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## **Biodiversity, International Tourism and development**

by

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## **Biodiversity, International Tourism and development\***

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March 2007

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### **Abstract:**

We analyze whether biodiversity is increasing the receipts of tourism and beneficial for Least Developed Countries (LDCs). The underlying assumption is that a rich biodiversity provides a comparative advantage for most LDCs. We use a simple trade theory framework. The model is supported by an empirical analysis. The main findings are that first LDCs seem to have a comparative advantage in (sustainable) tourism, that second incidence of birds as the probably best explored taxonomic group has a positive impact on inbound tourism receipts per capita, and that third the rate of endangered to total birds is negatively influencing tourism receipts.

**Key words:** tourism, economic growth, biodiversity conservation

**JEL-Classification:** F18, Q26

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## 1. Introduction

Since the beginning of the twentieth century tourism has been one of the most remarkable socio-economic phenomena. While in the first half of the last century tourism was an activity for only a small group of often wealthy people, it has become a mass phenomenon after World-War II, particularly from the 1970s on. Now it can be considered that it is a vital dimension of global integration and trade activities. This development suggests that tourism is a superior good with an income elasticity of demand exceeding one. Although domestic tourism currently accounts for approximately 80% of all tourist receipts (Neto 2003, p. 1), there is increasing interest in international tourism. It has now become the world's largest source of foreign exchange receipts and is therefore an essential part of global trade (World Tourism Organization 2007). According to the latest figures compiled by the World Tourism Organization, in 2005 international tourism receipts are estimated at US\$ 680 billion (including international passenger transport it exceeds US\$ 800 billion) and represented approximately 6 per cent of worldwide exports of goods and services (World Tourism Organization 2006, p. 5f). The share of tourism exports has increased to nearly 30 per cent by considering service exports exclusively.

In developing countries, international tourism as superior good may well become an important factor for economic development, as demand increases more than proportionally with income. It stimulates new economic activity because in any destination tourists demand a number of goods and services: e.g. food, accommodation, transportation, entertainment and local handcrafts as souvenirs. To satisfy this demand, the current level of production needs to increase, mainly in Least Developed Countries (LDCs). This provides many more positive effects on the economy beside an increase in production and income as the direct effect. Because the tourism sector is labor intensive this tends towards an increase in employment (Deloitte&Touch, iied and odi 1999; Neto 2003, p. 4ff; Nijkamp 1998, p. 4ff). Another indirect effect is that international tourism may enforce the political leaders in the country of destination to establish good governance, approve more civil rights or open the country for international trade. These assumed effects are particularly relevant for LDCs, which often have high rates of unemployment, low levels of GDP per capita, "problematic" governments and difficulties in entering international trade.

Recent studies investigate empirically the effect that tourism has on economic growth. For instance, Brau, Lanza and Pigliaru (2003) analyze if specializing in tourism is appropriate for LDCs. To answer this question they have compared 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 grow significantly faster than all the other sub-groups considered in their analysis (OECD, Oil, LDC, small countries). Moreover, they find that other growth factors – low basic 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. In other words, they find that tourism specialization is an independent determinant for economic growth (Brau, Lanza and Pigliaru 2003, p. 11-17). Another empirical study supports and confirms this result. Eugenio-Martin et al. (2004) consider the relationship between tourism and economic growth with an analysis based on a panel data approach focusing on Latin American countries between 1985 and 1998. They estimate the relationship between economic growth and increase in the number of tourist arrivals per population conditional on main macroeconomic variables. The findings show that the tourism sector is adequate for the economic growth of medium or low-income countries, though not necessarily for developed countries (Eugenio-Martin et al. 2004, p. 5-11).

Because of these assumed positive effects tourism may have on economic development, a second question to answer is which determinants can promote the demand for tourism. There are many explaining factors for international tourism arrivals such as nature, price, safety<sup>1</sup>, infrastructure and educational level,<sup>2</sup> also entertainment and sightseeing in a certain region or country play a prominent role in the decision making process of tourists for a destination. Proxies for sightseeing and entertainment activities may be such “hard” factors like the number of beaches, bars,

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<sup>1</sup> Eilat and Einav (2004) show in three-dimensional panel data analysis about the determinants of international tourism, that the political risk is quite important for the choice of destination, while the price level only matters for tourism to developed countries.

<sup>2</sup> Eugenio-Martin et al. (2004) try to explain tourist arrivals conditional on GDP and other control variables such as safety, prices and educational level, and investment in infrastructure empirically. Their results provide evidence that low-income countries seem to need adequate levels of infrastructure, education and development to attract tourists, while medium-income countries need high levels of social development like health services and relatively high GDP per

sport facilities, museums, memorial sites, the quantity and quality of accommodation facilities and the like. In addition, geographical aspects such as the number of directly neighboring countries or the distance to rich countries may play a role.

The focus of our examination is on the factor nature, in particular on the question of whether and to what extent biodiversity, as a direct influence for sightseeing activities (safaris etc.) and an indirect influence for “nice nature”, determines the demand for tourism, as it is supposed in number of theoretical papers (e.g. Ashley and Elliott 2003, Creaco and Querini 2003; Muir-Leresche and Nelson 2000, Nijkamp 1998 Valente 2005). Zhang and Jensen (2005) confirm in a panel data analysis dealing with the supply-side of tourism flows that the country fixed effects are highly relevant for the destination choice. They conclude – albeit without a proof – that this result depends on the natural endowment and cultural heritages of the respective country.<sup>3</sup> Because it may be assumed that LDCs are relatively rich in biodiversity, it can be an important precondition for a growing tourism industry, which then contributes to sustainable development in LDCs. In other words: a rich biodiversity may provide a comparative advantage for tourism in LDCs.

This paper concentrates on the determinants of tourism. To deal with this problem, we first present the theoretical considerations and derive three hypotheses about the relation of biodiversity and international tourism. In section 3, we assess the hypotheses empirically. In section 4, we draw cautious conclusion with respect to biodiversity conservation and development.

## 2. Theoretical Foundations

As the aim is to explain the determinants of international tourism, the analysis is based upon a standard Heckscher-Ohlin framework in international trade. Consider a world formed of two small countries, country B (well endowed with biodiversity) and country C (relatively rich of capital). Each country is characterized by a two sector

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capita levels. Finally, the results show that the price level of the destination, in terms of exchange rate and PPP is irrelevant for tourism growth.

<sup>3</sup> There exist, of course, also negative impacts from economic growth and especially tourism (e.g. Berno and Bricker 2001; Neto 2003; Nijkamp 1998) on biodiversity. For general empirical assessments of the relation between biodiversity and economic welfare see Asufu-Adjaye (2003); Freytag, Vietze and Völkl (2007); Lomborg (2004) as well as Naidoo and Adomowicz (2001).

economy which produces manufactures and tourism with two factors of production: capital ( $C$ ) and biodiversity ( $BD$ ). Trade then is based on differences in factor endowment.

The assumption of biodiversity being a factor of production is not standard (see e.g. Brander and Taylor 1997, 1998; Hannesson 2000). These authors treat nature as product. However, it seems highly plausible to treat biodiversity as factor rather than as product: tourists are not directly interested in the number of species. They consume services such as recreation, sightseeing and education. Nature is an input to provide these services. Second, given that the property rights are assigned correctly, biodiversity can be analytically treated like any given factor of production. If property rights exist, the factor has a positive price.

The factor prices are determined differently for both factors. The capital market is decisive for the interest rate as the price for capital. This is standard. The price for the factor biodiversity is the cost of preserving nature. This assumption has important implications for the long run use of this factor. Without a positive price, there is the danger of an overuse, as biodiversity then can be treated as a common pool property. In other words, the distribution of property rights plays a major role for the factor price and factor use.

The two goods are produced with different factor intensities. Manufactures are produced relatively capital intensively, while the production of tourism requires relatively more biodiversity. 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. In a Heckscher-Ohlin world, international trade will force the individuals in the two countries to specialize according to their comparative advantage. Thus, country B focuses on the production of tourism, while country C produces relative more manufactures.<sup>4</sup> The trade implications of this model are the following: country B exports tourism services via mode 2 of GATS (consumption of foreign services abroad). In exchange for the consumption of tourism, the citizens of country C export manufactures. We will use this result in hypothesis 1, claiming that countries with high biodiversity abundance display a comparative advantage in tourism.

After discussing comparative advantage, we focus on absolute figures. The second and third hypotheses deal with absolute tourism receipts and therefore critically depend on the problem of factor prices. First consider that the property rights of capital (and biodiversity) are correctly assigned in country C, but the property rights for biodiversity in country B are not correctly distributed. If property rights are not assigned correctly, the factor price of BD is zero. Country B, thus, faces a typical problem of a common property. Yet, if a species is completely extinct it can not be recovered (Asufu-Adjaye 2003, p. 182). The supply of tourism increases, the price for this service is lower than needed to regenerate the factor and nature will be overused. It takes time to regenerate biodiversity. In the long run, this effect leads to a decrease in international tourism receipts as the input factor degenerates.<sup>5</sup> We use the result in hypothesis 2 in a general manner by claiming that an overuse of biodiversity reduces absolute tourism exports of country B.

In contrast, the third hypothesis is based on a long-term political calculus in country B. This approach leads to a correct assignment of property rights not only for capital, but also for biodiversity; positive factor prices exist in both countries for both factors. The holders of biodiversity have an incentive to reproduce their resource and to prevent an overuse of it. Therefore, trade is taking place according comparative advantage. Hypothesis 3 claims that the absolute international tourism receipts are positively influenced by the degree biodiversity in a country.

### 3. Empirical Evidence

This section of the paper is dedicated to an assessment of the three hypotheses of our theoretical section. First, we claim that countries with abundant biodiversity endowment are likely to export tourism services; they attract high tourism receipts because they have a comparative advantage in tourism services. In other words, there should be a positive correlation between the degree of biodiversity and a measure reflecting comparative advantage, namely the revealed comparative advantage (RCA) for the tourism industry T in country  $i$  in the year 2003. The RCA-

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<sup>4</sup> We do not solve a formal model, as an equilibrium resulting in new world market prices for the traded goods with factor price equalisation is not in our focus.

<sup>5</sup> As factor prices tend to not be equalised in this situation country B may even experiences a loss from trade (Brander and Taylor 1998).



index is calculated as follows:  $RCA_{Ti} = \ln \frac{X_{Ti} / M_{Ti}}{\sum X_i / \sum M_i}$ , where  $X_T$  are the inbound

tourism receipts,  $M_T$  are the outbound tourism expenditure, both reported by World Tourism Organization (2007); and  $X$  respectively  $M$  are the total amount of goods- and services exports and imports (source is WTO 2006) of country  $i$ . This hypothesis will be assessed by estimating the influence of proxies for biodiversity and some control variables on the RCA in a cross country analysis using a simple OLS model.<sup>6</sup>

The second hypothesis reflects the short-term perspective of a biodiversity abundant country. Assuming that a permanent biodiversity loss diminishes the export in tourism of the very country at least in the long run we assess, how a proxy for potential biodiversity loss and therefore for a wrong or incomplete assignment of the property rights of biodiversity influences the inbound tourism receipts per capita for 2003 ( $TR_i$ ) as reported by the World Tourism Organization (2007). For this estimation, we expect a negative sign. The necessary data are available for more than 160 countries and seem uncontroversial. The controls are the same as in hypothesis 1.

The third hypothesis of the theoretical section is that sustainable tourism is a superior good and can “in the long run” create substantial export receipts in tourism, if the regeneration of the natural resource  $BD$  is taken seriously and the property rights of biodiversity are assigned completely. We assess whether the absolute amount of inbound tourism receipts per capita is determined by the same exogenous variables as above, with the exception that we use a proxy for biodiversity instead of one for biodiversity loss. We expect a positive influence of biodiversity on inbound tourism receipts. Furthermore, we use a proxy for property rights of biodiversity as well as a number of control variables to assess their influence on inbound tourism receipts. These are beside those used in hypotheses 1 and 2 mainly institutional variables (see below).

The most important exogenous variables (variable BIRDS and ENBIRDS) as proxies for biodiversity and its loss respectively are measured by the number of birds living in the country for the year 2003, as documented by BirdLife International (2005). Birds are suitable indicators for biodiversity for several reasons (BirdLife International

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<sup>6</sup> It has to be noted that RCA scores may be distorted by trade policy measures. Given that we do not have better indicators, we have to accept this problem and be cautious when deriving policy conclusions.

2004; Boening-Gaese and Bauer 1996; DO-G 1995; Gregory et al. 2003; Plachter et al. 2002; Riecken 1992), especially for studies on a global scale (Bibby et al. 1992; Burgess et al. 2002):

- 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).
- Many species are carnivorous, representing high positions in the food chain. Thus, they also need a complexly structured habitat, fulfilling the requirements for a high prey density. 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.
- Birds may represent the best-known animal taxon, and an avifauna is usually available not only for countries, but also for other geographical or political units.
- The number of bird species can not be politically instrumentalized (Metrick and Weitzman 1998; Rawls and Laband 2004), as long as the counting is done correctly.

The variable BIRDS is expressed as number of bird species in relation to the size of the country in square kilometers (km), as it is done by Asufu-Adjaye (2003). In addition to BIRDS, we calculate the ratio of endangered birds to all birds in a country (variable ENBIRDS). The list of endangered birds is applied world-wide. Therefore, even if some distortions are in the list, this holds for all countries similarly. Other exogenous variables are the following:

- real GDP per Capita in current US-\$ for the year 2000 (GDP2000) and 2003 (GDP2003), source is Heston, Summers and Aten (2006) and IMF (2006),
- the length of the coast line (in km) in relation to the size of the country in square km (COAST) as a proxy for beaches, source is CIA (2005),
- the number of UNESCO world heritage sites in relation to the size of the country in square km (WHS), source is UNESCO (2005),
- the distance of the country to the equator in grad (EQ) as a proxy for differences in climate, source is CIA (2005),

- the number of national borders (BORD), source is CIA (2005),
- life expectancy (LE) as a proxy for the safety of a destination, source is CIA (2005),
- the World Bank governance indicators for Control of Corruption (CCORR), Political Stability (POLST), Rule of law (LAW) and Voice and Accountability (VOICE); all of these also as proxy for the safety of a destination, source is Kaufmann, Kraay and Mastruzzi (2006).
- the ratio of ICNU category I-IV protected areas per total land area of the country (ICNU) as a proxy for well allocated property rights of biodiversity, source is WRI (2006),
- finally the number of internet accesses per thousand inhabitants (NET) as a proxy for communication possibilities, source is World Bank 2007.

Because it is apparent that the variables are very heterogeneous we generally run a White-Heteroskedasticity Residual Test. These tests approve our assumption. Thus we use an estimator robust to heteroskedasticity. Although this estimation technique produces higher standard errors and therefore lower t-statistics in our sample, the significance of the following regression results is high.

*a) Biodiversity and comparative advantage*

The first hypothesis suggests that biodiversity is influencing the comparative advantage of countries. The higher the biodiversity abundance in a country, the higher is the RCA index for tourism in this country. We add the current GDP per capita as proxy for the state of development (expected sign negative), the number of World heritage sites (positive) and the length of the coastline (positive) as control variables. For a test of this hypothesis, we apply the following OLS estimation:

$$(1) \quad RCA_T = \beta_0 + \beta_1 BIRDS + \beta_2 GDP2003 + \beta_3 WHS + \beta_4 COAST + \varepsilon$$

**Table 1: Biodiversity and Revealed Comparative Advantage**

	I	II	III	IV
<b>Constant</b>	0.129***	0.835***	0.717***	0.699***
<b>BIRDS</b>	2.632***	2.79***	2.803***	2.441***
<b>GDP2003</b>		-3.45E-05***	-3.02E-05***	-3.01E-05***
<b>WHS</b>			-41.3	-56.9
<b>COAST</b>				0.5*
<b>R<sup>2</sup>adj</b>	0.122	0.225	0.221	0.223
<b>N</b>	126	125	124	124

Dependent variable is the RCA-index in 2003 as calculated above.

\* Significant at the 90 percent level.

\*\* Significant at the 95 percent level.

\*\*\* Significant at the 99 percent level.

The interpretation of Table 1 is fairly simple. The abundance of biodiversity has a positive impact on the RCA-index. Countries with a rich biodiversity have a comparative advantage in tourism services and are able to exploit it. At the same time, these countries have a relatively low GDP per capita, implying that the potential for convergence is given. Both results make sense and are in line with the theoretical reasoning. These two results remain robust, even if we introduce further control variables, i.e. the number of UNESCO world heritage sites and the length of the coast. The latter variables do not improve our estimates, which is probably due to the fact that the RCA index is directed at relative trade flows. These variables may rather influence absolute flows (Tables 2 and 3). The rather low R<sup>2</sup>adj reflects the fact that the RCA index contains much more information than just tourism data.

#### *b) Biodiversity and tourism receipts: the short-term perspective*

The next function we estimate can be interpreted as an aggregate demand function for tourism services by foreigners. As we take the short term perspective, we analyze the loss of biodiversity. We expect a negative impact of potential biodiversity loss, namely the share of endangered birds in all birds living in a country, on inbound tourist receipts per capita. The additional determinants of inbound tourism receipts of a country depend on roughly the same exogenous variables as in model 1. However,

we expect that the GDP per capita in the host country is positively influencing inbound tourism receipts per capita, as foreigners expect certain standards in the host country. As tourists plan some time in advance, we use data of 2000. Similarly, life expectancy can be interpreted as proxy for personal security (positive). The distance to the equator increases the attractiveness for tourist. Again, we use an OLS regression model:

$$(2) \quad TR_i = \beta_0 + \beta_1 ENBIRDS + \beta_2 WHS + \beta_3 GDP2000 + \beta_4 LE + \beta_5 EQ + \beta_6 COAST + \varepsilon$$

*Table 2: Endangered Biodiversity and Tourism Receipts: Empirical Evidence*

	I	II	III	IV
<b>Constant</b>	38.5	-856*	-874***	-1,149***
<b>ENBIRDS</b>	-2,228**	-3,035*	-2,896**	-4,616**
<b>WHS</b>	250,281***	273,977***	276,187***	275,827***
<b>GDP2000</b>	0.052***			
<b>LE</b>		21.78***	22.28***	28.33***
<b>EQ</b>		0.029	-0.58	
<b>COAST</b>	223.8	85.9		198.3
<b>R<sup>2</sup>adj</b>	0.5843	0.4859	0.4872	0.3700
<b>N</b>	159	149	149	161

Dependent variable is the amount of Tourism Receipts in 2003.

\* Significant at the 90 percent level.

\*\* Significant at the 95 percent level.

\*\*\* Significant at the 99 percent level.

The results are supporting our second hypothesis. A potential biodiversity loss discourages international tourism; the result is robust when other variables are added. The same holds with the positive impact of GDP on inbound tourism receipts and the number of world heritage sites. Whereas the latter are attracting foreign demand for domestic tourism services, potential biodiversity loss is deterring tourists. However, the explanatory power of other variables (with the exception of life expectancy) is relatively low, but the signs are as expected.

*c) Biodiversity and tourism receipts: the long-term perspective*

Again we estimate an aggregate demand function for tourism services by foreigners, employing all of the foregoing and some additional exogenous variables to explain inbound tourism receipts of a country. Instead of biodiversity loss, we employ actual biodiversity abundance (BIRDS). We expect a positive influence from the incidence of bird species to inbound tourism receipts per capita. For the rest of the variables we also expect a positive sign. Again, we use an OLS regression model:

$$(3) \quad TR_i = \beta_0 + \beta_1 BIRDS + \beta_2 WHS + \beta_3 GDP2000 + \beta_4 LE + \beta_5 CCORR + \beta_6 POLST \\ + \beta_7 LAW + \beta_8 VOICE + \beta_9 EQ + \beta_{10} COAST + \beta_{11} BORD + \beta_{12} ICNU + \beta_{13} NET + \varepsilon$$

The results in Tables 3a and 3b do indeed support the third hypothesis. Those countries rich in biodiversity are attracting high inbound tourism receipts per capita. This result is absolutely robust across all fourteen estimations. This finding implies that it is sensible to assign the property rights of biodiversity to preserve biodiversity in the long run. The proxy for property rights of biodiversity, the ratio of ICNU protected areas per total land area, shows the right sign but is not significant, except in estimation XIV ICNU is significant at the 90 % level. Nevertheless, the result is encouraging as anecdotal evidence shows. Muir-Leresche and Nelson (2000) describe that in the past 30 years, Zimbabwe, Namibia and South Africa have given private landowners full control (and the full opportunity to profit) over the use of wildlife of there land. Consequently, wildlife tourism on private land has boomed. This task has had more success in promoting biodiversity in the southern African region than any other policy measure.

The other control variables high GDP per capita or high life expectancy, good governance expressed with the World Bank governance indicators, as proxy for safety are relevant predictors for tourists' choice of a destination.<sup>7</sup> As expected a high number of world heritage sites, mild climate (increasing distance to the equator)

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<sup>7</sup> As in regression model 2) we do not use GDP2000, LE, CCORR, POLSTAB, LAW and VOICE simultaneous in the same estimation because they are highly correlated. This counts also for LE and CCORR, POLSTAB, LAW and VOICE.

and good communication possibilities (a high rate of internet access) are also important for the demand for tourism, as tourists care for complementary goods and services. The higher the number of national borders the lower are the tourism receipts. Because long-range travelers generate high tourism receipts but will be discouraged by cross-border mass tourists, this finding is astonishing only at first glance (see also section 4). The variable length of the coast line in relation to the size of the country (as proxy for beaches) does not add much to the explanatory power of the model.

*Table 3a: Biodiversity and Tourism Receipts: Empirical Evidence (I-VIII)*

	I	II	III	IV	V	VI	VII
<b>Constant</b>	-129.3	-147.7	610.8***	-1118.3***	297.4***	300.9***	306.4***
<b>BIRDS</b>	2,057.1**	1,999.2**	2,440.2**	2,399.0**	1,803.0**	2,857.6*	1,793.0**
<b>WHS</b>	223,428***	219,306***	236,181***	224,850***	245,036***	232,134***	236,932***
<b>GDP2000</b>	0.047***	0.048***					
<b>LE</b>			10.29***	22.03***			
<b>CCORR</b>					372.3***		
<b>POLST</b>						291.1***	
<b>LAW</b>							386.4***
<b>VOICE</b>							
<b>EQ</b>			8.54*				
<b>COAST</b>		132.1	-0.22	67.65			
<b>BORD</b>							
<b>ICNU</b>							
<b>NET</b>							
<b>R<sup>2</sup>adj</b>	0.6097	0.6130	0.5300	0.3868	0.5916	0.5681	0.5920
<b>N</b>	160	160	150	162	160	153	160

Dependent variable is the amount of Tourism Receipts in 2003.

\* Significant at the 90 percent level.

\*\* Significant at the 95 percent level.

\*\*\* Significant at the 99 percent level.

*Table 3b: Biodiversity and Tourism Receipts: Empirical Evidence (IX-XII)*

	VIII	IX	X	XI	XII	XIII	XIV
<b>Constant</b>	351.3***	-26.8	-24.4	-206.3	-229.85	-635.9***	-71.35
<b>BIRDS</b>	2,046.0**	2,629.7**	2,638.7**	2,137.9**	2,146.5**	2,451.1**	1,004.1***
<b>WHS</b>	234,550***	238,892***	239,252***	235,898***	236,612***	236,769***	916,134**
<b>GDP2000</b>							
<b>LE</b>				6.23*	6.03*	10.19***	
<b>CCORR</b>							
<b>POLST</b>							
<b>LAW</b>							
<b>VOICE</b>	375.2***						
<b>EQ</b>		12.41***	12.36**	11.19**	11.03**	8.38*	2.00
<b>COAST</b>		11.1					
<b>BORD</b>				-57.38**	-58.34**		
<b>ICNU</b>					6.16	5.10	8.97*
<b>NET</b>							0.8528***
<b>R<sup>2</sup>adj</b>	0.4245	0.527	0.532	0.5430	0.5411	0.5313	0.5131
<b>N</b>	161	150	150	150	150	150	117

Dependent variable is the amount of Tourism Receipts in 2003.

\* Significant at the 90 percent level.

\*\* Significant at the 95 percent level.

\*\*\* Significant at the 99 percent level.

#### 4. Implications for Economic Development

After demonstrating the positive effects of biodiversity on international tourism receipts, we will extend the analysis to the development and growth effects of international trade in tourism for country B. In addition to the assumptions in section 2, it first will be assumed, that B has a low GDP per capita; probably lower than in C. Then the GDP per capita of B can converge to the higher one of C if the growth rate of GDP  $\dot{x}_B$  in country B is higher than that of country C ( $\dot{x}_C$ ).



We now turn to the question of how trade in tourism affects economic development in LDCs. The answer to this question can be assumed to depend on a “terms of trade effect”. In other words, tourism is beneficial for growth if the international terms of trade move in favor of tourism services. This is the case if tourism is a superior or luxury good, such that consumers’ preferences increase strongly by increasing income (income elasticity of demand higher than one) (Brau, Lanza and Pigliaru 2003, S. 16; Eilat and Einav 2004, p. 1325). Furthermore there is a low price elasticity of demand at least aside from mass tourism.<sup>8</sup> The consequence is a terms of trade “improvement” in country B as an increase of the relative price of tourism by increasing world GDP. In other words, an increase of GDP in country C tends to result in a higher demand for tourism, which is produced by country B and this causes a relative rise in prices for tourism. Growth in country B then exceeds the growth in country C.

However, this mechanism is only working if it is not based on output expansion; it demands the development of sustainable tourism, which is using but is not overusing biodiversity. 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, the complete allocation of the property rights for biodiversity to private or governmental land owners is crucial. Their self-interest lead them not to overuse “their” biodiversity.

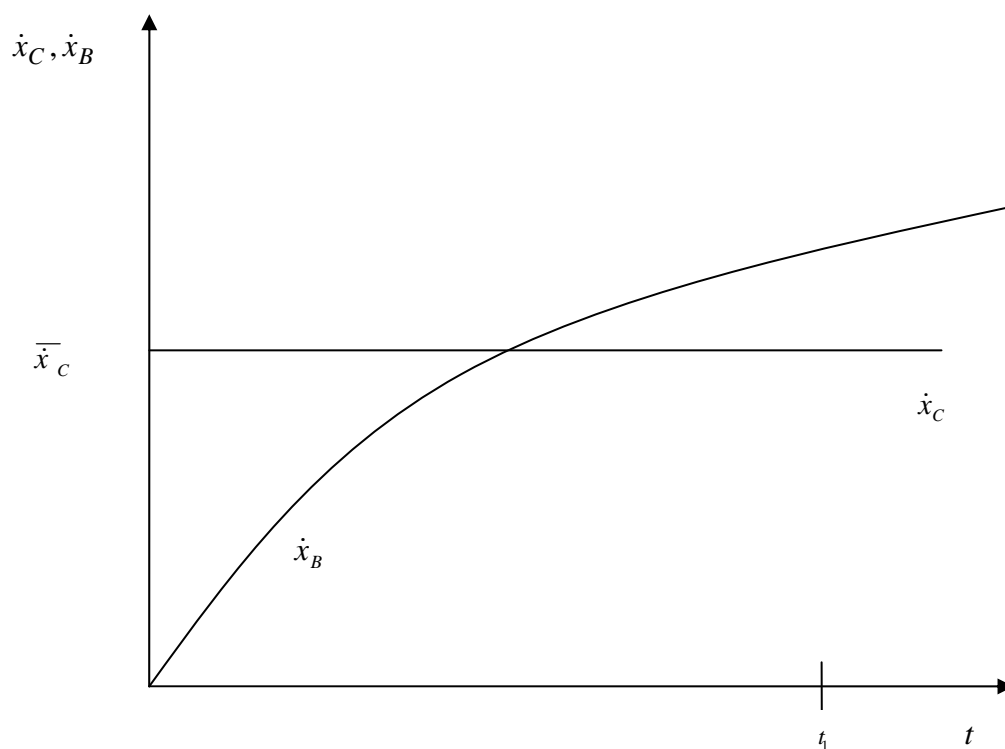
In Figure 1, the degree of biodiversity remains constant (“correct” factor price) and the GDP growth rate  $\dot{x}_B$  increases beyond the growth rate of country C (whose GDP-growth rate remains constant).<sup>9</sup> Hence, the regeneration of biodiversity is a necessary condition in this framework, which then attracts sustainable tourism and an expansion of tourism products with low price elasticity of demand.

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<sup>8</sup> Eilat and Einav (2004) find empirically that there is a low price elasticity of demand for tourism to low GDP destinations, in which tourism are typically no mass phenomena. 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.

<sup>9</sup> There may be a point in time far beyond  $t_1$  when growth in country B is deteriorating again as convergence in proceeding. This is not covered by Figure 1.

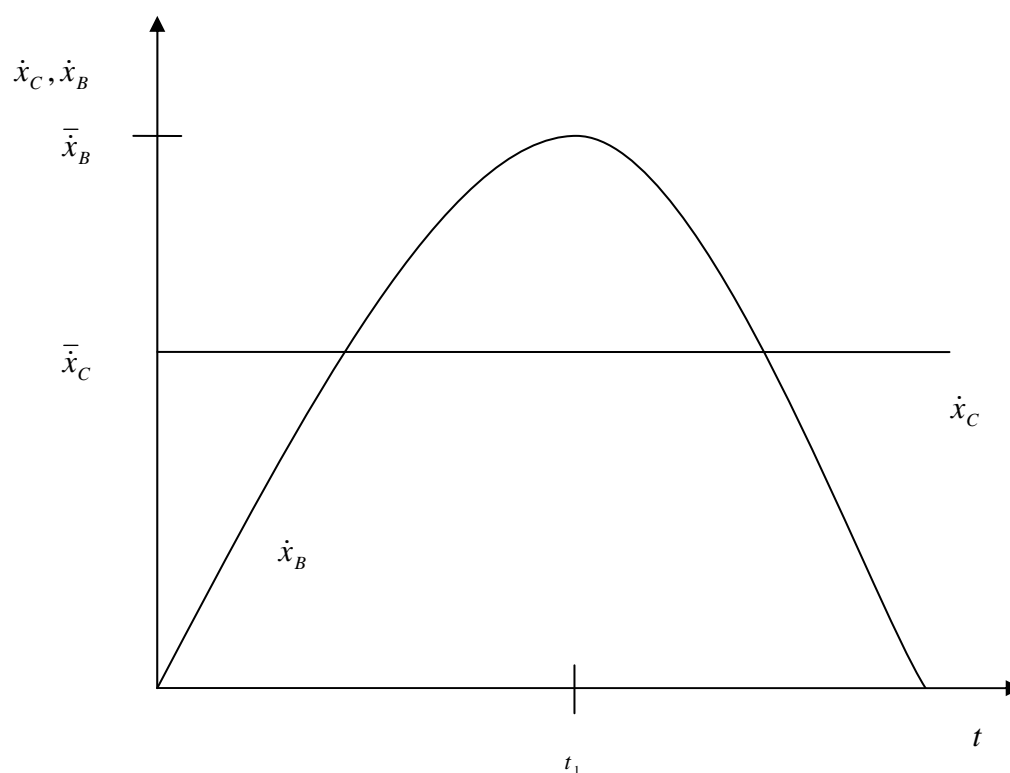
**Figure 1: Regeneration of Biodiversity and Convergence**



What happens if property rights are not assigned correctly? Given that under this condition biodiversity is overused, the growth dynamics in country B will not be sustainable, which can be shown in a short-term interpretation. For the short term interpretation, consider at a certain point of time  $t < t_1$ , not all of the common property biodiversity is used in country B, so that in the short run a maximum economic utilization of biodiversity in country B tends to result in a higher rate of GDP-growth in B than in C ( $\dot{x}_B > \dot{x}_C$ ). So, a complete utilization of the (slowly regenerative) biodiversity in country B tends to support a convergence of the GDP-growth rate  $\dot{x}_B$  to the upper limit  $\bar{x}_B$ , where an increase of  $\dot{x}_B$  is impossible. For this to happen, the absolute supply of tourism services and respective tourism receipts have to increase with the abundance of biodiversity.

From the point of time  $t_1$ , an additional utilization of biodiversity 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. Figure 2 points out to this development. This is an individually rational action of every tourism manager assuming that if she does not use (and thereby overuse) the biodiversity, her competitors will be doing it. Over time and because of a decrease of the natural endowment of biodiversity in B, this behavior results in a lower GDP-growth rate in country B than in country C ( $\dot{x}_B \leq \dot{x}_C$ ). The incremental degeneration of biodiversity causes losses from trade instead of gains from trade. Country B exploits its natural resource and generates an increasing GDP. Until  $t_1$ , the growth rate of GDP increases and income convergence to country C takes place. From  $t_1$  on, the resource is overused. Productivity and growth decline. Instead of a convergence, the income divergence to country C increases after that. Consequently, in this interpretation a long run GDP growth as a result of the specialization on tourism is impossible.

**Figure 2: Over Utilization of Biodiversity and Convergence**



Turning to policy implications, this analysis makes clear 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 is characterized by the opposite elasticity structure. Therefore, to compete on this market and to increase income and employment via mass tourism, the supply 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 does not depend on biodiversity nor on other elements of highly priced tourism such as culture.

The latter has been shown by Bigano, Hamilton and Tol (2005) and is further validated in Table 4. Instead of the absolute amount of receipts generated through international tourism, we focus on the number of tourist arrivals 2003 (World Tourism Organization 2005) in a country as endogenous variable.

$$(4) \quad TA_i = \beta_0 + \beta_1 BIRDS + \beta_2 WHS + \beta_3 GDP2000 + \beta_4 LE + \beta_5 CCORR + \beta_6 POLST + \beta_7 LAW + \beta_8 VOICE + \beta_9 EQ + \beta_{10} COAST + \beta_{11} BORD + \beta_{12} ICNU + \beta_{13} NET + \varepsilon$$

As can be seen in Table 4, some of the control variables remain stable and significant (GDP 2000, LE, CCORR, POLSTAB, LAW, VOICE, NET) whereas both BIRDS as proxy for biodiversity and WHS as proxy for culture lose their explanatory power.<sup>10</sup> In some cases biodiversity has even a significant negative impact on the number of tourists traveling in a country. We find this evidence plausible as arrivals do not say anything about the sustainability of tourism. Rather, the figures reflect the share of mass tourism which is not dependent on nature and culture in the first place. The significant positive impact which 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

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<sup>10</sup> As in regression model 3) we do not use GDP2000, LE, CCORR, POLSTAB, LAW and VOICE simultaneous in the same estimation because they are highly auto correlated. This counts also for LE and CCORR, POLSTAB, LAW and VOICE.

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 4: Biodiversity and Tourism Arrivals: Empirical Evidence*

	I	II	III	IV	V	VI	VII	VII
<b>Constant</b>	-4,536**	-4,651***	-2E+4***	-5,243**	-666.4	-389.1	-661.8	-862.8
<b>BIRDS</b>	-3,194	-2,849	-1,198***	-4,075	-4,812	-5,294	-5,462	-964.5
<b>WHS</b>	-48,604	-57,778	852.9	6,628,017	176,915	97,588	83,406	84,773
<b>GDP2000</b>	0.465***	0.450***						
<b>LE</b>			283.1***					
<b>CCORR</b>					4,584.8***			
<b>POLST</b>						3,810.1***		
<b>LAW</b>							4,889.9***	
<b>VOICE</b>								4,019.1***
<b>EQ</b>		27.27	58.83	8.46				
<b>COAST</b>	514.6**	577.5**	201.7					
<b>BORD</b>	1,281.0**	1,323.0***	1248.0***	1,545.1***	1,384.4***	1,329.4***	1,395.0***	1,416.0***
<b>ICNU</b>		-53.79						
<b>NET</b>				29.44***				
<b>R<sup>2</sup>adj</b>	0.2675	0.2674	0.2216	0.2678	0.2735	0.5681	0.2775	0.2164
<b>N</b>	160	149	152	116	162	153	162	164

Dependent variable is the amount of Tourism Arrivals in 2003.

\* Significant at the 90 percent level.

\*\* Significant at the 95 percent level.

\*\*\* Significant at the 99 percent level.

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 leads 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 necessary degree, causing a loss of biodiversity and in the long run also losses from trade (Figure 2). Thus, the lesson for developing countries is pretty clear. It is not sensible to

concentrate on mass tourism, as 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 probably generates gains from international trade and has positive effects on biodiversity.

## **5. Summary and Conclusions**

In this paper we discuss how biodiversity contributes to trade structures and economic growth. While we are able to find a robust positive impact of biodiversity on the comparative advantage in tourism services in poor countries, the potential of sustainable tourism can be seen indirectly via absolute inbound tourism receipts per capita. These are positively influenced by the richness of biodiversity and negatively determined by a potential biodiversity loss. These results support the idea that sustainable tourism is growth friendly, although they do not provide strong evidence. Further research is necessary to learn more about price and income elasticities for sustainable tourism. Nevertheless, our results give us an indirect and 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.

## References

- Ashley, C. and J. Elliot (2003), 'Just Wildlife?' or a Source of Local Development?, *Natural Resource Perspectives*, No. 85, pp. 1-6.
- Asufu-Adjaye, J. (2003), Biodiversity Loss and Economic Growth: A Cross-Country Analysis, *Contemporary Economic Policy*, Vol. 21, No. 2, pp. 173-185.
- Berno, T. and K. Bricker (2001), Sustainable Tourism Development: The Long Road from Theory to Practice, *International Journal of Economic Development*, Vol. 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.
- Bigano, A., J. M. Hamilton and R. S. J. Tol (2005) *The Impact of Climate on Holiday Destination Choice*, Fondazione Eni Enrico Mattei Working Paper Series, NOTA DI LAVORO 4.2005.
- 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*, <http://www.birdlife.org/datazone/index.html>, internet research of October 13, 2005.
- Boening-Gaese, K. and H.-G. Bauer (1996), Changes of Species Abundance, Distribution and Diversity in a Central European Bird Community, *Conservation Biology*, Vol. 10, pp. 175-187.
- Brandner, J. A. and M. S. Taylor (1997), International Trade and Open Access Renewable Resources: The Small Open Economy Case, *Canadian Journal of Economics*, Vol. 30, pp. 526-552.
- Brandner, J. A. and M. S. Taylor (1998), Open Access Renewable Resources: Trade and Trade Policy in a Two-Country Model, *Journal of International Economics*, Vol. 44, pp. 181-209.
- Brau, R., A. Lanza and F. Pigliaru (2003), *How Fast are the Tourism Countries Growing? The Cross-Country Evidence*, Fondazione Eni Enrico Mattei Working Paper Series, NOTA DI LAVORO 85.2003.
- 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*, Vol. 107, No 3, pp. 327-339.
- Central Intelligence Agency (CIA) (2005), *The World Factbook 2005*, <http://www.cia.gov/cia/publications/factbook/index.html>, internet research of December 21, 2005.
- Creaco, S. and G. Querini (2003), *The Role of Tourism in Sustainable Economic Development*, mimeo, 43<sup>rd</sup> Congress of European Regional Science Association, 27. August – 30. August 2003, Zagreb.
- Deloitte&Touch, International Institute for Environment and Development (iied) and 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.
- Eilat, Y. and L. Einav (2004), Determinants of International Tourism: A Three-Dimensional Panel Data Analysis, *Applied Economics*, Vol. 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.; C. Vietze and W. Völkl (2007), *Biodiversity and Economic Development*, mimeo, Friedrich-Schiller-Universität Jena.
- 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*, Vol. 12-13, pp. 11-25.
- Hannesson R. (2000), Renewable Resources and the Gains from Trade, *Canadian Journal of Economics*, Vol. 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.
- International Monetary Fund (IMF) (2006), *World Economic Outlook September 2005, Database*, <http://www.imf.org/external/pubs/ft/weo/2005/02/data/index.htm>, internet research of January 08, 2006.
- Kaufmann D., A. Kraay and M. Mastruzzi (2006), Governance Matters V: Governance Indicators for 1996-2005, Governance Matters V Excel Dataset, Washington: The World Bank.
- 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*, Vol. 391, No. 6662, pp. 72-76.
- Lomborg, B. (2004), *The Skeptical Environmentalist, Measuring the Real State of the World*, Cambridge, UK: Cambridge University Press.
- Metrick, A. and M. L. Weitzman (1998), Conflicts and Choices in Biodiversity Preservation, *Journal of Economic Perspectives*, Vol. 12, No. 3, pp. 21-34.
- Muir-Leresche, K. and R. H. Nelson (2000), *Private Property Rights to Wildlife: The Southern African Experiment*, mimeo, Harare and Maryland.
- Naidoo, R. and W. L. Adomowicz (2001), Effects of Economic Prosperity on Numbers of Threatened Species, *Conservation Biology*, Vol. 15, No. 4, pp. 1021-1029.
- Neto, F. (2003), *A New Approach to Sustainable Tourism Development: Moving Beyond Environmental Protection*, United Nations, Department of Economic and Social Affairs, DESA Discussion Paper, No. 29.



- 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, No. 28.
- Plachter, H., D. Bernotat, R. Müssner and U. Riecken, (2002), Entwicklung und Festlegung von Methodenstandards im Naturschutz, *Schriftenreihe für Landschaftspflege und Naturschutz*, Vol. 70, pp. 1 – 566.
- Rawls, R. P. and D. N. Laband (2004), A public Choice Analysis of Endangered Species Listings, *Public Choice*, No. 121, p. 263-277.
- Riecken, U. (1992), Planungsbezogene Bioindikation durch Tierarten und Tiergruppen, *Schriftenreihe für Landschaftspflege und Naturschutz*, Vol. 36, pp. 1-187.
- 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.
- World Bank (2007), *World Development indicators 2005, Table 5.11: The Information age*, <http://devdata.worldbank.org/wdi2005/Section5.htm>, internet research of March 08, 2007.
- World Resources Institute (2006), *EarthTrends: The Environmental Information Portal. Biodiversity and Protected Areas*, Washington DC: World Resources Institute, <http://earthtrends.wri.org>, internet research of May 04, 2006.
- World Tourism Organization (2006), *Tourism Highlights 2006 Edition*, Madrid: UNWTO.
- World Tourism Organization (2007), *Tourism Market Trends, 2006 Edition – Annex*, <http://www.unwto.org/facts/menu.html>, internet research of March 08, 2007.
- World Trade Organization (WTO) (2006), *International Trade Statistics 2005*, [http://www.wto.org/english/res\\_e/statis\\_e/its2005\\_e/its05\\_toc\\_e.htm](http://www.wto.org/english/res_e/statis_e/its2005_e/its05_toc_e.htm), internet research of January 24, 2006.
- Zhang, J. and C. Jensen (2005), *Comparative Advantages in Tourism: A supply-Side Analysis of Tourism Flows*, mimeo, 45<sup>th</sup> Congress of European Regional Science Association, 23. August – 27. August 2005, Amsterdam.

## Appendix A: Countries included in the Analysis

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