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Do wildfires burn tourism intentions? The case of Portugal

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Abstract

Fire intensity and size incite visitation decrease and recreational losses, relevant tourism variables for European economies. As a result of climate change, the wildfires recurrence is becoming more evident. Due to significant gaps in analyzing the relationship between wildfires and tourism demand, this paper aims to explain how tourism demand reacts to wildfires in Portugal. We use a spatial econometric model to analyze the relationship between total burned areas and overnight stays in a touristic establishment in a given municipality and its neighboring municipalities. Our results show that wildfires negatively affect the overnight stays in the same location but also cause spillover effects in neighboring municipalities. Also, the wildfire occurrences are positively related to the number of overnight stays after three months, suggesting a delay in tourism activities.

1. Introduction

Climate change relates to shifts in the mean climate and variations in the frequency and intensity of extreme weather events. The increased frequency and intensity of extreme precipitation, droughts, tropical cyclones, and compound extremes, including fire weather, are evident, as shown in the IPCC 6th Assessment Report (IPCC 2021). In particular, the recurrence and duration of wildfires, as a result of climate change, has increased in many countries all over the world, including Greece, Spain, and Portugal (Giannakopoulos, Kostopoulou et al. 2011, Hall, Scott et al. 2011, Marques, Borges et al. 2011, Doerr and Santín 2016). Consequently, economic activities, specialization, and other economic geography variables are also predicted to shift in the coming years (Yohe and Schlesinger 2002, Conte, Desmet et al. 2021). A region that is expected to be severely affected by climate change and fires is the Mediterranean.

In the Mediterranean, tourism constitutes a significant economic activity, totalizing 217 billion euros in international tourism receipts, 23% of the world total, in 2014. The Mediterranean climate is the principal element tourists consider regarding travel planning, especially relevant for summer tourism (Giannakopoulos, Kostopoulou et al. 2011, Roson and Sartori 2014). Hence, the dependence of tourism activities on climate resources makes the industry one of the most vulnerable to climate change (Dogru, Bulut et al. 2016, Dogru, Marchio et al. 2019).

Portugal, as a Mediterranean country, has historical wildfires. Natural ignitions in the European Mediterranean basin, such as lightning, are standard where the atmospheric conditions feature low humidity and little or no precipitation. However, the modified socio-economic, environment and land patterns, in Portugal, as well as in other European Mediterranean countries, led to changes in the traditional causes of fire ignition in recent decades, whose origins have predominantly become anthropogenic instead of natural (Pereira, Trigo et al. 2005, de Zea Bermudez, Mendes et al. 2009). Currently, Portugal has the highest incidence of wildfire events in the Mediterranean basin and the whole of Europe, which have also become larger and more intense (Meira Castro, Nunes et al. 2020).

As in other similar regions, wildfires in Portugal are more prone to occur in the summer, when high temperatures and relative air humidity are low. In the same period, tourism activities are at their highest, and studies already look to patterns of seasonality and global warming implications in summer tourism (Vergori 2017, Koutroulis, Grillakis et al. 2018). The tourist accommodation sector registered 2.5 million guests and 7.5 million overnight stays in August 2021 in Portugal, versus 1.5 million guests and 3.6 million overnight stays in November 2021. This summer tourism peak is responsible for a seasonal increase in the income of associated economic sectors, such as food and hospitality. The average daily rate (ADR) amounted to EUR 115.8 in August, and EUR 98.7 in July, versus EUR 47.1 in February (INE 2021).

Although the broad impacts of climate change in tourism have been analyzed (Scott, Gössling et al. 2012, Kaján and Saarinen 2013, Dogru, Marchio et al. 2019, Scott, Hall et al. 2019), more specific studies only focus on tourism activities that will suffer most immediately from climate change, expectedly, the decrease in snow and skiing activities (Dawson and Scott 2013, Gilaberte-Búrdalo, López-Martín et al. 2014, Steiger, Scott et al. 2019). Some of these studies use simplified regression models to evaluate the effect on ski tourism variables resulting from increased temperatures (Demiroglu, Kučerová et al. 2015, Damm, Greuell et al. 2017).

Studies on wildfire impacts in tourism are even in more remarkable absence, as noted by Arabadzhyan, Figini et al. (2021) in a review on coastal tourism. Such may be explained both by the difficulty in collecting and treating data and coordinating analysis between two vastly different scientific areas and by the fact that the tourism boom is still very recent in some wildfire-prone regions, such as Portugal. Additionally, the years of the pandemic and substantial restrictions on travel further hinder the collection of information, although new analyses are emerging (Marques, Guedes et al. 2021). Existing analyses include Sánchez, Baerenklau et al. (2016) that develop a Kuhn–Tucker model of recreation demand, with survey data, to look to relationships between wildfires and wilderness access, looking to the effects on visits, showing significant potential welfare loss. In Portugal, Otrachshenko and Nunes (2022) use yearly data in a two-level analysis in a panel regression model with fixed effects to reveal that burned areas negatively impact the number of tourist arrivals.

As evidenced, the literature presents significant gaps in analyzing the relationship between wildfires and tourism demand. In the context of climate change, with perspectives of future worsening of extreme events in the Mediterranean region, and with the growing importance of the tourism sector for regional socio-economic development, it becomes critical to understand how tourists change their journeys in the evidence of those events.

This paper aims to understand how tourism demand reacts to wildfires and how tourists adjust their destination / monthly travel intentions within monthly time lags. Do tourists postpone their trips for a few months when faced with the evidence of the fires? Will they change their intentions to visit at similar times in the following years? This study builds on previous analysis and develops a model to address these questions. Looking at all mentioned works, we conclude that regression analyses, adequately tuned to the variables in question, can produce valuable results. We apply spatial econometric techniques not yet used in this field to develop a novel spatial regression model that considers the possibility of spillovers in time and space, contributing to the economic geography literature on climate change impacts. The model analyses wildfires over monthly time units and municipalities, capturing their effects on the variation in the distribution of tourism along with the municipalities mentioned above.

2. Data and Methodology

2.1. Data

This study uses wildfires data provided by the Portuguese Institute for Conservation of Nature and Forests (ICNF) (ICNF 2021). The database includes monthly distributed data on the burned area in hectares by municipalities from 2017 to 2020. The total burned area includes forests and shrubs lands and rural areas. The percentage of wildfires events during summers increased severely from 49% to 70% from 2019 to 2020.

As a proxy for tourism demand, the municipality's number of tourist guests and monthly overnight stays were obtained from the Statistics Portugal website (INE) from 2020 to August 2021 (INE 2021b, INE 2021c).Figure 1 and 2 shows the occurrence of wildfires of more than 1000ha in continental Portugal during summers 2019 and 2020, respectively. Comparing figure 2 with tourism demand, in 2020 and 2021 summers (Figure 3), it is possible to see the lowest tourism records in the same municipalities with the most significant fires. In Proença-a-Nova (Pr-a-Nova in Figure 2), for example, had the most significant wildfire in 2020 summer (Figure 2), and this municipality registered the lowest tourism demand rate in 2020 and 2021 (Figure 3). This data shows possible wildfires interfering in summer tourism demand in the same year and one year later after the wildfire event.

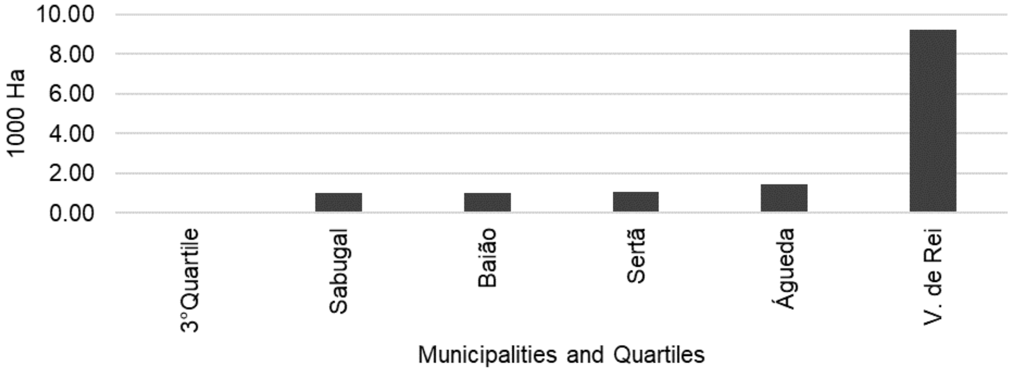

Figure 1- Burned areas per Municipalities of the 4th Quartile, summer 2019. Source: (ICNF 2021).

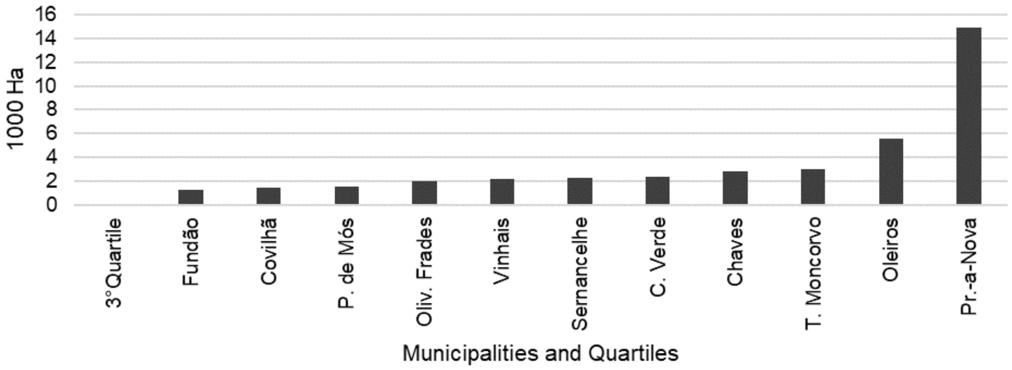

Figure 2- Burned areas per Municipalities of the 4th Quartile, summer 2020. Source: (ICNF 2021).

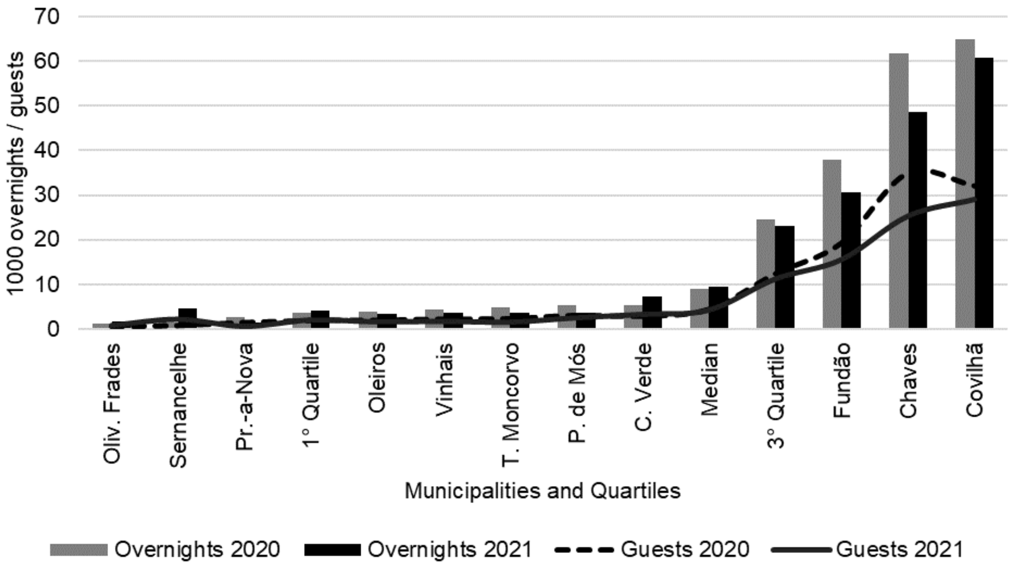

Figure 3- Tourism demand, per representative Municipalities with wildfires in 2020 - summers 2020 and 2021. Source: INE (2021b); INE (2021c).

In the same way, a similar effect appeared when comparing figure 4 with the tourism demand in 2020 summer for the same municipalities illustrated in figure 1. For example, Vila de Rei municipality, wherein 2019 had the most significant wildfire registered during summer (Figure 1), and in the next year (2020) had the lowest summer tourism demand recorded (Figure 4), showing a one-year later effect.

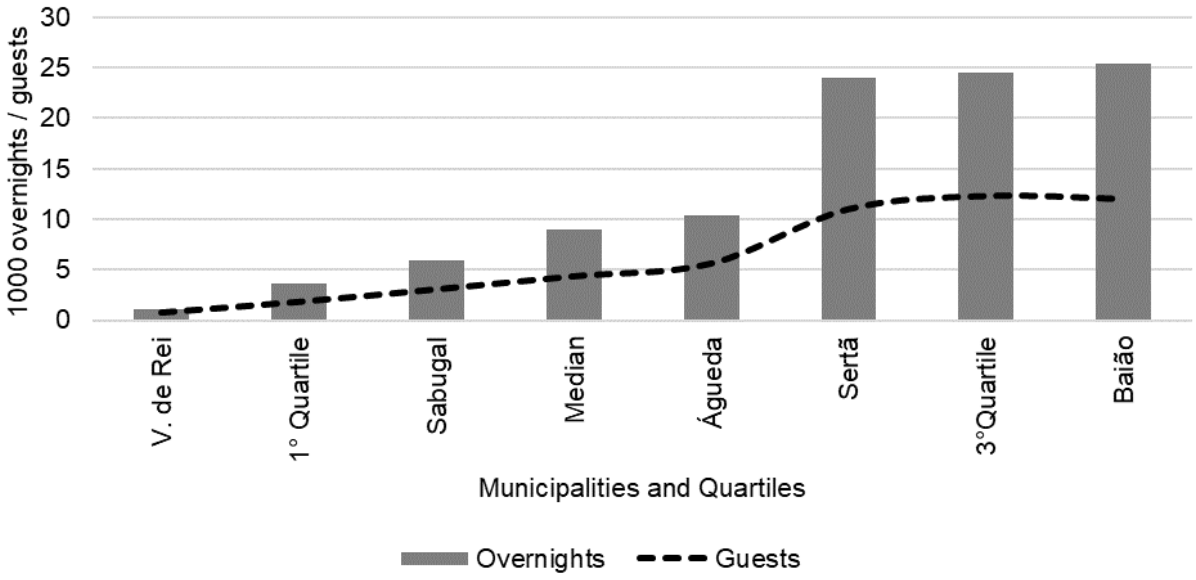

Figure 4- Tourism demand, summer 2020, per Municipalities with wildfires in 2019. Sourc e: INE (2021b); INE (2021c).

2.2. Methodology

In this paper, we use a spatial econometric regression to look at the effects on neighbor regions. We estimate the relationship between total burned areas and overnight stays in a touristic establishment in a given municipality by month. The main equation has the following specification:

$$Stays_{i,m,y} = \beta_0 + \beta_1 Burned_{Area\,i,m,y} + \theta_i + month_m + year_y + \varepsilon_{ii,y}$$

where $Staysi,m,y$ is the number of overnight stays, considered in relation to each person, by municipality, $Burnedi,m,y$ stands for the total area of burned forest, agriculture land, and shrub. The terms θi, $monthm$, and $yeary$, are the municipality, month and year fixed effects, respectively.

The municipality fixed effects control for time-invariant unobserved local characteristics that may affect the number of overnight stays, such as the area of the municipality, the landscape, the location or the supply of cultural and environmental amenities that do not vary in 2020 and 2021. Monthly and yearly fixed effects control for any common changes across municipalities and for the seasonal nature of the touristic demand as well as COVID19 restrictions implemented nationally wide.

The coefficient of interest is $\beta 1$ which measures the change in the number of overnight stays due to an increase in one hectare in burned area.

The model is estimated with contemporaneous information for overnight stays and burned area, but the $\beta 1$ estimator potentially suffers from omitted variable bias, if there are other factors that affect tourist demand and the burned area simultaneously.

Wildfires in one given municipality can also affect tourism demand in neighboring municipalities. In order to control for that, we estimate a set of models including a spatial lag of the burned area in other municipalities, weighted by a spatial weight matrix. This matrix is row-standardized and is based on the power functional form as follows:

$$w_{ij} \begin{cases} \dfrac{d_{ij}^{-2}}{\sum_{j=1}^{n} d_{ij}^{-2}}, i \neq j \\ 0, \end{cases}$$

The model with spatially lagged burned area has the following specification:

$$Stays_{i,m,y} = \beta_0 + \beta_1 Burned\_Area_{i,m,y} + \beta_2 WBurned\_Area_{i,m,y} + \theta_i + month_m + year_y + \varepsilon_{ii,y}$$

where $WBurnedi,m,y$ denotes the spatial lag of $Burnedi,m,y$.

3. Results

The analysis of effects on the number of overnights spent by tourists resulting from wildfires is presented below in Table 1. The model comprises 1, 3, 6, 9 and 12 monthly temporal lags, identified with *"L#"*, to capture the changes in intentions. For each temporal lag, a spatial lag, noted with *"W"*, is also considered, showing the effects of wildfires on neighboring municipalities in local tourism demandable. These results are presented in Table 2.

According to Table 1, burned area is positively related to the number of overnight stays after three months. This can be the result of postponed reservations or the decrease in prices that might occur if wildfires reduce the attractiveness of the municipality in the following days. The negative effect appears to be statistically significant after twelve months of the wildfires. On average, one hectare of burning area reduces overnight stays in almost 3 units.

Table 1 - Results of the spatial regression model with time lags.

	(1) Overnights	(2) Overnights	(3) Overnights	(4) Overnights	(5) Overnights	(6) Overnights
Burned Area	-0.535 (0.382)					
L. Burned Area		-0.251 (0.434)				
L3. Burned Area			0.887^{**} (0.404)			
L6. Burned Area				0.0662 (0.439)		
L9. Burned Area					0.598 (0.524)	
L12. Burned Area						-2.953^{*} (1.637)
Mun. fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	2636	2815	3137	3783	4259	4259
R^2	0.055	0.054	0.056	0.034	0.048	0.048
adj. R^2	0.051	0.049	0.052	0.031	0.045	0.045

Table 2 presents the results of the model with the temporal and spatially lags of the burned area. The negative effects of the burned area on overnight stays are now statistically significant on the contemporaneous month of the wildfire, as well as on the twelve months lag. A novel result is the impact of wildfires in neighboring municipalities. The magnitudes are much higher than the magnitude of the coefficient for the same location. The positive effect after three months is also significant, as in Table 3, as well as the effect of the neighboring wildfires.

We construct the model considering fixed effects from external variables, such as climate temperature and the occurrence of COVID 19. However, a further analysis that may be carried out is to consider the effect of COVID 19 on the tourism demand in Portugal. In addition, we hope to analyze further the effects of wildfires on tourism revenues and their impact on regional and national GDP.

Table 2 - Results of the spatial regression model with time and space lags.

	(1) Overnights	(2) Overnights	(3) Overnights	(4) Overnights	(5) Overnights	(6) Overnights
Burned Area	-0.706* (0.407)					
W_Burned Area	-28.96** (13.06)					
L. Burned Area		-0.252 (0.424)				
L.WBurned Area		-0.227 (4.428)				
L3. Burned Area			0.728** (0.324)			
L3.W_Burned Area			27.98** (12.80)			
L6. Burned Area				0.0958 (0.427)		
L6.W_Burned Area				-7.286 (5.082)		
L9. Burned Area					0.612 (0.507)	
L9.W_Burned Area					7.707 (7.254)	
L12. Burned Area						-2.623* (1.477)
L12.W_Burned Area						-26.11*** (8.929)
Mun. fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	2636	2815	3137	3783	4259	4259
R^2	0.055	0.054	0.056	0.034	0.048	0.048
adj. R^2	0.051	0.049	0.052	0.031	0.045	0.045

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