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Identifying the Link Between Coastal Tourism and Marine Ecosystems in the Baltic, North Sea, and Mediterranean Countries

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Summary

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Keywords: Coastal Tourism, Marine Ecosystem Quality, Panel Data
JEL Classification: C33, Q57, Q26

The authors acknowledge the European Union FP7 project VECTORS (Vectors of changes in marine life, impact on economic sectors), grant agreement no: 266445, under which the present research has been developed.

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Identifying the Link Between Coastal Tourism and Marine Ecosystems in the Baltic, North Sea, and Mediterranean Countries*

Vladimir Otrachshenko† Francesco Bosello‡

Abstract

This paper examines the impact of marine ecosystem quality on inbound coastal tourism in the Baltic, North Sea, and Mediterranean countries. Given extensive empirical findings in ecological science, we use marine protected areas (MPAs) and the fraction of species that are fished in each country's exclusive economic zone that are overexploited or collapsed as a proxy for marine ecosystem quality. We use an autoregressive distributed lag model in a destination-origin panel set up. The empirical findings of this paper suggest that MPAs have a negative direct effect on tourism. However, this effect is reversed when the interaction terms with economic variables are included. Also, by using the fraction of species that are overexploited as an indicator of the deterioration of marine ecosystem quality, we find a considerable negative impact of this index on inbound coastal tourism. The short-term (current) impact of this index on tourism constitutes less than half of the long-term impact. Results provide valuable information for policy makers, suggesting that measures enhancing marine ecosystem quality should be considered in addition to conventional tourism policies focused on price.

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1 Introduction

The importance of coastal and marine ecosystems for human well-being is widely recognized. There is a growing literature that has been discussing and trying to evaluate economically the benefits for human society of their services (Costanza et al. [6], Daily et al. [8], De Groot [18], [17], De Groot et al. [16], Halpern et al. [25], UNEP-WCMC [60], among others). These are traditionally grouped into provisioning services (e.g. food production), regulating services (e.g. climate regulation through carbon sequestration), cultural services (e.g. generation of recreational or esthetic value), and supporting services (e.g. nutrient cycling and fertility).[1]

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.[2] Although official and worldwide statistics are not available, the coastal segment often accounts for the bulk of tourism and is growing quickly 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. [55], UNEP [60], Cinner et al. [5], FAO [20], IPCC [31] and [32]), 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.

The relationship between ecosystem quality and tourism demand has been analyzed very little, especially regarding marine ecosystems. While the research conducted at a micro level

[1] See MA [44], [45], and UNEP [60].

[2] See epp.eurostat.ec.europa.eu.

(site or country specific) is rather ample (e.g. Hall [24], Davis and Tisdell [9], Harriott et al. [26], Green and Donnelly [22], Maddison [43], among others), it is narrower at a global scale when several countries are involved in the analysis. To our best knowledge, the latter case is limited to the work of Bigano et al. [3] and Onofri and Nunes [48].[3]

In ecological science, a substantial body of research identifies a detectable impact of overfishing on the composition of trophic levels (see Utne-Palm et al.[61], among others), outbreaks of diseases (see Jackson [35], Hochachka and Dhondt [27]), blooms of toxic plankton, and other outbreaks of microbial populations (Officer et al. [47], among others). Using paleoecological, archaeological, and historical data, Jackson et al. [36] 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. [49]. 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. In this paper overfishing and overexploitation are used interchangeably.

A relationship between overexploitation and ecosystems is also discussed by Hughes [29]. Using the data since 1950 for Jamaica, the author conclude 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. [42], analyzing the historical data for 12 estuarine and coastal ecosystems in North America, Europe, and Australia.

[3] In fact, Bigano et al. [3] build a database and a core tourism model linking tourism arrivals to many explanatory variables, among which is the length of coastline.

Futhermore, according to Granéli et al. [15], overexploitation and euthrophication 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.[4] The latter type of blooms are also known as harmful microalgae blooms (HAB), poisoning and killing the shellfish, and polluting recreational waters.[5] As stated in Granéli et al. [15], the concentration of HAB may lead to significant economic losses, especially, in tourism sector.

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 IUCN – 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...*".[6] 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 [37], Grigg [23], Roberts and Polunin [53], among others).[7] Accordingly, they may also exert a positive effect on tourism activity. For instance, as suggested by Green and Donnelly [22], MPAs that contain coral reefs attract for underwater flora and fauna, especially divers. Hall [24] 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 affect tourism activity.[8]

Onofri and Nunes [48] in particular, use the marine protected area as a predictor of domestic

[4] See Valiela et al. [62].

[5] See Anderson [1].

[6] See www.wwf.org and Kelleher and Phillips [40].

[7] According 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/.

[8] See also Rudd [54] for a discussion of importance overfishing and MPAs for tourism sector in a case of the Turks and Caicos Islands.

and international coastal tourism in world "coastal states". The authors find a positive correlation between MPAs and international tourism demand, but not with domestic tourism. They also find a positive and significant relationship between a set of ecosystem quality indicators and marine protected areas. They thus conclude that ecosystem quality and MPAs are important drivers of inbound tourism in coastal regions. However, unlike this study, they could not establish a direct relationship between ecosystem quality indicators and tourist arrivals. Moreover, their findings are based on a cross-sectional data analysis. It would be interesting to analyze the issue using panel data. The latter methodology has an advantage over the cross-section analysis since it deals with a time-constant unobserved effect. This allows us to reduce the omitted variables problem avoiding inconsistent results and misleading statistical inferences.[9]

This paper examines 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.[10] The environmental component of marine ecosystems is measured by the overexploitation index and MPAs. The overexploitation index is presented by Grainger and Garcia [14] and then, modified by Froese and Kesner-Reyes [21]. This index allows us to compare marine ecosystem quality, which is very diversified and complex to define across countries.

We employ an autoregressive distributed lag model with fixed effects, using an unbalanced panel data set up from 1995 until 2010 for those countries. This approach helps to control for the most important time varying factors and to deal with other important factors that are assumed to be heterogeneous, but time invariant across observation units.

In this study we use two measures of inbound tourism demand, namely, the number of arrivals and length of stays of non-residents in a particular coastal region from 40 countries of origin. This

[9] For a discussion of advantages of panel data see Baltagi [2] and Hsiao [28].

[10] Note that inbound tourism and international tourism are used interchangeably.

destination-origin country analysis is rather common in the tourism literature. The estimation strategy allows us to identify and test robustly the relationship between inbound tourism and marine ecosystems.

Even though the number of arrivals and length of stays of non-residents are strongly correlated (correlation is 0.93), 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.

This study contributes to the literature on coastal tourism demand and marine environmental ecosystem quality in several ways. First, it combines the information on arrivals and length of stay at country and NUTS 2 levels. Thus, it can directly identify coastal tourism demand, rather than modeling it under some assumptions, as done in Onofri and Nunes [48] and in Bigano et al. [3]. Second, it conducts a destination-origin panel data estimation, which to our knowledge is a novelty in the related literature. Third, it proposes a new channel for capturing the impact of marine environmental quality on tourism demand, and provides further empirical evidence to policy makers on the importance of environmental quality, which is still an underdeveloped area in the literature.

The empirical findings of this paper suggest that the deterioration of marine ecosystem quality has a considerable negative impact on inbound coastal tourism. In particular, one percentage change in ecosystem deterioration measured by the suggested overexploitation index, determines 2.6% of tourism expenditure loss over the 18 countries analyzed. In addition, in the model with the length of stay as the dependent variable, the short-term (current) impact of marine ecosystem quality constitutes only 38% of the overall long-term impact. This finding suggests that the impact of marine ecosystem quality may be underestimated in a cross-section analysis. Overall, results provide valuable information for policy makers, suggesting that measures enhancing marine ecosystem quality should be considered in addition to conventional tourism policies focused on price.

The role of MPAs is less straightforward to comment. On the one hand, our results suggest that more protected areas are in fact reducing tourism activity. We explain this, observing that protection indeed imposes some restrictions to the touristic exploitation of an area. On the other hand, developing a richer model specification where MPAs interact with the most important economic variables, we find that MPAs in destination countries reinforce the positive effects of GDP from origin countries on tourism demand.

The rest of the paper is organized as follows. In Section 2 determinants of tourism demand are discussed. Section 3 presents the econometric framework. Section 4 describes the data. Estimation results are discussed in Section 5, while Section 6 concludes.

2 Determinants of Tourism Demand

Following earlier literature, we include a set of economic variables controlling for the level of economic development, cross country price differentials, and government performance.[11] In our analysis the latter is presented by the government effectiveness indicator. This variable 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.

In a seminal study by Elliot [12], the author underlines the importance of government effectiveness in tourism sector (p.223). In a case of a Thai destination, the author points out that the main concerns of tourists was poor infrastructure, an inefficient public service and a perceived political instability. These concerns were addressed by the Thai government by building and improving airports, reducing bureaucracy, settling duty-free shops, and increasing the numbers

[11] For an extensive literature review on tourism see Song and Li [57], Witt and Witt [65], among others.

of flights. Also, the author states that government should have clear and consistent policies to ensure the coordination between public and private sectors that often conflicting within and between each other.

In a theoretical paper by Rigall-I-Torrent [51], 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 Fluvià [52] also underscore the importance of public services and goods for tourists' choices.[12]

We also include the number of beaches that comply with mandatory values, measuring the satisfactory level of beach hygiene to capture a direct element of attractiveness for coastal tourist.[13] According to the European Union, a published report on the quality of coastal bathing areas helps people to make a better choice of beaches. In related studies by Bigano et al. [3] and by Onofri and Nunes [48], the authors use the length of beaches and coastline as a determinate of aggregate tourism demand,respectively.

To explain the share of tourism demand, the income level of tourists' country of origin has to be taken into account in the analysis. However, this information is rarely observed, and can be proxied by GDP per capita (see Song et al. [56], Witt and Witt [65], among others).

Witt and Witt [65], in a review of tourism literature, conclude that substitute prices may be important for choice destination. 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 [7] and Witt and Witt [65] mention that consumer price indices and exchange rates has been used to reflect prices of tourism services since direct prices are rarely

[12] For the importance of trasnport and non-transport infrastructures for tourism see also Khadaroo and Seetanah [39], among tohers.

[13] See country reports on the quality of bathing waters EEA [13].

observed.

In general, tourism destinations can be differentiated vertically and horizontally.[14] 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.[15]

In addition, biodiversity factors such as a number of birds, mammals, and cultural heritages and coastline are also included as determinants of attractiveness of a country destination. We recognize that marketing expenditure is an important promotional factor for tourism, however, the data are rarely available.

3 Econometric Model

In this study we use an aggregate tourism demand model in a log-linear form. This model has several advantages (see Witt and Witt [65] and Song et al. [58] and [56]). First, the interpretation of results is straightforward in terms of elasticities. Second, this model provides superior results in terms of coefficients, sings, and fit of data. The general representation of this model is:

$$CTD = AX^{\beta_1}Y^{\beta_2}E^{\beta_3} \qquad \text{(Eq.1a)}$$

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 country of destination. Then, taking the log of this equation, we get:

[14] For a detailed discussion of horizontal and vertical differentiation see Candela and Figini [4].

[15] See also Song et al. [59], [58], [57], and [56].

$$\ln(CTD) = \ln(A) + \beta_1 \ln(X) + \beta_2 \ln(Y) + \beta_3 \ln(E) + e \tag{Eq.1b}$$

To capture dynamics of tourism demand, our model is modified as follows:

$$\begin{aligned} ln(CoastTourism_{int}) \quad = \quad & \alpha_0 + \alpha_1 Temp_{it} + \alpha_2 Temp_{it}^2 + Year'\boldsymbol{\delta} + \\ & + FixedEff_{in} + \sum_{j=0}^{N} \beta_j ln(GDP_{nt-j}) + \sum_{j=0}^{N} \Phi_j GovEff_{it-j} + \\ & + \sum_{j=1}^{N} \gamma_j ln(CoastTourism_{int-j}) + \sum_{j=0}^{N} \lambda_j ln(QualBeach_{it-j}) + \\ & + \sum_{j=0}^{N} \theta_j ln(P_{nt-j}) + \sum_{j=0}^{N} \phi_j ln(P_{st-j}) + \sum_{j=0}^{N} \varphi_j Quality_{it-j} + \\ & + \sum_{j=0}^{N} \psi_j ln(MPA_{it-j}) + \varepsilon_{int} \end{aligned} \tag{Eq.1c}$$

where subscripts i, n, t stand for the countries of destination and of origin, and time respectively. $ln(CoastTourism_{int})$ 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.

Differently from Onofri and Nunes [48] and Bigano et al. [3], 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:

$$CoastTourism_{int} = s_{it}^{c} * TotalTourism_{int} \tag{Eq.2}$$

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:

$$s_{it}^{c} + s_{it}^{nc} = 1 \qquad \text{(Eq.3)}$$

where s_{it}^{nc} is the share of non-resident arrivals or length of stay in non-coastal regions.[16]

$Temp_{it}$ 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 [65]; Woolridge [66]). 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 helps us control 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.

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

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

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:

$$P_{nt} = \frac{CPI_{it}/EX_{it}}{CPI_{nt}/EX_{nt}} \qquad \text{(Eq.4)}$$

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 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 [19], Song et al. [56], among others).

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

$$P_{st} = \sum_{j=1}^{N} \frac{CPI_{jt}}{EX_{jt}} w_{jnt} \qquad \text{(Eq.5)}$$

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

$$w_{jnt} = \frac{CoastTourism_{jnt}}{\sum_{j=1}^{N} CoastTourism_{jnt}} \quad \text{(Eq.6)}$$

where $CoastTourism_{jnt}$ is the inbound tourism arrivals or length of stay at the coastal regions to substitute destination j 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. [56]). The constructed price differentials in *Eq.4* and *Eq.5* 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.

Eq.1 is likely to suffer from serial correlation. As pointed out by Baltagi [2] (p. 84), ignoring serial correlation leads to biased standard errors and makes estimates inefficient. In order to test serial correlation in *Eq.1*, we apply the modified Wooldridge test (Drukker [11]). The null hypothesis of this test is that of no first-order serial correlation. This is an autoregressive process of order one AR(1) as follows:

$$\varepsilon_{int} = \rho\varepsilon_{int-1} + \nu_{int} \quad \text{(Eq.7)}$$

where ε_{int} is taken from *Eq.1* and $|\rho| < 1$. ν_{int} is independent and identically distributed with mean zero and variance σ^2_ν. Also, in the fixed-effects model, the ν_{in} may be correlated with the explanatory variables.

$P - values$ from this test detect serial correlation in both models (the log of coastal arrivals and length of stay).[17] To solve the issue of the AR(1) process in residuals, we perform a two-step estimation. In the first step, $\hat{\rho}$ from *Eq.7* is estimated. In the second step, $\hat{\rho}$ is incorporated into *Eq.1* using Feasible Generalized Least Squares. In Section 5 results from the two-step estimation are presented.[18]

4 Data

The primary data source for the inbound tourism demand model described in the previous section is the Eurostat.[19] 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 [64]), 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.[20] 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

[17] The results are avalaible upon request.
[18] See Wooldridge [67].
[19] See http://epp.eurostat.ec.europa.eu.
[20] See http://www.eea.europa.eu/themes/water/status-and-monitoring/

List of Threatened Species[21] and BirdLife International[22], respectively, while related to cultural heritages are taken from UNESCO[23].

The government effectiveness indicator is obtained from Kaufmann et al. [38], 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*".[24] 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.[25]

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 [14] and Froese and Kesner-Reyes [21]). However, the data are available only from 1950 to 2006.[26] 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 test[27] for detecting non-stationarity in data suggests taking the first difference of $Quality$ and $ln(GDP)$. Then, the

[21] See www.iucnredlist.org.
[22] See http://www.birdlife.org/datazone/sowb.

[23] See whc.unesco.org.
[24] For a detailed discussion see Kaufmann et al. [38].
[25] See www.worldbank.org.
[26] http://seaaroundus.org/
[27] See Im et al. [30].

following equation for the 1960-2006 period is estimated:

$$\triangle Quality_{it} = \varkappa_0 + \varpi_i + \varkappa_1 \triangle ln(GDP_{it}) + e_{it} \qquad \text{(Eq.8)}$$

where ϖ_i is a fixed effect of country i. After estimating *Eq.8*, the overexploitation index for the 2007-2010 period is computed as:

$$\widehat{Quality}_{it+1} = \triangle\widehat{Quality}_{it+1} + Quality_{it} \qquad \text{(Eq.9)}$$

where t starts from 2006.

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 $\triangle\widehat{Quality}_{it}$ for the 2003-2006 period. Then, we estimate the following equation using the 1960-2006 period (all sample):

$$\triangle Quality_{it} = \pi_0 + \iota_i + \pi_1 \triangle \widehat{Quality}_{it} + \zeta_{it} \qquad \text{(Eq.10)}$$

where ι_i is a fixed effect of country i. Finally, 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.[28]

Finally, to obtain a marine protected area within each country's EEZ in km^2, 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.[29]

[28] All estimation results are avalaible upon request.
[29] http://seaaroundus.org/.

5 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 *Eq.1* we apply the sensible economic interpretation and statistical significance ($t - statistic$). This approach is common in the tourism literature (see Song et al. [56], among others). 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 show a bell-shaped relationship in both models, meaning that increasing temperature is good for tourism up to a certain level, and then it becomes a negative factor. The optimal temperature is quite low: roughly 8°C and 13°C for arrivals and length of stay, respectively. 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. Futhermore, the marginal significance of the temperature variable may also point out that various tourists' activities depend on different temperatures and different perceptions of "optimal" temperatures among tourists. These findings are similar to Bigano et al. [3].

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 0.604 and 0.59 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 22.5 (=0.208*(1.50-0.42)*100) and 23.5 (=0.218*(1.50-0.42)*100) percentage points, respectively. 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 "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 0.664 and 0.673 percentage points increase in arrivals and length of stay in the next year, 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 $ln(QualBeach_{it-1})$ 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 both models, 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. 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 two lags 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 38% of the long-term (overall) impact (=0.349/(0.349+0.266+0.30).

Futhermore, the coefficients are greater for the length of stay than for arrivals (0.915 and 0.605, respectively), suggesting that ecosystem quality is a relatively more important factor for determining the length of stay than is the number of visits. In the case of arrivals, the long-run effect is 66% of that of the length of stay. All this indicates that albeit highly correlated the analysis of arrivals and length of stay provide richer and complementary 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 decreases by 15.12 (=(0.317+0.406)*0.25*100) and 22.87 (=(0.472+0.412+0.267)*0.25*100) percentage points in the long term.

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 a direct economic interpretation. Protected areas impose often partial or full restrictions to tourism activities. On the one hand, even when thay 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. As a result, MPAs may have a direct depressing effect on arrivals or length of stay. These findings are partially supported by the literature on entrance fee (see Pascoe et al. [50] and Walpole et al. [63]), 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 [48], highlighting instead a positive relationship between arrivals and marine protected areas. That study, however, developed a cross section rather than a panel analysis. It is also worth mentioning when we estimate *Eq.1c* 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 cross section analysis cannot.

However, it is misleading to conclude that marine protected areas are "bad" for tourism. To illustrate this point, consider models 1a and 2a in Table 1 where a set of interaction terms between protected areas and the major economic explanatory variables have been introduced. 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. This result provides support to environmental protection.

Destination-origin Fixed Effects

We also attribute the destination-origin fixed effects to country's cultural heritages, coastline, 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 2a.[30] As shown, the direction and significance of coefficients make sense. Tourists prefer a destination with richer biodiversity and with more heritages. In addition, the significance of coefficient on coastline captures the effect of scope in a country destination.

To conclude this section, in Table 3 we report an ex post estimation of what the changes

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

(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 0.69 percentage points with forgone total tourism expenditure of roughly 8 billion Euros, corresponding to 2.6% 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.

This study underscores the importance of both domestic and international price differentials, tourism support services, and quality of beaches as crucial factors in tourists' destination choice. Also, the paper draws attention of policy makers to marine ecosystem quality, especially, due to its persistence impact.

6 Conclusion

We investigate the relationship between marine ecosystem quality and inbound coastal tourism in the countries of the Baltic, Mediterranean, and North seas. This research contributes to the related empirical literature in several ways. First, it applies a panel destination-origin analysis rather than the cross-section analysis. This allows a better characterization of dynamic or intertemporal behavior of tourists. Second, it presents a richer model specification controlling for factors such as institutional quality, price competition across different destinations, and quality of beaches. Third, it suggests the use of the overexploitation index as an indicator of ecosystem quality. Fourth, we find a negative direct effect of MPAs on tourism. However, this effect is

[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.

reversed when the interaction terms with economic variables are included.

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. Also, the findings stress the role of investment in preservation as a strategy to enhance tourism destination attractiveness that can complement price competition.

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 38% of the total, signaling potential underestimation from cross-sectional analyses. Finally, a tourism pull factor is also associated with the quality of tourism support services captured by the government effectiveness indicator. The magnitude of this impact highlights 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 1a			Model 2a		
Dependent Variables	*ln(Arrivals)*		*P-values*	*ln(Length)*		*P-values*	*ln(Arrivals)*		*P-values*	*ln(Length)*		*P-values*
$Temp_{it}$	0.016		(0.68)	0.026		(0.50)	0.010		(0.79)	0.038		(0.32)
$Temp_{it}^2$	-0.001		(0.27)	-0.001		(0.32)	-0.001		(0.32)	-0.001		(0.20)
$\ln(GDP_{nt})$	0.604	***	(0.00)	0.590	***	(0.00)	0.263	*	(0.08)	0.525	***	(0.00)
$Gov.Eff_{it}$	-			0.159	***	(0.00)	-			0.162	***	(0.00)
$Gov.Eff_{it-1}$	0.208	***	(0.00)	-			0.218	***	(0.00)	-		
$\ln(Arrivals_{it-1})$	0.664	***	(0.00)	-			0.656	***	(0.00)	-		
$\ln(Nights_{it-1})$	-			0.673	***	(0.00)	-			0.670	***	(0.00)
$\ln(QualBeach_{it-1})$	0.077	***	(0.00)	0.056	*	(0.07)	0.079	***	(0.00)	0.066	**	(0.04)
$\ln(P_{nt})$	-0.439	***	(0.00)	-0.376	***	(0.00)	-0.474	***	(0.00)	-0.328	***	(0.00)
$\ln(P_{st})$	-0.059		(0.23)	-0.081		(0.11)	-0.254	***	(0.00)	-0.223	***	(0.01)
$Quality_{it}$	-			-0.349	**	(0.01)	-			-0.384	**	(0.01)
$Quality_{it-1}$	-0.234	**	(0.02)	-0.266	**	(0.04)	-0.311	***	(0.00)	-0.303	**	(0.01)
$Quality_{it-2}$	-0.371	***	(0.00)	-0.300	***	(0.00)	-0.379	***	(0.00)	-0.289	***	(0.00)
$\ln(MPA_{it})$	-0.015	*	(0.06)	-0.022	***	(0.00)	-0.683	***	(0.00)	-0.432	***	(0.00)
$\ln(MPA_{it})\times\ln(GDP_{nt})$	-			-			0.053	***	(0.00)	0.032	**	(0.02)
$\ln(MPA_{it})\times\ln(P_{nt})$	-			-			0.002		(0.66)	-0.004		(0.21)
$\ln(MPA_{it})\times\ln(P_{st})$	-			-			0.024	***	(0.00)	0.019	**	(0.04)
Constant	1.076		(0.24)	0.531		(0.48)	1.098		(0.23)	1.600	*	(0.06)
Fixed Effects	Yes			Yes			Yes			Yes		
Year Dummies	Yes			Yes			Yes			Yes		
R^2_{within}	0.63			0.61			0.64			0.61		
# of Obs.	4896			5149			4896			5149		
Average Years	7.7			8.3			7.7			8.3		

Notes: The p-values are in parentheses. ***,**,* stand for 1, 5, and 10% significance levels, respectively.

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

Dependent Variable	*Fixed Effects*		*P-values*
$\ln(Birds_i)$	0.010		(0.13)
$\ln(Mammals_i)$	0.008	**	(0.00)
$\ln(Herritage_i)$	0.012	**	(0.00)
$\ln(CoastLine_i)$	0.043		(0.00)
Constant	-6.194	***	(0.00)
R^2	0.14		
# of Obs.	5128		

Notes: Standard errors are robust to heteroskedastcity.

Table 3: Estimated loss in tourism industry due to 1% worsening quality of marine ecosystems. Reference value for year 2010

Country	Average Loss
Belgium	197,164,176
Croatia	198,137,464
Denmark	91,721,137
Estonia	45,060,379
Finland	113,668,929
France	892,400,917
Germany	121,619,505
Greece	154,698,424(*)
Ireland	158,542,816(*,**)
Italy	2,065,984,250
Latvia	15,898,543
Lithuania	23,404,869
Netherlands	1,657,068,276
Poland	19,932,924(*)
Portugal	122,520,602
Spain	809,210,248
Sweden	223,087,248(*)
UK	584,592,416(*)
Total Loss (Euros)	7,494,713,416
International tourism Expenditure European Union (Euros, 2010)	288,743,546,000
Change Due to Quality Loss (in%)	2.6

Notes: The computations are based on the overfishing index in Model 1a. (*) 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.

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