Extended Abstract

Rising Temperatures, Shifting Paradigms: Exploring the Interplay Between Climate Change and Italian Tourism Dynamics

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Europe is the most visited region globally, receiving 585 million of the world's 900 million international travellers in 2022. The tourism sector directly contributes 5% to the European Union's (EU) Gross Domestic Product (GDP) and indirectly accounts for over 10%. Several EU Member States are particularly dependent on tourism, with Croatia deriving 26% of its GDP from the sector, followed by Greece (18.5%), Spain (13.6%), and Italy (10%). Over the past decade, the EU has experienced average annual economic losses of approximately €26 billion due to extreme climate-related events (European Court of Auditors, 2024). In response, the EU has developed an Adaptation Strategy aimed at achieving climate resilience by 2050. Given the cross-sectoral nature of climate adaptation measures, estimating total EU funding for this purpose is challenging. However, budget allocations include at least €8 billion for the 2014-2020 period and €26 billion for 2021-2027.

The COVID-19 pandemic underscored the vulnerability of the tourism sector to external shocks, including pandemics, geopolitical conflicts, and extreme weather events. Economies heavily reliant on tourism have demonstrated lower resilience during crises (Watson and Deller, 2021). Climate change presents an increasing challenge, as it disrupts infrastructure, alters environmental conditions, and intensifies the frequency of extreme weather events. Rising sea levels pose risks to coastal destinations through beach erosion, saltwater intrusion, and heightened flood risks, necessitating costly adaptation measures such as seawalls and beach replenishment. Ocean warming accelerates coral bleaching and biodiversity loss, thereby impacting eco-tourism. In southern Europe, heatwaves and water scarcity diminish the region's appeal as a summer destination, while wildfires and altered precipitation patterns further disrupt tourism activities. Similarly, winter tourism faces challenges due to declining snow cover, which shortens ski seasons and threatens the viability of resorts. Although artificial snowmaking has been introduced as an adaptation strategy, it increases water and energy

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consumption, raising sustainability concerns. Conversely, climate change may enhance the attractiveness of cooler northern regions, as tourists seek alternatives to traditionally popular southern destinations.

This study examines the impact of climate change on tourism demand across the NUTS-2 regions of the EU, analysing various global warming scenarios projected through 2100. By assessing long-term trends, the research aims to provide insights into the potential geographic shifts in tourism patterns within Europe.

The relationship between climate and tourism has been widely studied, with research focusing on the influence of climate on destination choice, seasonality, and types of tourism activities (Hu & Ritchie, 1993; Moreno, 2010; Goh, 2012; Scott et al., 2016), as well as its effect on destination attractiveness (Lohmann & Kaim, 1999; De La Mata et al., 2012). The Sixth Assessment report by the Intergovernmental Panel on Climate Change (IPCC, 2023) identifies tourism as one of the five sectors most affected by climate change, with Mediterranean summer tourism particularly vulnerable. However, some regions with comparative climatic advantages may benefit (Burzynski et al., 2022).

For this analysis, an original dataset has been constructed by integrating multiple data sources. The dependent variable is the total number of nights spent by tourists in region i during month m and year y, serving as a proxy for tourism demand. The primary independent variable is the Tourism Climate Index (TCI), which quantifies thermal comfort for tourism activities. Historical TCI values from 1981 to 2020 have been obtained from ERA5 daily climate reanalysis data, while future projections for 2021-2100 are derived from an ensemble of 10 EURO-CORDEX climate models, based on two greenhouse gas emission scenarios: RCP 4.5 and RCP 8.5 (García León et al., 2023). Additionally, a categorical variable has been included to distinguish among six tourism typologies—urban, coastal, nature-based, rural, snowy mountain, and mixed tourism (Lavalle et al., 2022). These classifications are based on tourism supply (number of rooms) and demand (nights spent) across different geographical zones at the NUTS-3 level, subsequently aggregated to NUTS-2. The interaction between tourism typology and the TCI allows for differential effects of climate variation. Control variables include annual population (and its squared term to capture non-linearity), real GDP per capita, and multiple fixed effects.

The empirical strategy involves applying a multi-way fixed effects log-log panel regression model. The estimated coefficients are then used to perform out-of-sample predictions of tourism demand. The findings indicate that most regions are projected to experience a decline in TCI values. In summer, coastal regions in the Mediterranean—particularly in Greece and Italy—are expected to face a decrease in tourism demand. However, an overall increase in tourism demand is observed across

other regions, suggesting a substitution effect, where visitors shift from coastal destinations to alternative tourism locations during the summer months.

During spring and autumn, improved climate conditions are associated with increased overnight stays in coastal regions, with a 0.8% rise in spring and a 0.7% rise in autumn for every 1% increase in TCI. Conversely, in nature-based tourism regions, a 1% increase in TCI corresponds to a 0.93% decline in overnight stays during autumn and a 0.62% decline during summer, indicating that warmer conditions may deter visits to these areas and redirect demand toward coastal destinations. A similar trend is observed in rural areas during autumn, where the negative coefficient suggests a seasonal shift in preferences toward other tourism types, reinforcing the notion of a substitution effect. The adverse impact of declining TCI values on mountain regions in winter is particularly significant, as it highlights the negative consequences of reduced snowfall on ski tourism and winter sports. Finally, the findings suggest that mixed-tourism regions may experience marginally positive effects during summer, as tourists increasingly favour destinations that offer a diverse combination of coastal, cultural, and outdoor activities, making these locations attractive alternatives during periods of elevated temperatures.

The findings of this study highlight the substantial impact of climate change on tourism demand across European regions, with significant spatial and seasonal variations. Rising temperatures and increasing frequency of extreme weather events are projected to alter traditional travel patterns, reducing the attractiveness of coastal and nature-based destinations during peak summer months while enhancing demand in cooler seasons and in less climate-vulnerable regions. The projected decline in tourism demand for Mediterranean coastal areas, particularly in Greece and Italy, underscores the urgency of implementing adaptive strategies to mitigate economic losses in regions highly dependent on tourism revenues. Simultaneously, the anticipated increase in tourism demand in alternative destinations, including mixed-tourism regions, points to a possible reconfiguration of Europe’s tourism geography.

These results align with existing literature documenting the negative effects of climate change on Mediterranean summer tourism and the potential benefits for northern and high-altitude regions (Amelung & Moreno, 2009; Matei et al., 2023).