodiversity per unit of labor $\bar{b}$ is reached. From this point in time t_1, an additional utilization of biodiversity B leads to an overuse of that resource. In other words: the consumption rate of biodiversity by the tourism industry is higher than the regeneration rate of biodiversity. This assumption has important implications for the long-run use of this factor, in particular as a market for biodiversity does not exist without political support. Without a positive price, there is the danger of an overuse, as biodiversity then can be treated as a common pool property. Thus, the assignment of biodiversity property rights plays a major role for the factor price and factor use.

It is an individually rational action of every tourism manager to assume that if she does not use (and thereby overuse) the biodiversity, her competitors will be doing it. Then the supply of tourism increases, factor prices tend to not be equalized, and country B experiences a loss from trade (Brander and Taylor 1998). An incremental degeneration of B, which involves a decrease of the comparative advantage for tourism T in country T, is the reason for this development. Thus, over time this results – because of a decrease of the natural endowment of biodiversity $\bar{B}$ (and therefore a lower biodiversity productivity rate $b < \bar{b}$) – in a lower GDP-growth rate in country T than in country M ($\dot{y}_{T_S} / y_{T_S} \leq \dot{y}_M / y_M$).

By contrast, the long-term interpretation considers the property rights on biodiversity B assigned appropriately in the tourism specialized country. It relies on a terms of

trade effect. In other words, tourism is beneficial for growth if the international terms of trade (p_T/p_M in case of country T) move in favor of tourism services. Essentially, tourism is beneficial for growth if the international terms of trade move fast enough to more than offset the gap in sectoral productivity growth ($\gamma_M - \gamma_T$) so that $\frac{\dot{p}}{p} > \gamma_M - \gamma_T$ and if the terms of trade effect can outweigh the productivity differential. From equation (5) follows that this is the case if $\frac{\dot{p}}{p} = \frac{\gamma_M - \gamma_T}{\sigma} > (\gamma_M - \gamma_T)$, so that $\sigma < 1$ is sufficient for this result.

This means that if the relative price for tourism increases at one per cent, the relative demand shift from tourism to manufactures is lesser than one per cent. With goods as different as tourism and manufactures in our model, every reason is given for supposing that the elasticity of substitution will be low. This is related to a low price elasticity of demand for tourism which is evidenced by empirical findings, at least aside from mass tourism.[8] Hence, a steady increase in the relative price of tourism leads to a relative low decrease in tourism demand. So, the gains from tourism increases without (relative) demand expansion like more hotels etc. This is the case if consumer preferences are such that tourism specialization (or some types of tourism specialization) is highly valued in the international marketplace.

Hence, there is an additional interpretation that yield further theoretical support: specializing on tourism (under consideration of $\sigma < 1$) could be start a growth mechanism. If the manufactures sector, on which only country M is (completely) specialized, growths faster than the tourism sector in country T, an output shift to T – regarding to income effects – and with it an intensifying of the above mentioned terms of trade "improvement" can be reached. In our two-good-two-country world the output expansion of M (as exclusively produced by this country) can be interpreted as relative increase in income in this country compared to country T. If adding – empirically well supported – non-homothetic preferences to the model, tourism T is a superior or luxury good, such that consumers' demand increases strongly with

[8] Eilat and Einav (2004) empirically find that there is a low price elasticity of demand for tourism to low-GDP destinations, in which tourism are typically no mass phenomenon. Eugenio-Martin et al. (2004) find in an empirical study about the determinants of demand for tourism in Latin America that the relative price of goods and services in a destination is not relevant for the demand of tourism.

increasing income (income elasticity of demand higher than one) (Lim 1997; Brau et al. 2003, p. 16; Divisekera 2003; Eilat and Einav 2004, p. 1325, Vietze 2009, pp. 21ff). The consequence is a second growth mechanism, namely an increase of the relative demand of tourism by increasing world GDP. Therefore, the human capital accumulation based increase of GDP in country M tends to result in a higher demand for tourism (which is produced by country T). This causes a relative increase in tourism demand by rising relative prices for tourism, due to the above mentioned terms of trade effect.

Thus, the international terms of trade in tourism move fast enough to more than offset the gap in sectoral productivity growth. Then the sum $\dot{y}_T/y_T = \gamma_T + \dot{p}/p$ would steadily be greater than $\dot{y}_M/y_M$, even if the biodiversity utilization growth rate is zero ($\dot{b}/b = 0$). Now we have

(9) $$\frac{\dot{y}_{T_S}}{y_{T_S}} = \gamma_T + \frac{\dot{p}}{p} + \frac{\dot{b}}{b} > \frac{\dot{y}_T}{y_T} = \gamma_T + \frac{\dot{p}}{p} > \frac{\dot{y}_M}{y_M}.$$

Therefore, for a long time a higher rate of GDP-growth in T than in M ($\dot{y}_T/y_T > \dot{y}_M/y_M$) and therefore a convergence from country T to country M is possible.

Summarizing, we can conclude that economic growth based on a fast and unsustainable increase in tourism supply T leads to a short term over-utilization of the free production factor biodiversity B. Thereby it might hide temporarily the logical long-term decline of biodiversity and with it the growth damaging effects of this (mass-) tourism expansion.

Nevertheless, long term growth is also possible, if consumers' preferences are such that tourism demand is a superior good on international markets. This second mechanism – which is crucially not based on physical (e.g. more hotels) output expansion, but on higher valued and priced tourism supply – makes tourism based sustainable economic development feasible. Hence, this result rests on sustainable tourism, which is using but is not overusing biodiversity ($b \leq \bar{b}$). While biodiversity is a common good (competition in consumption) with problems described above, "biodiversity watching" is a public good (no competition in consumption). In turn, this

finding suggests the complete allocation of the property rights for biodiversity to private or governmental land owners. If these property rights on B are assigned correctly, rivalry in consumption is likely and a complete exploitation of biodiversity B can be avoided. The land owners' self-interest leads them not to overuse "their" biodiversity.

4. Trade in Tourism and Economic Development: The Empirical Evidence

The next step to take is to test the theoretical considerations. We want to know whether biodiversity can contribute to growth via the expansion of sustainable trade. We have to make two distinctions for this purpose: first, we distinguish between OECD and developing countries to figure out whether tourism may be particularly relevant in developing countries. Second, we have to distinguish mass tourism from sustainable tourism; in explaining the drivers of tourism as well as in explaining the potential of tourism for economic growth. Start with the different country groups. In an empirical analysis about the drivers of comparative advantage in tourism and absolute international tourism receipts, Freytag and Vietze (2009) show that biodiversity richness (measured as the number of living and breeding bird species in a country)[9] is contributing to a comparative advantage in tourism (see equation I in table 1). In addition they show that endangered biodiversity negatively affects the absolute amount of inbound tourism receipts (see equation IV in table 1) and that

[9] The most important exogenous variables ($BIRDS$ and $ENBIRDS$) as proxies for biodiversity and its loss respectively are measured by the number of bird species in relation to the size of the country in square kilometers (km^2) as done by Asufu-Adjaye (2003). Birds are suitable biodiversity indicators (Riecken 1992; DO-G, 1995; Boening-Gaese and Bauer 1996; Plachter et al. 2002; Gregory et al. 2003; BirdLife International 2004; Naidoo and Andamowicz 2005), especially for studies on a global scale (Bibby et al. 1992; Burgess et al. 2002): (1) Individual birds usually have large home ranges in complex habitats that require specific structures for several parts of the life-cycle (e.g. nesting sites, hibernation sites). Thus, they respond often very sensitively to changes in their habitat (e.g. due to economic efforts or due to nature protection efforts). (2) Many species are carnivorous, representing high positions in the food chain. Consequently, many bird species are considered as "flagship species" (Lawton et al. 1998) whose presence indicates the presence of a species-rich animal and plant community. (3) Birds may represent the best-known animal taxon, and an avifauna is available for all countries. (4) The number of bird species cannot be politically instrumentalized (Metrick and Weitzman 1998; Rawls and Laband 2004), as long as the counting is done independently. Additionally, we calculate the ratio of endangered bird species to all bird species in a country ($ENBIRDS$). To use $ENBIRDS$ is sensible. It indicates the incentives in a country to preserve nature and represents the common pool property. The list of endangered birds is applied world-wide. Therefore, even if some distortions are in the list, this holds for all countries similarly. These two variables are statistically not interdependent (see Appendix C). See also Freytag and Vietze 2009.

biodiversity richness positively affects the absolute amount of inbound tourism receipts (see equation VII in table 1).

Their analysis does not distinguish between industrialized and developing countries. This is done in table 1, using their data. Appendix A displays and explains the used data; as well as the data sources. Because it is apparent that the sample does not have disturbances with identical variance, we generally run a White-Heteroskedasticity residual test and use an adjusted OLS-estimator robust to heteroskedasticity in these estimations. We also test for reverse causality between the dependent variable and explanatory variables, running a Granger causality test between $BIRDS$ and tourism receipts per capita (TR). According to this test, we cannot reject the hypothesis that TR does not Granger cause $BIRDS$ but we can reject the hypothesis that $BIRDS$ does not Granger cause TR. Therefore, it appears that Granger causality runs one-way from $BIRDS$ to TR and not the opposite way. Another problem may be multicollinearity, in particular high correlation between the World Bank governance indicators as control variables. To avoid this problem, we do not use all indicators simultaneously. The correlation matrix of all variables is presented in Appendix C.[10]

For OECD-countries as tourism destination, the main driver for comparative advantage (RCA) in tourism is the own GDP per capita, which is not surprising as a high GDP per capita goes along with a high standard of living in the destination (see table 1). Equation II and III show that biodiversity as an important driver for comparative advantage in tourism is more relevant for developing countries. The same holds for the relative length of the country's coastline; the other variables display the same overall results. Regarding to the effects of endangered biodiversity on tourism receipts (equation III-VI), one can see that the extent to which biodiversity is endangered is not relevant for OECD-countries but for developing countries all the more. Also the ratio of cultural sites plays an important role in attracting foreign tourists to Non-OECD countries. The last finding is further strengthened by estimations VIII – IX which correspond to the impact of absolute biodiversity richness

[10] The descriptive statistics referring to revealed comparative advantage of tourism exports (RCA), inbound tourism receipts per capita (TR), tourism arrivals (TA), bird species in relation to the size of the country ($BIRDS$), the ratio of endangered bird species to all bird species ($ENBIRDS$) and the number of UNESCO world heritage sites in relation to the size of the country (WHS) are reported in Appendix D.

on tourism demand. As the ratio of *WHS* do not differ within OECD-countries to a great extent, this result is not surprising. Our variable of interest, the richness of biodiversity in a country, shows the same impact on the absolute amount of inbound tourism receipts for all three estimations. The findings confirm the result that *BIRDS* is important for absolute tourism receipts in OECD-countries, whereas *ENBIRDS* impedes tourism exports in developing countries.

Table 1: Biodiversity/ Endangered Biodiversity and RCA/Tourism Receipts: Empirical Evidence

Model	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**
Dependent Variable	**RCA 2003**	**RCA 2003**	**RCA 2003**	**TR 2003**	**TR 2003**	**TR 2003**	**TR 2003**	**TR 2003**	**TR 2003**
Countries included	All Countries (Freytag and Vietze 2009)	OECD	Non-OECD	All Countries (Freytag and Vietze 2009)	OECD	Non-OECD	All Countries (Freytag and Vietze 2009)	OECD	Non-OECD
Constant	0.724***	1.184***	0.803***	-1,149**	-6,824.1**	-1,114.3**	-1,115.6**	-6,159***	-895.947
	(6.469)	*(3.492)*	*(6.150)*	*(-2.875)*	*(-2.136)*	*(-2.134)*	*(-2.006)*	*(-2.987)*	*(-1.649)*
BIRDS	2.415***	21.324*	*3.029****				2,393.9***	93,534***	2,398.8**
	(3.161)	*(1.797)*	*(4.580)*				*(3.369)*	(25.508)	*(2.372)*
ENBIRDS				-4,616**	1,649.4	-5,510.6*			
				(-2.055)	*(1.080)*	*(-1.953)*			
WHS	-56.500	-375.392	*-60.664*	275,827***	93.0E07*	280,814***	224,830***	-1,317,881	226,318***
	(-0.535)	*(-0.188)*	*(-1.060)*	*(12.687)*	*(1.808)*	*(11.673)*	*(7.446)*	*(-1.691)*	*(8.751)*
GDP2003	-3.1E-5***	-4.1E-5***	-7.8E-5**						
	(-4.436)	*(-3.686)*	(-2.289)						
LE				28.330***	86.189**	28.755**	22.027***	84.632***	18.116*
				(3.393)	*(2.164)*	*(2.483)*	*(2.712)*	*(3.156)*	*(1.902)*
COAST	0.487	*0.871*	*0.597***	198.300	-171.949	208.316	67.322	467.330	79.784
	(1.127)	*(0.220)*	*(1.999)*	*(1.143)*	(-0.085)	*(1.213)*	*(0.535)*	*(0.333)*	*(0.508)*
R^2adj	0.2314	0.3052	0.2018	0.3700	0.4112	0.4089	0.3865	0.9063	0.4237
N	123	29	94	161	30	131	161	30	131

Dependent variable is the RCA-index in 2003; or the amount of tourism receipts per capita in 2003.
See Appendix A; for sources see also Appendix A. For countries see Appendix B.
Absolute t-values in parenthesis.
* Significant at the 90 percent level.
** Significant at the 95 percent level.
*** Significant at the 99 percent level.

This exercise shows the relative importance of tourism for developing countries again as well as the relevance of biodiversity protection. It is not distinguished between different forms of tourism. According to our model however, it is sensible to

distinguish two types of tourism at this point. Derived from the definition of sustainable development of the Brundtland-Report (UN 1987), sustainable tourism is a tourism development that meets the needs of the present without compromising the ability of future generations of both, visitors and the tourism industry, to meet their own needs. By contrast, unsustainable (mass-) tourism is based on an output expansion at the expense of future generations through an exhaustible consume of nature and culture.

The outcome of our theoretical model suggests that a developing country can maintain a catching-up process by concentrating on sustainable tourism (with relatively high income and low price elasticity of demand) and using its natural endowment as an input into the production process. To the contrary, mass-tourism is obviously less attractive as it could be characterized by the opposite elasticity structure. Therefore, to compete on this market and to increase income and employment via mass tourism, the output measured in tourist arrivals has to be increased over time. This does not necessarily but probably lead to an overuse of the input factor, in particular as mass-tourism depends neither on biodiversity nor on other elements of highly priced tourism such as culture.

The latter has been shown by Bigano et al. (2005) and is further validated in Table 2. Instead of the absolute amount of receipts generated through international tourism, we focus on the number of tourist arrivals[11] in 2003 (World Tourism Organization 2007) in a country as endogenous variable, to specify the potential for development via tourism more exactly. As tourism arrivals count the absolute number of foreigners who come into a respective country for holiday purposes, we use this variable to distinguish between high priced quality tourism and mass-tourism. To control this variable for country size and population, we use these as additional control variables.[12]

$$TA_i = \beta_0 + \beta_1 BIRDS + \beta x_{1+j} + \varepsilon_i$$

$$x_{1+j} \text{ representing controls, namely } GDP2000, WHS, LE, CCOR, POLST, LAW, VOICE, EQ, COAST, BORD, SIZE, POP, ICNU \text{ and } NET$$

[11] This variable is used in lot of other tourism analyses (Song and Li 2008). Crouch (1994) indicates that of the 85 tourism studies reviewed, 48 per cent chose tourists arrivals as the measure of demand.

[12] The variables are explained in Appendix A.

Table 2: Biodiversity and Tourism Arrivals: Empirical Evidence

	I	II	III	IV	V	VI	VII	VII
Constant	-4,307**	-4,841***	-18,434***	-4,902**	-1,565	-2,714	-1,451	-2,420
	(-2.175)	*(-2.678)*	*(-3.034)*	*(-2.205)*	*(-0.925)*	*(-1.473)*	*(-0.856)*	*(-1.428)*
BIRDS	-3.167	-2,245	-135.0	-1,776	-2,836	-974.5	-3,046	-921.6
	(-1.503)	*(-1.007)*	*(-0.067)*	*(-0.219)*	*(-0.525)*	*(-0.129)*	*(-0.563*	*(-0.169)*
WHS	-38,586	-44,311	15,121	11,244,565	163,814	87,300	75,646	92,859
	(-0.738)	*(-0.703)*	*(0.370)*	*(0.883)*	*(0.789)*	*(0.394)*	*(0.366)*	*(0.439*
GDP2000	0.451***	0.419***						
	(3.427)	*(2.842)*						
LE			77.85***					
			(3.151)					
CCORR					4,070***			
					(4.559			
POLST						2,901***		
						(2.840)		
LAW							4,371***	
							(4.590)	
VOICE								3,342***
								(3.753)
EQ		45.84	38.45*	22.8	38.58	99.53*	33.96	84.97*
		(1.457)	*(2.198)*	*(0.630)*	*(0.727)*	*(1.825)*	*(0.635)*	*(1.675)*
COAST	485.3*	578.1*	233.4					
	(1.868)	*(1.931)*	*(1.040)*					
BORD	1,053**	1,101**	1,035*	1,198.2**	1,174***	1,011***	1,186***	1074***
	(2.170)	*(2.054)*	*(1.891)*	*(2.059)*	*(3.718)*	*(2.974)*	*(3.754)*	*(3.351)*
SIZE	0.0005	0.0005	0.0008	0.0005	0.0006	0.0009*	0.0007	0.0005
	(0.690)	*(0.651)*	*(0.956)*	*(0.591)*	*(1.255)*	*(1.825)*	*(1.458)*	*(1.646)*
POP	0.0099	0.092	0.0050	0.0087	0.0079	0.0075	0.0064	0.0075
	(1.509)	*(1.387)*	*(0.770)*	*(1.371)*	*(1.324)*	*(1.171)*	*(1.065)*	*(1.221)*
IUCN		-45.56						
		(-0.548)						
NET				26.51***				
				(3.237)				
R^2adj	0.2977	0.2966	0.2505	0.2813	0.2986	0.2339	0.2998	0.2683
N	159	148	149	116	149	143	149	149

Sources: See Appendix A.
Dependent variable is the number of tourism arrivals in 2003. Absolute t-values in parenthesis.
* Significant at the 90 percent level.
** Significant at the 95 percent level.
*** Significant at the 99 percent level.

Table 3: Biodiversity and Tourism Arrivals: Empirical Evidence for OECD and Developing Countries

	I	II	III	IV	V	VI
Countries Included	OECD	Non-OECD	OECD	Non-OECD	OECD	Non-OECD
Constant	5,375	-1,332*	-181,79	-5,476***	6,357	80.577
	(0.442)	*(-1.905)*	*(-1.351)*	*(-3.007)*	*(0.524)*	*(0.118)*
BIRDS	-560,509**	-862.62	-220,075	572.06	-325,252	-1,195.5
	(-1.996)	*(-0.729)*	*(-1.025)*	*(0.421)*	*(-1.540)*	*(-0.973)*
WHS	17,101,112	54,130	10,196,492	89,782***	25,206,877	136,237***
	(-0.371)	*(1.475)*	*(0.220)*	*(3.093)*	*(0.556)*	*(7.532)*
GDP2000	0.775	0.175***				
	(1.144)	*(2.903)*				
LE			2,445	84.203***		
			(1.376)	*(2.944)*		
CCORR					4,779	1,661
					(0.827)	*(3.375)*
EQ	-436.72	14.910	-211.19	6.031	-306.45	16.338
	(-1.200)	*(0.784)*	*(-0.921)*	*(0.279)*	*(-0.843)*	*(0.803)*
COAST	-7,440	185.89	-4,998	49.843		
	(-0.235)	*(1.217)*	*(-0.121)*	*(0.351)*		
BORD	3,211*	310.94**	3,381*	336.65**	3,188*	340.1**
	(1.810)	*(2.202)*	*(1.920)*	*(2.182)*	*(1.751)*	*(2.383)*
SIZE	-0.0001	0.0003	0.0002	0.0003	0.0003	0.0003
	(-0.114)	*(0.528)*	*(0.217)*	*(0.452)*	*(0.292)*	*(0.576)*
POP	0.0721	0.0119	0.1045**	0.0110	0.1043***	0.0113
	(1.652)	*(1.461)*	*(2.385)*	*(1.368)*	*(2.894)*	*(1.385)*
R^2adj	0.2459	0.4778	0.2894	0.4390	0.2483	0.4686
N	28	120	28	121	28	121

Sources: See Appendix A.
Dependent variable is the number of tourism arrivals in 2003. Absolute t-values in parenthesis.
* Significant at the 90 percent level.
** Significant at the 95 percent level.
*** Significant at the 99 percent level.

As can be seen in Tables 2 and 3, the additional control variables remain mostly stable and significant ($GDP2000$, LE, $CCORR$, $POLST$, LAW, $VOICE$, NET) whereas both $BIRDS$ as proxy for biodiversity and WHS as proxy for culture lose

their explanatory power.[13] In one case biodiversity has even a significant negative impact on the number of tourists traveling to a country. We find this evidence plausible as arrivals do not say anything about the sustainability of tourism, but rather reflect the share of mass-tourism. The significant positive impact of the number of national borders and length of the coast-line in relation to the size of the country (as proxy for beaches) has on tourism arrivals, is supporting this finding, as low costs for (land-based) travels and nice beaches are typical determinants promoting the demand for mass-tourism. Table 2 shows the results for the whole sample, whereas Table 3 distinguishes between OECD and developing countries. The outcome is similar for both country groups. Mass-tourism is not driven by nature.

This result has serious implications for economic policy concerning tourism. If nature is not relevant for the number of arrivals, a concentration on mass tourism might lead to a neglect of nature by the individual suppliers of tourism. In this case, the regeneration of nature will probably be below the ecologically and economically sustainable and necessary degree, causing a loss of biodiversity and in the long-run also losses from trade (see theoretical section).

Next, we test the growth enhancing potential of mass tourism versus sustainable tourism explicitly. We control the theoretical and previous empirical findings in the literature, concerning the positive impact of tourism on economic development. To do so, we try to explain GDP growth between 2003 and 2006 with tourism arrivals per capita 2003 ($TApCapita$) as variable of mass-tourism, and with tourism expenditures per GDP 2003 ($TRpGDP$) as variable of sustainable tourism respectively. Countries concentrating on mass tourism in the past have a high share of tourists relative to their number of inhabitants (see Model 1 below), whereas countries which extended their tourism sector sustainable obtain high tourism receipts relative to their absolute GDP (see Model 2 below). More explicitly, we explain in the following estimation the rate of GDP growth 2003 to 2006 ($GDPgrowth03-06$) with the variable for tourism and five control variables. As also done by Arezki et al. (2009), we use the empirically most important determinants of economic growth. These comprise the absolute GDP per capita ($GDP2003$, regarding the convergence hypothesis we

[13] We do not use $GDP2000$, LE, $CCORR$, $POLST$, LAW, $VOICE$, NET simultaneously in the same estimation because they are highly auto correlated (See Appendix C). This holds also for LE and $CCORR$, $POLST$, LAW and $VOICE$.

expect a negative sign); the openness to trade ($OpenT$, positive sign expected)[14]; the level of the country's education, measured via the HDI-education sub index ($HDIedu$, positive); the price level of investment goods relative to the price of consumer goods ($Kprice$, negative[15]), and the level of economic freedom (we use the Heritage Foundation Index of Economic Freedom (IEF) and expect a positive sign):

$$M1: \quad GDPgrowth03-06_i = \beta_0 + \beta_1 TApCapita + \beta x_{1+j} + \varepsilon_i$$
$$x_{1+j} \text{ representing controls, namely } GDP2003, OpenT, HDIedu, Kprice \text{ and } IEF$$

$$M2: \quad GDPgrowth03-06_i = \beta_0 + \beta_1 TRpGDP + \beta x_{1+j} + \varepsilon_i$$
$$x_{1+j} \text{ representing controls, namely } GDP2003, OpenT, HDIedu, Kprice \text{ and } IEF$$

The output of the White Heteroskedasticity-Consistent estimation is displayed in table 4 below. There is clear evidence that sustainable tourism is growth enhancing. More specific, the higher the share of tourism receipts on countries' GDP the higher is the economic growth in the following three years. On the other side of the coin, mass-tourism (measured as tourism arrivals per domestic inhabitants) is not; but even could deter growth. The coefficient of this relation is negative, although not significant. The other control variables of the growth model show the expected sign (except for IEF) and are significant (except for $Kprice$). An open trade regime and good education possibilities[16] enhance economic growth, which is greater the lower the starting point (GDP per capita) is.

[14] This variable is also suggested for growth models by Alcala and Ciconne (2004).

[15] Klenow and Hsieh (2007) provide evidence that a high relative price of investment goods can impediment economic growth and development.

[16] Education is more significant for economic growth in tourism countries (higher share of tourism receipts per GDP) and a simultaneously lower GDP per capita.

Table 4: Economic Growth and Countries Specialized in Mass versus Sustainable Tourism

	M1	**M2**
constant	0.2002***	0.0922*
	(2.709)	*(1.731)*
TApCapita	-0.0074	X
	(-1.271)	
TRpGDP	X	0.0174**
		(2.415)
GDP2003	-1,92E-06***	-2.17E-06***
	(-3.155)	*(-3.659)*
OpenT	0.0003***	0.0003***
	(3.244)	*(3.207)*
HDIedu	0.0968	0.2030***
	(1.481)	*(4.042)*
Kprice	-0.0092	-8.33E-05
	(-1.481)	*(-0.017)*
IEF	-0.0013	-0.0013*
	(-1.571)	(-1.698)
R^2adj	0.0990	0.1993
N	131	130

Sources: See Appendix A.
Dependent variable is the GDP growth 2003-2006.
Absolute t-values in parenthesis.
* Significant at the 90 percent level.
** Significant at the 95 percent level.
*** Significant at the 99 percent level.

Thus, the lesson for developing countries is pretty clear. It is not sensible to concentrate on mass-tourism. This market segment is not characterized by high income elasticity of demand and does not provide incentives to invest into biodiversity. Rather, developing countries should take measures to preserve nature and invest into sustainable tourism, which could – via gains from international trade – enhance economic growth and has positive effects on biodiversity, as long as it is the abundant factor.

5. Summary and Policy Conclusions

In this paper we discuss how biodiversity contributes to trade structures and economic growth in an endogenous growth framework. We conclude theoretically

that a long-term growth is also possible in a tourism country with a smaller endogenous growth like in industrialized countries, if these countries being engaged in international trade and consumers' preferences are such that tourism demand is highly valued on international markets.

By testing the assumed effects of the countries' biodiversity endowment on the respective received tourism receipts, our theoretical model gains further empirical support. As there is a robust positive impact of biodiversity on the comparative advantage in tourism services in poor countries (stronger than in the OECD), the potential of sustainable tourism can be seen via absolute inbound tourism receipts per capita. These are positively influenced by the richness of biodiversity and negatively determined by a potential biodiversity loss. Contrarily, if we take only the absolute number of tourism arrivals as endogenous variable taking unsustainable (mass-) tourism into consideration instead, the regression result do not hold stable. These results support the idea that only sustainable tourism is driven by biodiversity. By testing the impact of these two different kinds of tourism on economic growth empirically, we conclude that sustainable tourism is beneficial for growth (and therefore for economic development) while unsustainable (mass-) tourism is not growth enhancing in the long-run. To allow for long-term growth, countries must not overuse their nature, here applied as biodiversity, but should use it as a valuable input factor.

Further research is necessary to learn more about price and income elasticityies for sustainable tourism. Nevertheless, our results give us an encouraging hint that it makes sense for developing countries to preserve their biodiversity by assigning the property rights of these natural resource to private or governmental land owners or even to invest into more biodiversity.

Appendix A: Data used in Analysis

Symbol in Analysis	Name of Variable	Proxy for	Year	Source
RCA	Revealed Comparative Advantages	Comparative advantages for tourism, compared with trade†	2003	World Tourism Organization (2007); WTO (2006)
TR	Tourism Receipts	Tourism Receipts, proxy for quality tourism	2003	World Tourism Organization (2007)
TA	Tourism Arrivals	Tourism Arrivals, proxy for mass tourism	2003	World Tourism Organization (2007)
GDPgrowth 03-06	Growth of total GDP 2003 till 2006	GDP Growth	2003	IMF 2006
TApCapita	Tourism Arrival per Capita	Share of foreign tourists per domestic population, proxy for mass tourism	2003	World Tourism Organization (2007), Heston et al. 2006
TRpGDP	Tourism Receipts per GDP in PPP constant US-$	Share of earnings from tourism per GDP, proxy for quality tourism	2003	World Tourism Organization (2007), IMF 2006
BIRDS	Absolute amount of bird species in relation to size of country in km^2	Level of biodiversity‡	2003	BirdLife International 2005
ENBIRDS	Ratio of endangered bird species to all bird species in a country	Level of biodiversity loss	2003	BirdLife International 2005
GDP2000	Real GDP per capita in current US-$ in 2000	Level of disposable income, (lagged because of holiday booking in advance)	2000	IMF 2006
GDP2003	Real GDP per capita in current US-$ in 2003	Level of current development, and quality of life	2003	IMF 2006
LE	Average life expectancy (in years)	Level of current development, especially safety and the quality of the health system	2003	CIA 2005
POP	Absolute amount of population	Absolute amount of population	2003	Heston et al. 2006
SIZE	Size in square kilometers	Size of country	time-invariant	CIA 2005
BOARD	Land borders	Number of direct land borders	time-invariant	CIA 2005
OpenT	Openness to trade	Trade in relation of country's GDP; Exports plus imports in current US-$ divided by GDP per capita in current US-$	2003	Heston et al. 2006
HDIedu	Human Development Report, Education Index	Quality of education system; Index combined of gross enrolment ratio for primary, secondary and tertiary schools and adult literacy rate	2003	UNDP 2005
Kprice	Price of capital goods relative to consumption goods	Ratio price level of investment goods relative to price level of consumption goods	2003	Heston et al. 2006

COAST	length of the Coast Line (in km) in relation to the size of the country in square km	Length of beaches for recreation	time-invariant	CIA 2005
WHS	Number of UNESCO World Heritage sites in relation to the size of the country in square km	Influence of important historical and cultural sites on tourism	2003	German Commission for UNESCO 2005
EQ	Distance of the country (approximate geographic center) to the Equator in grad (longitude)	Differences in climate	time-invariant	CIA 2005
IUCN	Ratio of IUCN category I-IV protected areas per total land area	Additional proxy for assigned property rights of biodiversity to public land owners	2003	WRI 2006
NET	Number of internet accesses per thousand inhabitants	Communication possibilities regarding tourism	2003	World Bank 2007
IEF	Heritage Foundation Index of Economic Freedom	Quality of institutions regarding business activity	2003	Heritage Foundation 2010
CCORR	World Bank governance indicator for control of corruption	Safety of destination and quality of institutions (absence of corruption)	2002	Kaufmann et al. 2006
POLST	World Bank governance indicator for political stability	Safety of destination and quality of institutions (stability of governmental system)	2002	Kaufmann et al. 2006
LAW	World Bank governance indicator for rule of law	Safety of destination and quality of institutions (civil rights, independence of justice)	2002	Kaufmann et al. 2006
VOICE	World Bank governance indicator for voice and accountability	Safety of destination and quality of institutions (freedom of press)	2002	Kaufmann et al. 2006

† The RCA-index for country i is calculated as follows: $RCA(1)_{Ti} = \ln \frac{X_{Ti} / M_{Ti}}{\sum X_i / \sum M_i}$, were X_{Ti} are the inbound tourism receipts, M_{Ti} are the outbound tourism expenditure. The variables X_i and M_i are the total amount of goods and services exported and respectively imported of country i. Another measure reflecting revealed comparative advantages for the tourism industry T in country i is calculated as follows: $RCA(2)_{Ti} = \ln \frac{X_{Ti} / \sum X_{Ti}}{X_i / \sum X_i}$, were X_{Ti} are the inbound tourism receipts. The variables X_i is the total amount of goods and services exports of country i. The results are similar, and hold stable throughout the regression. This is not astonishing as both RCA-Indices are highly correlated ($corr(RCA(1)_{Ti}; RCA(2)_{Ti}) = 0.8747$).

‡ An alternative to the use of number of species for monitoring changes in biodiversity is a biodiversity index relying on individual countries' richness as favored by Magurran (2004) and by Bruckland et al. (2005). The theoretical rigor of their argument is convincing but our indicator ($BIRDS$) is the only indicator which is available worldwide on country scale.

Appendix B: Countries included in the Analysis

Afghanistan
Albania
Algeria
American Samoa
Andorra
Angola
Antigua and Barbuda
Argentina
Armenia
Aruba
Australia
Austria
Azerbaijan
Bahamas
Bahrain
Bangladesh
Barbados
Belarus
Belgium
Belize
Benin
Bermuda
Bhutan
Bolivia
Bosnia and Herzegovina
Botswana
Brazil
Brunei
Bulgaria
Burkina Faso
Burundi
Cambodia
Cameroon
Canada
Cape Verde
Cayman Islands
Central African Rep.
Chad
Chile
China
Colombia
Comoros
Congo, Dem. R.
Congo, Rep. of
Costa Rica
Cote d'Ivoire
Croatia
Cuba
Cyprus
Czech Republic
Denmark
Djibouti
Dominica
Dominican Rep.
Ecuador
Egypt
El Salvador
Equatorial Guinea
Eritrea
Estonia
Ethiopia
Fiji
Finland
France
French Polynesia
Gabon
Gambia
Georgia
Germany
Ghana
Greece
Grenada
Guam
Guatemala
Guinea
Guinea-Bissau
Guyana
Haiti
Honduras
Hong Kong
Hungary
Iceland
India
Indonesia
Iran, Islamic Rep.
Iraq
Ireland
Israel
Italy
Jamaica
Japan
Jordan
Kazakhstan
Kenya
Kiribati
Korea, DPRp
Korea, Republic of
Kuwait
Kyrgyzstan
Laos
Latvia
Lebanon
Lesotho
Liberia
Libya
Liechtenstein
Lithuania
Luxembourg
Macao
Macedonia, FYR
Madagascar
Malawi
Malaysia
Maldives
Mali
Malta
Marshall Islands
Mauritania
Mauritius
Mayotte
Mexico
Micronesia
Moldova
Monaco
Mongolia
Morocco
Mozambique
Myanmar
Northern Marianals
Namibia
Nepal
Neth. Antilles
Netherlands
New Zealand
New Caledonia
Nicaragua
Niger
Nigeria
Norway
Oman
Pakistan
Palau
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Portugal
Puerto Rico
Qatar
Romania
Russian Federation
Rwanda
Saint Kitts and Nevis
Saint Lucia
Saint Vincent and the Grenadines
Samoa
San Marino
Sao Tome and Principe
Saudi Arabia
Senegal
Seychelles
Sierra Leone
Singapore
Slovakia
Slovenia
Solomon Islands
Somalia
South Africa
Spain
Sri Lanka
Sudan
Suriname
Swaziland
Sweden
Switzerland
Syria
Taiwan
Tajikistan
Tanzania
Thailand
Togo
Tonga
Trinidad and Tobago
Tunisia
Turkey
Turkmenistan
Uganda
Ukraine
United Arab Emirates
United Kingdom
United States
Uruguay
Uzbekistan
Vanuatu
Venezuela
Vietnam
Virgin Island
Yemen
Zambia
Zimbabwe

Appendix C: Correlation Matrix

Correlation Matrix

	RCA	TR	TA	BIRDS	ENBIRDS	GDP growth 03-06	TRpGDP	Tap Capita	WHS	GDP 2000	GDP2003	LE	SIZE	POP	OpenT	HDIedu	Kprice	IEF	CCORR	POLST	LAW	VOICE	EQ	COAST	BORD	IUCN	NET
RCA	1,000																										
TR	-0,032	1,000																									
TA	0,000	0,358	1,000																								
BIRDS	-0,108	0,255	-0,005	1,000																							
ENBIRDS	0,075	0,030	-0,032	0,178	1,000																						
GDPgrowth03-06	-0,025	-0,204	-0,043	0,035	0,058	1,000																					
TRpGDP	-0,367	-0,308	-0,123	-0,081	0,022	0,139	1,000																				
TApCapita	-0,003	0,873	0,419	0,330	-0,073	-0,042	-0,297	1,000																			
WHS	-0,048	0,453	0,185	-0,074	-0,287	-0,122	-0,201	0,309	1,000																		
GDP2000	-0,450	0,725	0,456	0,265	-0,017	-0,245	-0,224	0,608	0,412	1,000																	
GDP2003	-0,406	0,725	0,432	0,127	-0,145	-0,263	-0,200	0,566	0,433	0,944	1,000																
LE	-0,235	0,448	0,326	0,160	0,106	-0,068	-0,155	0,385	0,381	0,611	0,525	1,000															
SIZE	-0,115	-0,163	0,303	-0,089	0,139	0,081	0,168	-0,168	-0,251	0,094	0,056	0,041	1,000														
POP	-0,075	-0,157	0,246	-0,057	0,136	0,202	0,312	-0,166	-0,128	-0,088	-0,073	0,004	0,576	1,000													
OpenT	-0,066	0,338	-0,060	0,752	0,106	0,161	-0,242	0,491	0,053	0,250	0,127	0,205	-0,240	-0,191	1,000												
HDIedu	-0,223	0,460	0,317	0,059	0,071	0,109	-0,359	0,428	0,395	0,603	0,531	0,730	0,062	-0,090	0,205	1,000											
Kprice	0,300	-0,434	-0,334	-0,132	-0,074	0,088	0,078	-0,373	-0,337	-0,596	-0,540	-0,628	-0,103	-0,081	-0,124	-0,714	1,000										
IEF	-0,212	0,576	0,146	0,404	0,111	-0,251	-0,298	0,530	0,206	0,694	0,624	0,448	-0,014	-0,208	0,461	0,535	-0,456	1,000									
CCORR	-0,272	0,731	0,368	0,238	0,003	-0,255	-0,281	0,610	0,395	0,899	0,865	0,508	0,035	-0,092	0,246	0,532	-0,542	0,751	1,000								
POLST	-0,079	0,605	0,260	0,163	0,004	-0,056	-0,397	0,587	0,239	0,634	0,616	0,382	-0,032	-0,135	0,312	0,568	-0,350	0,642	0,747	1,000							
LAW	-0,244	0,728	0,377	0,192	0,009	-0,201	-0,289	0,624	0,416	0,882	0,853	0,510	0,020	-0,063	0,247	0,557	-0,538	0,725	0,974	0,790	1,000						
VOICE	-0,106	0,640	0,310	0,029	-0,005	-0,203	-0,350	0,527	0,451	0,724	0,732	0,468	-0,047	-0,161	0,081	0,672	-0,575	0,654	0,807	0,763	0,821	1,000					
EQ	-0,245	0,400	0,279	-0,201	-0,269	0,246	-0,102	0,382	0,399	0,509	0,556	0,442	-0,020	-0,048	-0,007	0,587	-0,385	0,252	0,512	0,522	0,549	0,548	1,000				
COAST	-0,124	0,384	0,054	0,620	0,187	-0,009	-0,111	0,491	-0,049	0,346	0,248	0,239	-0,114	-0,066	0,659	0,140	-0,186	0,480	0,282	0,234	0,260	0,127	-0,054	1,000			
BORD	-0,043	-0,130	0,316	-0,212	-0,245	0,251	0,157	-0,064	-0,016	-0,179	-0,147	-0,191	0,346	0,462	-0,267	-0,088	0,086	-0,385	-0,229	-0,171	-0,196	-0,271	0,073	-0,305	1,000		
IUCN	-0,063	0,057	-0,098	-0,040	0,026	-0,192	-0,049	-0,032	-0,021	0,016	0,008	-0,057	-0,023	-0,067	-0,052	-0,014	-0,059	0,073	-0,014	-0,130	-0,027	-0,042	-0,339	0,049	0,070	1,000	
NET	-0,364	0,629	0,361	0,240	0,039	-0,126	-0,231	0,532	0,359	0,870	0,821	0,588	0,053	-0,088	0,301	0,619	-0,591	0,710	0,852	0,669	0,855	0,761	0,545	0,334	-0,228	0,006	1,000

Appendix D: Descriptive Statistics

Descriptive statistics

	MIN	MAX	Mean	Median	Std-dev.	N
RCA	-3.660	3.2079	0.5879	0.5671	1.1054	126
TR	0.0177	12,352	815.65	121.81	2,089.3	167
TA	6.000	75,048	3951.8	698.00	9170.6	172
BIRDS	3.69E-05	1.1969	0.0662	0.0038	0.1823	202
ENBIRDS	0.0000	0.4943	0.0709	0.0516	0.0701	203
WHS	0.000	0.0394	0.0004	5.74E-06	0.0030	191

References

Aghion, P. and P. Howitt (1998), '*Endogenous Growth Theory*', Cambridge, MA: The MIT Press.

Alcala, F. and A. Ciccone (2004), 'Trade and Productivity', *Quarterly Journal of Economics* 119(2), pp. 612-45.

Arezki, R., R. Cherif and J. Piotrowski (2009), 'Tourism Specialization and Economic Development: Evidence from the UNESCO World Heritage List', IMF Working Paper, WP/09/176.

Ashley, C. and J. Elliot (2003), 'Just Wildlife? or a Source of Local Development?', *Natural Resource Perspectives* 85, pp. 1-6.

Asufu-Adjaye, J. (2003), 'Biodiversity Loss and Economic Growth: A Cross-Country Analysis', *Contemporary Economic Policy* 21(2), pp. 173-185.

Barbier, E.B. and E.H. Bulte (2004), 'Introduction to the Symposium on Trade, Renewable Resources and Biodiversity', *Journal of Environmental Economics and Management* 48, pp. 883-890.

Berno, T. and K. Bricker (2001), 'Sustainable Tourism Development: The Long Road from Theory to Practice', *International Journal of Economic Development* 3, pp. 1-18.

Bibby, C. J., N.J. Collar, M.J. Crosby, M.F. Heath, C. Imboden, T.H. Johnson, A.J. Long, A.J. Stattersfield and S.J. Thirgood (1992), '*Putting biodiversity on the map: Priority areas for global conservation*', Cambridge, UK: International Council for Bird Preservation.

BirdLife International (2004), '*State of the World's Birds 2004: Indicators for the Changing World*', Cambridge, UK: BirdLife International.

BirdLife International (2005), 'Threatened Birds of the World 2005', Retrieved October 13, 2008, from http://www.birdlife.org/datazone/index.html.

Bigano, A., J.M. Hamilton and R.S.J. Tol (2005), 'The Impact of Climate on Holiday Destination Choice', *Climatic Change* 76, pp. 389-406.

Boening-Gaese, K. and H.-G. Bauer (1996), 'Changes of Species Abundance, Distribution and Diversity in a Central European Bird Community', *Conservation Biology* 10, pp. 175-187.

Brander, J.A. and M.S. Taylor (1997), 'International Trade and Open Access Renewable Resources: The Small Open Economy Case', *Canadian Journal of Economics* 30, pp. 526-552.

Brander, J.A. and M.S. Taylor (1998), 'Open Access Renewable Resources: Trade and Trade Policy in a Two-Country Model', *Journal of International Economics* 44, pp. 181-209.

Brau, R., A. Lanza, and F. Pigliare (2003), 'How fast are the Tourism Countries Growing? The Cross-Country Evidence', Fondazione Eni Enrico Mattei Working Paper Series, NOTA DI LAVORO 85.

Bruckland, S.T., A.E. Magurran, R.E. Green, and R.M. Fewster (2005), 'Monitoring Chance in Biodiversity through Composite Indices,' *Philosophical Transactions of the royal Society B* 306, pp. 243-254.

Burgess, N.D., C. Rahbek, F.W. Larsen, P. Williams and A. Balmford (2002), 'How Much of the Vertebrate Diversity of Sub-Saharan Africa is Catered for by Recent Conservation Proposals?', *Biological Conservation* 107(3), pp. 327-339.

Central Intelligent Agency (CIA) (2005), 'The World Factbook 2005', Retrieved December 21, 2005, from http://www.cia.gov/cia/publications/factbook/index.html.

Creaco, S. and G. Querini (2003), 'The Role of Tourism in Sustainable Economic Development', Mimeo, 43rd Congress of European Regional Science Association, 27. August – 30. August 2003, Zagreb.

Crouch, G.I. (1994), 'The Study of International Tourism Demand: A Survey of Practice', *Journal of Travel Research* 32, pp. 41-55.

Deloitte & Touch, International Institute for Environment and Development (iied) & Overseas Development Institute (odi). (1999), '*Sustainable Tourism and Poverty Elimination Study. A Report to the Department for International Development*', London: Deloitte&Touch, iied, odi.

Deutsche Ornithologische Gesellschaft (DO-G) (1995), '*Qualitätsstandards für den Gebrauch vogelkundlicher Daten in raumbedeutsamen Planungen*', Minden: NFN-Medienservice Natur.

Divisekera, S. (2003), 'A Model of Demand for International Tourism', *Annals of Tourism Research* 30(1), pp. 31-49.

Eilat, Y. and L. Einav (2004), 'Determinants of International Tourism: A Three-Dimensional Panel Data Analysis', *Applied Economics* 36, pp. 1315-1327.

Eugenio-Martin, J.L., N.M. Morales and R. Scarpa (2004), 'Tourism and Economic Growth in Latin American Countries: A Panel Data Approach', Fondazione Eni Enrico Mattei Working Paper Series, NOTA DI LAVORO 26.2004.

Freytag, A. and C. Vietze (2009), 'Biodiversity and International Tourism: A Story of Comparative Advantage', *The Open Political Science Journal* 2, pp. 23-34.

Freytag, A., C. Vietze, and W. Völkl (2009), 'What Drives Biodiversity? An Empirical Assessment of the Relation between Biodiversity and the Economy', *Jena Economic Research Paper*, 25/2009, pp. 1-20.

German Commission for UNESCO (UNESCO) (2005), '*Die UNESCO-Liste des Welterbes*', Bonn: unesco info.

Gregory, R.D., D. Noble, R. Field, J. Marchant, M. Raven and D.W. Gibbons (2003), 'Using birds as Indicators of Biodiversity', *Ornis Hungarica* 12/13, pp. 11-25.

Grossman, G. and E. Helpman (1991), '*Innovation and growth in the global economy*', Cambridge, MA: The MIT Press.

Hannesson R. (2000), 'Renewable Resources and the Gains from Trade', *Canadian Journal of Economics* 33, pp. 122-132.

Heston, A., R. Summers and B. Aten (2006), '*Penn World Table Version 6.2.*', Pennsylvania: Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.

Heritage Foundation, The (2010), 'The 2010 Index of Economic Freedom, Excel Dataset', Retrieved January 08, 2010, from http://www.heritage.org/Index/.

Heywood, V.H. (Eds.). (1995), '*Global Biodiversity Assessment. United Nations Environment Programme*', Cambridge, UK: Cambridge University Press.

International Monetary Fund (IMF) (2006), 'World Economic Outlook September 2005', Database. Retrieved January 08, 2006, from http://www.imf.org/external/pubs/ft/weo/2005/02/data/index.htm.

Kanellakis, V. (1975), '*International Tourism: Its Significance and Potential as an Instrument for the Economic Development of Greece*', Ph.D. diss.. Department of Economics, Manhattan, KS: Kansas State University.

Kaufmann, D., A. Kraay and M. Mastruzzi (2006), '*Governance Matters V: Governance Indicators for 1996-2005, Governance Matters V Excel Dataset*', Washington, DC: The World Bank.

Klenow, P.J. and C.-T. Hsieh (2007), 'Relative Prices and Relative Prosperity', *American Economic Review* 97(3), pp. 562-585.

Lanza, A. and F. Pigliaru (1994), 'The Tourism Sector in the Open Economy', *Rivista Internazionale di Scienze Economiche e Commerciali* 41, pp. 15-28.

Lanza, A. and F. Pigliaru (2000), 'Why are Tourism Countries small and fast-growing?', in: A. Fossati and G. Panella (eds), *Tourism and Sustainable Economic Development*, Dordrecht: Kluwer Academic Publisher, pp. 57-69

Lanza, A., P Templec. and G. Urgad (2003), 'The Implications of Tourism Specialisation in the long run: An Econometric Analysis for 13 OECD economies', *Tourism Management* 24, pp. 315-321.

Lawton, J.H., D.E. Bignell, B. Bolton, G.F. Bloemers, P. Eggleton, P.M. Hammond, M. Hodda, R.D. Holt T.B. Larsen, N.A. Mawdsley, N.E. Stock, D.S. Srivastav, and A.D. Watt (1998), 'Biodiversity Inventories, Indicator Taxa and Effects of Habitat Modification in Tropical Forest', *Nature* 391(6662), pp. 72-76.

Lim, C. (1997), 'Review of International Tourism Demand Models', *Annals of Tourism Research* 24(4), pp. 835-849.

Lomborg, B. (2004), '*The Skeptical Environmentalist, Measuring the Real State of the World*', Cambridge, UK: Cambridge University Press.

Lucas, R. (1988), 'On the mechanics of economic development'; *Journal of Monetary Economics* 22, pp. 3-42.

Magurran, A.E (2004), '*Measuring Biological Diversity*', Oxford: Blackwell Science.

McAusland C. and C. Costello (2004), 'Avoiding Invasives: Trade-related Policies for Controlling Unintentional Exotic Species Introductions', *Journal of Environmental Economics and Management* 48, pp. 954-977.

Metrick, A. and M.L. Weitzman (1998), 'Conflicts and Choices in Biodiversity Preservation,' *Journal of Economic Perspectives* 12(3), pp. 21-34.

Moretti, E. (2004), 'Workers' Education, Spillovers, and Productivity: Evidence from Plant-Level Production Functions', *The American Economic Review* 94(3), pp. 656-690.

Muir-Leresche, K. and R.H. Nelson (2000), 'Private Property Rights to Wildlife: The Southern African Experiment', Mimeo, Harare and Maryland: University of Zimbabwe and University of Maryland.

Naidoo, R. and W.L. Adomowicz (2001), 'Effects of Economic Prosperity on Numbers of Threatened Species', *Conservation Biology* 15(4), pp. 1021-1029.

Naidoo, R. and W.L. Adomowicz (2005), 'Biodiversity and Nature-based Tourism at Forest Reserves in Uganda', *Environment and Development Economics* 10(2), pp. 159-178.

Neto F. (2003), 'A new Approach to Sustainable Tourism Development: Moving beyond Environmental Protection', *Natural Resources Forum* 27 (3), pp. 212-222.

Nijkamp, P. (1998), 'Tourism, Marketing and Telecommunication: A Road towards Regional Development', Serie Research Memoranda from Free University Amsterdam, Faculty of Economics, Business Administration and Econometrics 28, pp 1-15.

Pigliaru, F. and A. Lanza (2003), 'How fast are the Tourism Countries Growing? The International Evidence, 1980-95', ERSA conference papers, ersa03p234, European Regional Science Association.

Plachter, H., D. Bernotat, R. Müssner and U. Riecken (2002), ‚Entwicklung und Festlegung von Methodenstandards im Naturschutz', *Schriftenreihe für Landschaftspflege und Naturschutz* 70, pp. 1-566.

Polasky S., C. Costello and C., McAusland (2004), 'On Trade, Land-use, and Biodiversity', *Journal of Environmental Economics and Management* 48, pp. 911-925.

Rawls, R.P. and D.N. Laband (2004), 'A Public Choice Analysis of Endangered Species Listings', *Public Choice* 121, pp. 263-277.

Riecken, U. (1992), 'Planungsbezogene Bioindikation durch Tierarten und Tiergruppen', *Schriftenreihe für Landschaftspflege und Naturschutz* 36, pp. 1-187.

Sinclair, M.T. (1998), 'Tourism and Economic Development: A Survey', *The Journal of Development Studies* 34(5), pp. 1-51.

Smulders S., D. van Soest and C. Withagen (2004), 'International Trade, Species Diversity, and Habitat Conservation', *Journal of Environmental Economics and Management* 48, pp. 891-910.

Song, H. and G. Li (2008), 'Tourism Demand Modeling and Forecasting – A Review of Resent Research', *Tourism Management* 29, pp. 203-220.

United Nations (UN) (1987), '*Report of the World Commission on Environment and Development, Development and International Co-operation: Environment, General Assembly document A/42/427, August 2, 1987, Annex: Our Common Future*', Geneva and New York: United Nations.

United Nations Development Program (UNDP) (2005), '*Human Development Report 2005*', New York: United Nations Development Program.

Valente, S. (2005), 'Growth, Conventional Production and Tourism Specialisation: Technological Catching-up Versus Terms-of-Trade Effects', Fondazione Eni Enrico Mattei Working Paper Series, NOTA DI LAVORO 140.2005.

Vietze, C. (2009), 'What's pushing International Tourism Expenditures?', *Jena Economic Research Paper*, 14/2009, pp. 1-33.

World Bank (2007), 'World Development indicators 2005, Table 5.11: The Information age', Retrieved March 08, 2007, from http://devdata.worldbank.org/wdi2005/Section5.htm.

World Resources Institute (WRI) (2006), 'EarthTrends: The Environmental Information Portal. Biodiversity and Protected Area, Washington DC: World Resources Institute', Retrieved May 04, 2006, from http://earthtrends.wri.org.

World Tourism Organization (2008), '*Tourism Highlights 2008 Edition*', Madrid: UNWTO.

World Tourism Organization (2007), 'Tourism Market Trends, 2006 Edition – Annex', Retrieved March 08, 2007, from http://www.unwto.org/facts/menu.html.

World Trade Organization (WTO) (2006), 'International Trade Statistics 2005', Retrieved January 24, 2006, from http://www.wto.org/english/res_e/statis_e/its2005_e/its05_toc_e.htm.

Zhang, J. and C. Jensen (2007), 'Comparative Advantage: Explaining Tourism Flows', *Annals of Tourism Research* 34 (1), pp. 223-243.