

Fishing for answers? Impacts of marine ecosystem quality on coastal tourism demand

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Vladimir Otrachshenko

Faculdade de Economia, Nova School of Business and Economics, Universidade Nova de Lisboa,
Campus de Campolide, 1099-032, Lisbon, Portugal.

Ural Federal University, Graduate School of Economics and Management, Mira 19, 620002,
Yekaterinburg, Russian Federation.

Email: vladoctr@novasbe.pt. (Corresponding author.)

Francesco Bosello

Fondazione Eni Enrico Mattei, Euro-Mediterranean Center on Climate Change, Isola di San
Giorgio Maggiore, 8, 30124, Venice, Italy.

University of Milan, Via Festa del Perdono 7, 20122 Milano, Italy.

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Abstract

This paper examines the impact of marine ecosystem quality on inbound coastal tourism in the Baltic, North Sea, and Mediterranean countries. Using marine protected areas (MPAs) and the fraction of overexploited species as a proxy for marine ecosystem quality, we apply an autoregressive distributed lag model in a destination-origin panel set up. The empirical findings suggest that the presence of MPAs and the fraction of overexploited species have a considerable impact on inbound coastal tourism. Moreover, the impact of the overexploitation index on tourism is persistent and its short-term (current) impact constitutes 65% of the long-term impact. The results underscore the importance of marine ecosystem quality for inbound coastal tourism and its overall impact that may exceed the impact of tourists' income. We also find that government performance is crucial for inbound tourism.

Keywords: coastal tourism; marine ecosystem quality; marine protected area; government performance; overexploitation index; panel data

JEL Classification: C33; Q57; Q26

Introduction

The importance of coastal and marine ecosystems for human well-being is widely recognized. There is a growing literature that discusses and attempts to estimate economic benefits for human society of their services (Costanza et al., 1998; Daily et al., 2000; De Groot, 1994; De Groot et al., 2002; Halpern et al., 2008; UNEP-WCMC, 2006; among others).

A particularly important economic benefit that healthy coastal and marine ecosystems can generate is a stimulus to tourism activity. The tourism industry is one of the major contributors to value added creation in both developing and developed countries. For instance, in 2012 total direct tourism expenditure alone in the European Union was approximately 331 billion Euros corresponding to 2.5% of its total GDP.¹

Although official and worldwide statistics are not available, the coastal segment often accounts for the bulk of tourism and is growing fast in many countries. It is thus essential to boost investment flows, create jobs, and support public and private sectors such as public and private transportation, accommodations, food and restaurants, recreational facilities, etc.

However, as confirmed by many studies and official documents (e.g. Sanchirico et al., 2002; UNEP, 2006; Cinner et al., 2012; FAO, 2013; IPCC, 2014a and 2014b), marine resources are either overexploited or are at a critically endangered level. Consequently, the services they provide, including the attractiveness for tourists, are also endangered.

To the best of our knowledge, there are few studies on the relationship between ecosystem quality and coastal tourism demand, especially regarding marine ecosystems. The main challenge of such analysis is that many countries have developed their own measures of environmental quality (EEA, 2012b) which are not always comparable. Yet, for policy purposes, it is important to quantify the relationship between coastal tourism and environmental quality, providing a better understanding of how economic benefits

and costs are associated with environmental quality such as in Bigano et al. (2007), Onofri et al. (2013), and Onofri and Nunes (2013) at a country level.²

Onofri et al. (2013) estimate the impact of biodiversity indicators and total protected area (PA) on coastal tourism in the Southern Mediterranean countries. The authors find a marginal correlation between PAs and tourist arrivals, concluding that the degradation of PAs leads to the reduction of total tourist arrivals in the range between 0.17% and 4.52% in this region.

Onofri and Nunes (2013) extend the previous work by analyzing a larger set of countries. The authors use the number of Coastal Protected Areas (CPAs) as a marine environmental quality indicator. They find that that 1% increase in the number of CPAs corresponds to 1.44% and 0.4% increase in the number of international and domestic visitors, respectively.

However, these studies present some limitations. First, they are based on a cross-section analysis. As a result, they may underestimate the impact of environmental quality on tourism, ignoring persistence effects (long-term effects). This is especially important since the reaction of tourism to a worsening of environmental quality may occur in the following period rather than in the current period. The cross-section analysis also omits important time-constant unobserved effects, leading to inconsistent estimates and incorrect statistical inferences.³

Second, those studies do not account for income levels of tourists' country of origin and price differentials between a destination and the origin country, and between the competing destinations. Witt and Witt (1995), Song and Li (2008), and Song et al. (2010) underline that the income level of tourists and price differentials are important factors for choice destination.

Third, those studies do not consider the quality of public services. The importance of public services in the tourism sector is underlined in a seminal study by Elliot (1987). For a Thai destination, the author points

out that the main concerns of tourists was poor infrastructure, an inefficient public service and perceived political instability.

The present paper addresses all of these limitations by examining the impact of ecosystem quality on inbound coastal tourism in the countries of the Baltic, Mediterranean, and North seas: Belgium, Croatia, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Spain, Sweden, and the UK.⁴ Inbound tourism demand is measured by the number of arrivals and length of stays of non-residents in a particular coastal region from 40 countries of origin. We apply an autoregressive distributed lag model with fixed effects, using an unbalanced panel data set up from 1995 until 2010. The panel data analysis overcomes the limitations of the cross-section analysis discussed above.

The environmental component of marine ecosystems is measured by the overexploitation index and Marine Protected Areas (MPA). The EU Biodiversity Strategy to 2020 (EC, 2011) underlines that overfishing is a proxy for marine ecosystem quality. According to this report, that MPAs are important for restoring marine ecosystems and promoting eco-tourism. These environmental indicators allow to compare marine ecosystem quality across countries.

In this study, we combine the information on arrivals and length of stay at country and region levels. Regions are classified according to the second level classification of the Nomenclature of Territorial Units for Statistics (NUTS 2). Thus, it is possible to directly identify coastal tourism demand, rather than modeling it as in Onofri and Nunes (2013), Onofri et al. (2013), and Bigano et al. (2007).

We conduct a destination-origin panel data approach. By using this approach, we account for the income levels of tourists' country of origin and price differentials between a destination and the origin country, and between the competing destinations.

We also control for the quality of public services, infrastructure, and sanitation across countries. Based on the government effectiveness indicator developed by Kaufmann et al. (2009). This indicator captures the perception of the quality of public services such as satisfaction with transportation system, health services, drinking water and sanitation, maintenance and waste disposal, and their implementation.

The rest of the paper is organized as follows. In Section 2 the relevant literature is reviewed. Section 3 presents the econometric model. Section 4 describes the data. Estimation results are discussed in Section 5, while Section 6 offers conclusions.

Literature Review

In this section we first briefly review the relevant literature on tourism demand and its determinants.

Second, we discuss the overfishing index and MPAs as measures of marine ecosystem quality.

Crouch (1994), Lim (1997), and Li et al. (2005) review measures of tourism demand commonly used in empirical studies. The most popular measures of tourism demand are tourist arrivals and length of stay.⁵ Even though these measures are strongly correlated, they capture different aspects of tourists' behavior. In particular, the length of stay is an indicator of people's budget, time availability, and enjoyment of a specific location and its services, while arrivals is a better indicator for the attractiveness of a specific location and its uniqueness.

Witt and Witt (1995) point out that substitute prices may be important for choice destination, especially between comparable destinations. For instance, deciding between comparable destinations such as Spain and Italy, people may prefer Spain compared to Italy if prices are higher in the latter destination. In addition, price comparison can be used in decision between domestic and international tourism. Crouch (1994) and Witt and Witt (1995) mention that consumer price indices and exchange rates has been used to reflect prices of tourism services since direct prices are rarely observed.

In general, tourism destinations can be differentiated vertically and horizontally.⁶ Vertical differentiation represents price levels for each destination. A typical example of vertical differentiation is that one prefers a "luxury" destination while another one prefers a cheaper destination, then price levels can be used for that purpose. The horizontal differentiation of destinations represents the variety of consumer preferences. For instance, one selects a particular destination because of the quality of beaches and sun, while another chooses the same destination because of heritages, biodiversity, etc.⁷

Witt and Witt (1995) also point out that the lags of dependent variables also play an important role. Their impacts are known as habitat persistence or as a "word of mouth". The former impact can be attributed to the situation when people visited a site and liked it. As a result, they may revisit this site. The latter impact can be attributed to the situation when people spread information about the visited site and recommend it to friends and relatives. As stated by Witt and Witt (1995), in fact such recommendation may be more important than commercial advertising.

Witt and Witt (1995), Song and Li (2008) and Song et al. (2010) discuss the importance of including the income level of tourists' country of origin as a predictor for tourism. However, the authors stress that this information is rarely observed, and can be substituted by GDP per capita of country of origin.

In a theoretical paper by Rigall-I-Torrent (2008), the author claims that the provision of public services and goods (e.g. cultural legacy, preservation of environment and landscape, roads, public safety, cleanness of public places, etc.) leads to sustainable development in tourism municipalities. Rigall-I-Torrent and Fluvà (2011) also underscore the importance of public services and goods for tourists' choices.⁸

Besides the socioeconomic determinants described above, environmental indicators may also be important. In ecological science, a substantial body of research identifies a detectable impact of overfishing on the composition of trophic levels (see Unte-Palm et al., 2010; among others), outbreaks of diseases (see Jackson, 2001; Hochachka and Dhondt, 2000), blooms of toxic plankton, and other outbreaks

of microbial populations (Officer et al., 1982; among others). Using paleoecological, archaeological, and historical data, Jackson et al. (2001) conclude that overfishing harms coastal and marine ecosystems even more than pollution, degradation of water quality, and anthropogenic climate change. The authors also point out that *"...the ecological extinction of trophic levels makes ecosystems more vulnerable to natural and human disturbances such as nutrient loading and eutrophication, hypoxia, storms, and climate change"*.

Against this background it seems justifiable to use the index of overfishing as a proxy indicator for marine ecosystem quality. This is for instance discussed by Pandolfi et al. (2003). As stated by the authors, overfishing and pollution are most threatening factors for coral reefs and associated tropical nearshore ecosystems, affecting abundance, diversity, and habitat structure.

A relationship between overexploitation and ecosystems is also discussed by Hughes (1994). Using the data since 1950 for Jamaica, the author concludes that overexploitation is one of human activities due to which many species disappeared while others became rare or below the minimum reproductive level in coral reef ecosystem, reducing ecosystem ability to provide water quality and complex habitats. A similar conclusion is drawn by Lotze et al. (2009), analyzing the historical data for 12 estuarine and coastal ecosystems in North America, Europe, and Australia.

Furthermore, according to Granéli et al. (1999), overexploitation and eutrophication are key factors of the concentration of macroalgal and microalgal blooms in coastal recreational waters. Macroalgal blooms are persistent nuisance species that displace seagrasses, corals, brown and red algae.⁹ The latter type of blooms are also known as harmful microalgae blooms (HAB), poisoning and killing the shellfish, and polluting recreational waters.¹⁰ As stated in Granéli et al. (1999), the concentration of HAB may lead to significant economic losses, especially, in tourism sector. In this paper overfishing and overexploitation are used interchangeably.

Also, marine protected areas (MPA) have been used as a predictor of tourism demand. As stated by World Wildlife Fund and supported by World Commission on Protected Areas of International Union for Conservation of Nature-The World Conservation Union, "*..... MPAs are an essential insurance policy for the future of both marine life and local people. They safeguard the oceans rich diversity of life and provide safe havens for endangered species as well as commercial fish populations...*".¹¹ The benefits of establishing MPAs are thus manifold. They include: the protection of biodiversity rich environments, known above all are coral reefs, of their structural complexity, reduction in fishing pressure, increase in the biomass of endangered and threaded species (see Jennings, 1998; Grigg, 1994; Roberts and Polunin, 1994; among others).¹² Accordingly, they may also exert a positive effect on tourism activity. For instance, as suggested by Green and Donnelly (2003), MPAs that contain coral reefs attract for underwater flora and fauna, especially divers. Hall (2001) argues that these protected areas, when accessible, can increase the presence of (regulated) fishers, windsurfers, and yachters. Given this literature, we may conclude that overfishing and MPAs may affect tourism activity.¹³

Bigano et al. (2007), Onofri and Nunes (2013), and Onofri et al. (2013) point out that the length of beaches and coastline as an important determinate of aggregate tourism demand. Another important determinate of coastal tourism is the quality of beaches. According to the reports of European Environment Agency (2012), the number of beaches that comply with mandatory values, measuring the satisfactory level of beach hygiene are a direct element of attractiveness for coastal tourism.¹⁴ According to the European Union, a published report on the quality of coastal bathing areas helps people to make a better choice of beaches.

Econometric Model

In order to estimate the impact of ecosystem quality on inbound coastal tourism in the countries of the Baltic Mediterranean, and North seas, we apply an autoregressive distributed lag model with fixed effects in a panel destination-origin set up. The panel destination-origin set up allows to combine the

characteristics of countries of origin and destination. In addition, in contrast to the cross-section analysis, the panel data analysis deals with unobserved time constant effects and allows for testing the persistence effects.

In this study we use an aggregate tourism demand model in a log-linear form. The log-linear form has several advantages (see Witt and Witt, 1995; Song et al., 2003 and 2010). First, the interpretation of results is straightforward in terms of elasticity. Second, this model provides superior results in terms of coefficients, signs, and fit of data. The general representation of this model is:

$$CTD = AX^{\beta_1}Y^{\beta_2}E^{\beta_3}, \quad (1)$$

where CTD is coastal tourism demand. X and Y are characteristics of countries of origin and destination, respectively, while E is an environmental component in a country of destination. Then, taking the log of this equation, we get:

$$\ln(CTD) = \ln(A) + \beta_1 \ln(X) + \beta_2 \ln(Y) + \beta_3 \ln(E) + e, \quad (2)$$

Coastal tourism demand is measured by the number of arrivals and length of stays of non-residents in a particular coastal region. Unlike in studies by Onofri et al. (2013), Onofri and Nunes (2013) and Bigano et al. (2007), we obtain information on the number of tourists' arrivals and length of stay in coastal regions at the NUTS 2 level. Nonetheless, identifying destination-origin flows at this level are an issue. Thus, the following steps are suggested. The coastal region arrivals and length of stays are approximated as follows:

$$CoastTourism_{int} = s_{it}^c * TotalTourism_{int}, \quad (3)$$

where $TotalTourism_{int}$ is the total number of non-resident arrivals and length of stay at accommodation establishments in country i from the country of origin n at time t . s_{it}^c stands for the share of non-resident arrivals or length of stay in country i coastal regions from a country of origin n at time t such that:

$$s_{it}^c + s_{it}^{nc} = 1, \quad (4)$$

where s_{it}^{nc} is the share of non-resident arrivals or length of stay in non-coastal regions.¹⁵

To capture dynamics of tourism demand, we modify equation (2) as follows:

$$\begin{aligned}
\ln(\text{CoastTourism}_{int}) = & \alpha_0 + \alpha_1 \text{Temp}_{it} + \alpha_2 \text{Temp}_{it}^2 + \text{Year}' \boldsymbol{\delta} + \text{FixedEff}_{in} + \\
& + \sum_{j=0}^N \beta_j \ln(\text{GDP}_{nt-j}) + \sum_{j=0}^N \Phi_j \text{GovEff}_{it-j} + \sum_{j=1}^N \gamma_j \ln(\text{CoastTourism}_{int-j}) + \\
& + \sum_{j=0}^N \lambda_j \ln(\text{QualBeach}_{it-j}) + \sum_{j=0}^N \theta_j \ln(\text{P}_{nt-j}) + \sum_{j=0}^N \phi_j \ln(\text{P}_{st-j}) + \sum_{j=0}^N \varphi_j \text{Quality}_{it-j} + \\
& + \sum_{j=0}^N \psi_j + \sum_{j=0}^N \psi_j \ln(\text{MPA}_{it-j}) + \varepsilon_{int}, \tag{5}
\end{aligned}$$

where subscripts i, n, t stand for the countries of destination and of origin, and time, respectively while N stands for the lag length. All other variables are defined below. $\alpha_0, \alpha_1, \beta_j, \Phi_j, \gamma_j, \lambda_j, \theta_j, \phi_j, \varphi_j$, and ψ_j are the coefficients and $\boldsymbol{\delta}$ is a vector of coefficients in the model to be estimated. ε_{int} is a disturbance term.

$\ln(\text{CoastTourism}_{int})$ stands for the natural logarithm of the number of non-resident arrivals, or length of stay (nights) depending on the model, at accommodation establishments including campus site in the recreational area at the NUTS 2 level coastal regions in country i from a country of origin n at time t .

Temp_{it} is the average temperature in country i at time t during the May-September period. The inclusion of temperature is standard as an indicator of climatic attractiveness or comfort. We also include the precipitation data of the destination country in the model. However, we found that the precipitation level and its squared term were not statistically significant, they were removed as a result.

Year is a set of dummy variables for each time period capturing secular changes and "off-events" that are being modeled. Including these dummies in the model helps to control for any unobserved trending factor that may affect the outcome of interest (Witt and Witt, 1995; Wooldridge, 2002). For instance, the tourism boom experienced which was during the 2003-2007 period or the financial crisis in 2008 which is still affecting tourism demand.

$FixedEff_{in}$ stands for a destination-origin country specific fixed effect. The use of the fixed effect estimation controls for all the potentially important explanatory variables such as the coastal area of the destination country, time spent on traveling to the destination countries, the uniqueness of the specific destination, the number of cultural-heritage attractions, etc. if these variables do not vary across time.

$\ln(GDP_{nt})$ is the natural logarithm of the real GDP per capita in constant 2005 US dollars in the origin country, representing the tourists' income.

$\ln(QualBeach_{it})$ stands for the natural logarithm of the number of beaches in a country of destination i at time t that comply with mandatory values, measuring the required levels of intestinal enterococci and Escherichia coli.

$GovEff_{it}$ stands for government effectiveness in the country of destination. This indicator, ranging from -2.5 (inefficient governance) to 2.5 (efficient governance), capture many aspects of institutional quality: the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies, but also, more relevant for our purposes, the perceptions of the quality of public and civil services that contribute to determine the attractiveness of a location.

P_{nt} accounts for price differentials across the origin and destination country. It is defined as the ratio between consumer price index and exchange rates in the two countries as follows:

$$P_{nt} = \frac{CPI_{it}/EX_{it}}{CPI_{nt}/EX_{nt}}, \quad (6)$$

where CPI_{it} and CPI_{nt} are the consumer price indices for the destination and origin countries, respectively, while EX_{it} and EX_{nt} are the exchange rates between the destination and origin local currency unit (e.g. Euro in the European Union countries) countries in US dollars, respectively. This constructed variable represents the "cost of being a tourist" in the destination country compared to the

country of origin and captures the substitutability between domestic and international tourism (see Foresyth and Dwyer, 2009; Song et al., 2010; among others).

Another important explanatory variable in the tourism demand equation is the "substitute price" variable, P_{st} constructed as:

$$P_{st} = \sum_{p=1}^N \frac{CPI_{pt}}{EX_{pt}} w_{pnt}, \quad (7)$$

where subscript p stands for each (substitutable) destination. w_{pnt} is the share of international tourism arrivals to country p and is calculated as follows:

$$w_{pnt} = \frac{CoastTourism_{pnt}}{\sum_p^N CoastTourism_{pnt}}, \quad (8)$$

where $CoastTourism_{pnt}$ is the inbound tourism arrivals or length of stay at the coastal regions to substitute destination p from an origin country n at time t . P_{st} captures the price competition across the 18 different tourism destination countries considered, measuring the importance of price differentials in determining the tourist destination choice (Song et al., 2010). The constructed price differentials in equations (7) and (8) capture vertical price differentiation among destinations.

In this study marine ecosystem quality is represented by two variables, namely, $Quality_{it}$ and $\ln(MPA_{it})$. As discussed in the introduction, $Quality_{it}$ is represented by an indicator of overfishing activity i.e. the fraction of species that are fished in each country's exclusive economic zone (EEZ) that are overexploited or collapsed. This variable accounts for the status of 900 stocks (a group of the same species) and takes a value from [0, 1]. For instance, $Quality_{it}$ equals 0.08 means that 8% of species are either overexploited or collapsed in the EEZ of country i at time t .

$\ln(MPA_{it})$ is the natural logarithm of the marine protected area of the exclusive economic zone (EEZ) in km^2 in country i at time t .

In the result section we present the estimation results for four specifications of equation (5). The first two specifications correspond to the situation when different dependent variables are used: coastal tourist arrivals and length of stay. Specifications 3 and 4 are the extension of the previous models with the interaction term between $\ln(GDP_{nt})$, P_{nt} , P_{st} , and $\ln(MPA_{it})$. The inclusion of the interaction terms is also discussed.

Data

The primary data source for the inbound tourism demand model described in the previous section is the Eurostat.¹⁶ This database provides the statistics for the non-resident arrivals and their length of stay for most European countries at national and NUTS 2 levels. In addition, it is possible to track the country of origin of the international tourism flow. However, the data coverage differs across countries, making our panel unbalanced. This study covers 18 countries of destination and 40 countries of origin from 1995 to 2010, providing approximately 5000 observations.

The data regarding the temperature of a specific country are taken from the National Center for Atmospheric Research (Willmott and Matsuura, 2013), while the data on the number of beaches that comply with mandatory values of intestinal enterococci and Escherichia coli in a specific country are from the European Environmental Agency (EEA, 2012a). However, the data regarding the quality of bathing in Croatia are only available for the 2009-2011 period. Thus, earlier years of the quality of bathing are imputed by the average value of the 2009-2011 period. The data related to mammals and birds species diversity in country of destination are taken from the Red List of Threatened Species¹⁷ and BirdLife International¹⁸, respectively, while related to cultural heritages are taken from UNESCO¹⁹.

The government effectiveness indicator is obtained from Kaufmann et al. (2009), incorporating information from 18 data sources. This constructed index captures a broad spectrum of government performance, including "...perceptions of the quality of public services, the quality of the civil service and

the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies".²⁰ However, the data are missing for years 1995, 1997, 1999, and 2001. Since this indicator does not change much from one year to another, we cover the missing years with adjacent ones. Consumer price index, GDP per capita, and exchange rates are taken from the World Bank Database.²¹

To capture the marine ecosystem quality, the overexploited fish stocks information is taken from the University of British Columbia Fisheries Centre. This index represents the intensity of marine resource exploitation and includes the following sequential stages: underdeveloped, developing, fully exploited, overfished, and collapsed (see Grainger and Garcia, 1996; Froese and Kesner-Reyes, 2002). However, the data are available only from 1950 to 2006.²² Since many countries have provided information regarding tourism flow in the 2007-2010 period, we decided to extrapolate the overexploitation index for the missing period.

Using the retrospective data on the fish stocks overexploitation, we extrapolate this index for the 2007-2010 period as a function of GDP per capita. The Im-Pesaran-Shin test²³ for detecting non-stationarity in data suggests taking the first difference of *Quality* and $\ln(GDP)$. Then, the following equation for the 1960-2006 period is estimated:

$$\Delta Quality_{it} = \kappa_0 + \varpi_i + \kappa_1 \Delta \ln(GDP_{it}) + \epsilon_{it}, \quad (9)$$

where ϖ_i is a fixed effect of country *i*. κ_0 and κ_1 are the coefficients and ϵ_{it} is a disturbance term of the model. After estimating (9), the overexploitation index, $Quality_{it+1}$, for the 2007-2010 period is computed as:

$$Quality_{it+1} = \Delta \widehat{Quality}_{it+1} + Quality_{it}, \quad (10)$$

where *t* starts from 2006. $\Delta \widehat{Quality}_{it+1}$ stands for a predict value from (9).

In order to confirm that our extrapolation is accurate we conduct an in-sample estimation using the 1960-2002 period and compute the values of $\Delta Quality_{it}$ for the 2003-2006 period. Then, we estimate the following equation using the 1960-2006 period (all sample):

$$Quality_{it} = \pi_0 + \iota_i + \pi_1 \Delta \widehat{Quality}_{it} + \xi_{it} \quad (11)$$

where ι_i is a fixed effect of country i . π_0 and π_1 are the coefficients and ξ_{it} is a disturbance term of the model. Next, we test the null hypotheses $\pi_0=0$ and $\pi_1=1$, using *t-statistics*. Indeed, *p-values* for those hypotheses are 0.98 and 0.81, respectively, suggesting that the extrapolation is quite accurate.²⁴

Finally, to obtain a marine protected area within each country's EEZ in km², we multiply the percentage of MPAs in each country's EEZ by the area of EEZ in this country. The percentage of MPAs in each country's EEZ is taken from IUCN and UNEP-WCMC (2011), while the EEZ for each country is from the Sea Around Us Project.²⁵

We also checked the robustness of our results by (i) dropping observations for 1995, 1997, 1999, and 2001 because of the availability of the government effectiveness indicator, (ii) dropping observations for the 2007-2010 period because of the availability quality index, (iii) dropping observations for Croatia because of the availability of beach quality index, (iv) taking the logs of temperature, government effectiveness index, and marine ecosystem quality index, and (v) combining together (i)-(iv). The sign and significance of explanatory variables are robust to all modifications.²⁶

Estimation Results

In this section we present and discuss the results of models on the international tourism arrivals and their length of stay. In order to identify the optimal number of lags of explanatory variables in (5) we apply the sensible economic interpretation and statistical significance (t-statistic). This approach is common in the tourism literature (see Song et al., 2010). The results of four models are shown in Table 1. As shown, the R^2_{within} is relatively high, confirming that data fit the models well.

Models 1 and 2, where (log) arrivals and length of stay are dependent variables, show a similar behavior compared to the explanatory variables chosen. The coefficients related to temperature and its squared term are not statistically significant. Even though we consider the average temperature over the May-September period, there is still considerable variability in the temperature during this period since our sample covers colder and warmer countries. This may also indicate that various tourists' activities depend on different temperatures and on different perception of "optimal" temperature.

The positive coefficient associated with (log) GDP per capita in the origin country reflects the push effect of increasing wealth on tourism. The magnitude in both models is considerable. A one percentage point increase in GDP per capita raises tourism demand by 0.537 and 0.489 percentage points in Models 1 and 2, respectively.

Another important effect is captured by the government effectiveness variable. As shown, the current government effectiveness determines time spent in a country of destination while in a case of arrivals its lag is a crucial determinant. This variable has a remarkable impact on both arrivals and lengths of stay, even though the analysis is conducted over a group of highly developed countries that should be able to provide in-sample similar and high standard performances. In fact, there is considerable cross-country variability in their performance. The estimated coefficient on government effectiveness has to be interpreted as follows. If a country's government effectiveness changed from 0.42 to 1.50 (that is, for instance, how Italy and the UK are scored in 2009, respectively), then the number of tourist arrivals and their length of stay in the Italian coastal region in 2010 would have been greater by 15 percentage points.²⁷ This result is quite striking in our analysis. Even though it is reasonable to assume that a good quality of services and infrastructure that support tourist activity is an important pull factor, we recognize that the magnitude of this effect is difficult to justify. At this stage we leave this issue for further investigation, and we stress the potential very high importance of tourism infrastructure, in a broader sense, as an attractor.

Also, the lagged (log) arrivals and length of stay appear with positive and statistically significant coefficients, suggesting that habits, tastes, and preferences of tourists persist and tend to consolidate. Once people have visited a specific destination and liked it, it is likely that they will return. In addition, they may spread information about the visited location by a "word of mouth", inducing others to choose this touristic destination. For instance, one percentage point increase in arrivals and length of stay in one year, causes an inertial effect of 0.752 and 0.728 percentage points increase in arrivals and length of stay in the next two years, respectively.

Another important determinant of attractiveness for coastal tourism is the number of beaches that comply with mandatory bacteriological values. The sign of the estimated coefficients on $\ln(\text{QualBeach}_{it})$ is positive and significant. The advantage of using the quality of beaches compared to coastline and beach length is an annual variation in the number of beaches that comply with the requirements while in the latter case, the lengths are constant. As a result, it is possible to capture the potential loss in numbers of tourists due to the unsatisfactory level of beach hygiene.

In Table 1, $\ln(P_{nt})$, which expresses the relative difference between consumer price index and exchange rates in countries of destination and origin, measures the impact of price differentials across origin and destination countries. The negative sign of coefficients and their significance in models 1 and 2 shows that if prices increase in the destination countries compared to the country of origin, people prefer domestic tourism relative to the international one.

Similar information is provided by $\ln(P_{st})$, measuring the impact of price differential across different destination countries. However, the estimated coefficients are not significant in models 1 and 2, meaning that tourists' choices, especially of those who have already chosen a specific international destination, are much more influenced by amenities (environmental, cultural, or recreational) and the uniqueness of the

destination itself rather than the destination's price. The key explanatory variables of our analysis are *Quality* and $\ln(MPA)$, which capture marine ecosystem quality and diversity.

Quality index

As shown in Table 1, there is a notable difference between Models 1 and 2 with respect to *Quality*. In Model 1 only the lags of this variable are statistically significant.²⁸ This means that tourists may not be aware of environmental quality in specific locations prior to their destination choice. Note that this finding also marks an important difference from cross-sectional studies that may result in lower or even no impact of marine ecosystem degradation on tourism behavior.

In Model 2 we observe that both the current quality of marine ecosystems and its lag are crucial for the length of stay. This implies that restricting the analysis to the current impact may lead to underestimation of the "true" effect. In particular, the short-term (current) impact constitutes only 65% of the long-term (overall) impact ($=0.521/(0.521+0.278)$).

Furthermore, the long-term impact of quality index is two times greater for the length of stay than for arrivals (0.80 and 0.43, respectively), suggesting that ecosystem quality is a relatively more important factor for determining the length of stay than for the number of visits. This indicates that albeit the number of arrivals and the length of stay are highly correlated, two models provide complimentary insights.

The *Quality* variable appears with a negative sign in both models. Therefore, an increase in the number of overexploited or collapsed species, a worsening of quality, determines a decrease in arrivals or length of stay. For instance, if overexploited or collapsed number of species increases by 25 percentage points, the number of coastal arrivals and the length of stay decrease by 10.85 ($=(0.233+0.201)*0.25*100$) and 19.97 ($=(0.521+0.278)*0.25*100$) percentage points in the long term, respectively.

Marine Protected Areas

The log of marine protected areas, $\ln(MPA)$, is negatively correlated with both tourism arrivals and length of stay. This apparently counterintuitive result may have several interpretations. MPAs suffer from several well-known shortcomings such as poor design, inappropriate management, degradation of the unprotected surrounding ecosystems, and creation of an illusion of protection when indeed no protection is occurring.²⁹ For instance, as stated by Abdulla et al. (2008), more than half of the Mediterranean MPAs do not even have appointed management, i.e. these MPAs exist, but in fact do not perform their functions. This may explain why MPAs have a direct depressing effect on arrivals or length of stay.

In addition, protected areas impose often partial or full restrictions to tourism activities. On the one hand, even when they can be visited, tourism flows are regulated and/or an entrance fee has to be paid. On the other hand, they may limit the expansion of tourism facilities in the nearby areas. These findings are partially supported by the literature on entrance fee (see Pascoe et al., 2014; Walpole et al., 2001), which points out that entrance fee should be carefully designed, since they may dissuade tourists from visiting the site and result in loss for local economies in coastal regions.

This outcome differs from what found in Onofri and Nunes (2013), highlighting instead a positive relationship between arrivals and coastal protected areas. That study, however, developed a cross section rather than a panel analysis. It is also worth mentioning when we estimate (5) using a cross-section analysis, we also find a positive effect of marine protected areas. This confirms that the panel data highlights a "historical" dimension and that a cross section analysis cannot.

Even though the impact of MPAs on coastal tourism is negative, it might be misleading to conclude that marine protected areas are "bad" for tourism. For instance, a coastal region with a larger MPA may be more costly to visit. As such, tourists' decision to visit this region may be affected by price differentials and GDP per capita in a country of origin that serves as proxy for tourists' income. To test this hypothesis,

we include interaction terms between GDP per capita and price differentials and MPAs (see Models 3 and 4 in Table 1).

As shown in Table 1, the interaction term of protected areas with origin country GDP, in particular, is characterized by a significant positive coefficient. This means that the overall positive effects that an increasing GDP exerts on the willingness to visit a given destination is enhanced by the fact that its (marine) environmental amenities are also protected, independent upon the fact that protection may limit tourism activity.

A similar effect of the interaction term between protected areas and price differential across different destination countries $\ln(P_{st})$ on arrivals and length of stay is also observed. Since the coefficient on $\ln(P_{st})$ is negative, meaning that even though people prefer a cheaper destination, having larger marine protected areas attract more tourist.

We also find that the total impact of quality index exceeds the impact of tourists' income in models 3 and 4 and the impact of the "word of mouth" in Model 4 (*p-values* are 0.07, 0.00, and 0.09, respectively). This results provides support to environmental protection.

Destination-origin Fixed Effects

We also attribute the destination-origin fixed effects to country's cultural heritages and biodiversity factors such as a number of birds and mammals. The results presented in Table 2 are based on the fixed effects of Model 1.³⁰ As shown, the direction and significance of coefficients make sense. Tourists prefer a destination with richer biodiversity and with more heritages.

To conclude this section, in Table 3 we report an ex post estimation of what the changes (losses) in tourism expenditure could have been in the examined countries in 2010 assuming a worsening of one percentage point in our index measuring marine ecosystem quality. In order to compute those losses, we first

estimate the forgone coastal arrivals for each country due to degraded marine ecosystems. Then, we associate these with the average tourist expenditure per trip reported by the Eurostat.³¹

As shown in this table, the total loss in the number of arrivals in the 18 countries is 0.49 percentage points with forgone total tourism expenditure of roughly 5 billion Euros, corresponding to 1.84% of tourism expenditure loss in 2010. This result is especially notable as it is due only to the coastal component in the relevant subset of European Union countries.

Conclusion

We investigate the relationship between marine ecosystem quality and inbound coastal tourism in the countries of the Baltic, Mediterranean, and North seas. We apply a panel destination-origin analysis rather than the cross-section analysis. This allows a better characterization of dynamic or intertemporal behavior of tourists. We also use the overexploitation index as an indicator of ecosystem quality.

The empirical findings suggest that the deterioration of marine ecosystems exerts a considerable negative impact on tourism arrivals and length of stay with consequential economic losses. One percentage point change in ecosystem deterioration measured by the suggested overexploitation index, determines 1.84% of tourism expenditure loss over the 18 countries analyzed. This impact may exceed the impact of tourists' income. Another important finding is the persistent effect of changes in marine ecosystem quality on inbound tourism. This conclusion is based on the overexploitation index and is underscored by the panel investigation. The short-term (current) effect constitutes only 65% of the total. This information can be used for improving, planning, and developing tourism projects.

The findings of this study can be of particular interest for managerial decision makers. First, the findings stress the role of investment in environmental preservation and its management as a strategy to enhance tourism destination attractiveness that can complement price competition. Attracting tourists from a richer country of origin may reverse a negative direct effect of MPAs. Second, government performance

in a country of destination, price competition across different destinations, and quality of beaches are crucial pulling factors for inbound coastal tourism, highlighting an interesting direction for future research.

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Table 1: The estimated coefficients for the tourism demand equation.

	Model 1	Model 2	Model 3	Model 4
Dependent Variables:	ln(Arrivals _{it})	ln(Length _{it})	ln(Arrivals _{it})	ln(Length _{it})
Temp _{it}	-0.011 (0.61)	0.015 (0.54)	-0.015 (0.47)	0.009 (0.72)
Temp _{it} ²	-0.001 (0.39)	-0.001 (0.28)	-0.0004 (0.47)	-0.0007 (0.37)
ln(GDP _{nt})	0.537 (0.00)***	0.489 (0.00)***	0.255 (0.04)**	0.168 (0.20)
Gov.Eff _{it}	-	0.143 (0.00)***	-	0.146 (0.00)***
Gov.Eff _{it-1}	0.142 (0.00)***	-	0.151 (0.00)***	-
ln(Arrivals _{it-1})	0.639 (0.00)***	-	0.633 (0.00)***	-
ln(Arrivals _{it-2})	0.113 (0.00)***	-	0.109 (0.00)***	-
ln(Length _{it-1})	-	0.596 (0.00)***	-	0.592 (0.00)***
ln(Length _{it-2})	-	0.132 (0.00)***	-	0.129 (0.00)***
ln(QualBeach _{it-1})	0.019 (0.12)	0.096 (0.00)***	0.022 (0.09)*	0.101 (0.00)***
ln(P _{nt})	-0.386 (0.00)***	-0.375 (0.00)***	-0.391 (0.00)***	-0.363 (0.00)***
ln(P _{st})	-0.058 (0.30)	-0.090 (0.16)	-0.209 (0.00)***	-0.252 (0.00)***
Quality _{it}	-	-0.521 (0.00)***	-	-0.384 (0.01)**
Quality _{it-1}	-0.233 (0.00)***	-0.278 (0.00)***	-0.290 (0.00)***	-0.303 (0.01)**
Quality _{it-2}	-0.201 (0.00)***	-	-0.200 (0.00)***	-
ln(MPA _{it})	-	-0.017 (0.01)**	-	-0.614 (0.00)***
ln(MPA _{it-1})	-0.013 (0.06)*	-	-0.587 (0.00)***	-
ln(MPA _{it})× ln(GDP _{nt})	-	-	-	0.049 (0.00)***
ln(MPA _{it})× ln(P _{nt})	-	-	-	-0.004 (0.30)
ln(MPA _{it})× ln(P _{st})	-	-	-	0.018 (0.01)**
ln(MPA _{it})× ln(GDP _{nt})	-	-	0.047 (0.00)***	-
ln(MPA _{it})× ln(P _{nt})	-	-	-0.002 (0.55)	-
ln(MPA _{it})× ln(P _{st})	-	-	0.018 (0.00)***	-
Constant	-0.273 (0.80)	0.463 (0.71)	3.562 (0.00)***	4.733 (0.00)***
Fixed Effects	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
R ² _{within}	0.69	0.63	0.70	0.63
Number of Observations	5,228	5,350	5,228	5,350
Average Years	8.3	8.6	8.3	8.6

Notes: The p-values are in parentheses. ***, **, * stand for 1, 5, and 10% significance levels, respectively. Standard errors are robust to heteroskedasticity and are clustered at a destination-origin level.

Table 2: The correlation between a destination-origin fixed effects and country's attractiveness indicators.

Dependent Variable	<i>Fixed Effects</i>
ln(Birds)	1.250 (0.07)*
ln(Mammals)	0.235 (0.65)
ln(Heritage)	0.122 (0.06)*
Constant	-8.479 (0.00)***
R ²	0.13
Number of Observations	5,228

Notes: Standard errors are robust to heteroskedasticity.

Table 3: Estimated loss in tourism industry due to 1% worsening quality of marine ecosystems.

Country	Average Loss
Belgium	140,015,140
Croatia	140,706,315
Denmark	65,135,428
Estonia	31,999,400
Finland	80,721,413
France	633,733,985
Germany	86,367,475
Greece	109,858,377(*)
Ireland	112,588,377(*,**)
Italy	1,467,148,236
Latvia	11,290,269
Netherlands	16,620,849
Poland	1,176,758,631
Portugal	14,155,265(*)
Spain	87,007,384
Sweden	574,656,386
United Kingdom	158,424,277(*)
Total Loss (Euros)	5,322,332,469
International tourism Expenditure in European Union (in 2010 Euros)	288,743,546,000
Change Due to Quality Loss (in%)	1.84

Notes: The computations are based on the coefficients on the overexploitation index, $Quality_{it-1}$ and $Quality_{it-2}$, in Model 3. We used the Consumer Price Index to compute the average estimated loss in 2010 prices. (*) For these countries the average tourism expenditure per trip is not available. We replace Norway and Sweden with the Denmark data, Greece with the Spain data, UK with the Ireland data, and Poland with an average of the Estonia, Latvia and Lithuania data. (**) The data for these countries regarding coastal non-resident arrivals are not available in 2010. Thus, for Ireland and Norway, the data are taken from 2011 and 2012, respectively.

Endnotes

¹ See epp.eurostat.ec.europa.eu.

² In fact, Bigano et al. (2007) build a database and a core tourism model linking tourism arrivals to many explanatory variables, among which is the length of coastline.

³ For a discussion of advantages of panel data see Baltagi (2005) and Hsiao (2003).

⁴ Note that inbound tourism and international tourism are used interchangeably.

⁵ In fact, tourist expenditures are also used as a measure of tourism demand. However, these data have several limitations such as the data collection process, their reliability, small sample size, among others (Witt and Witt, 1995; Song et al., 2010).

⁶ For a detailed discussion of horizontal and vertical differentiation see Candela and Figini (2010).

⁷ See also Song et al. (2000), (2003), (2008), and (2010).

⁸ For the importance of transport and non-transport infrastructures for tourism see also Khadaroo and Seetanah (2008), among others.

⁹ See Valiela et al. (1997).

¹⁰ See Anderson (1995).

¹¹ See www.wwf.org and Kelleher and Phillips (1999).

¹² According to the World Conservation Union (IUCN), there are I-VI management categories for MPAs based on the primary management objectives. For more details see <http://www.unep-wcmc.org/>.

¹³ See also Rudd (2001) for a discussion of importance overfishing and MPAs for tourism sector in a case of the Turks and Caicos Islands.

¹⁴ Another measure of quality of beaches is the Blue Flag certification (see www.blueflag.org). However, the data are only available for the most recent years in our analysis.

¹⁵ Indeed, s_{it}^c and s_{it}^{nc} can be a function of a set of explanatory variables. This can be addressed in future research.

¹⁶ See <http://epp.eurostat.ec.europa.eu>.

¹⁷ See www.iucnredlist.org.

¹⁸ See <http://www.birdlife.org/datazone/sowb>.

¹⁹ See whc.unesco.org.

²⁰ For a detailed discussion see Kaufmann et al. (2009).

²¹ See www.worldbank.org.

²² <http://seaaroundus.org/>.

²³ See Im et al. (2003).

²⁴ All estimation results are available upon request.

²⁵ <http://seaaroundus.org/>

²⁶ The results are available up on request.

²⁷ The impact of the government effectiveness indicator for Models 1 and 2 are 15.3 ($=0.142*(1.50-0.42)*100$) and 15.4 ($=0.143*(1.50-0.42)*100$) percentage points, respectively.

²⁸ The persistence effect of the quality should be calculated only for the statistically significant coefficients on the *Quality* variable. Therefore, we do not include the insignificant coefficients on $Quality_{it}$ in Models 2 and 4.

²⁹ For a detailed discussion see Abdulla et al. (2008), Agardy et al. (2011), Toropova et al. (2010), among others.

³⁰ We find similar results for the destination-origin fixed effects from other models. They are available upon request.

³¹ The Eurostat provides the average tourist expenditure per trip only since 2012. To adjust these expenditures for 2010, we used the Consumer price indexes for 2010 and 2012.