Soundscape and Pollution: Assessing the Environmental Effects of Peer-to-Peer Occupancy in Barcelona and Madrid

Authors: Josep Maria Raya Vilchez, Catalina Llaneza Hesse
Keywords: Pollution, Noise, P2P demand, COVID-19, time of stay.

Extended Abstract

In the current context of increasing environmental awareness and mass tourism, to address the relationship between tourism and pollution is critical research topic that poses significant challenges and opportunities for addressing sustainability within the tourism industry (Su y Lee, 2022; Deng et al., 2017). It is known that Air pollution can negatively affect the quality of life and health of residents. Moreover, negative perceptions of highly polluted destinations can discourage tourists from choosing those places as holiday destination. Previous studies at country level (Shakouri et al., 2017; Dogan et al., 2015), have found that tourism can be beneficial in reducing pollution, while others have found that tourism contributes to an increase in pollution (i.e., Akadırı et al., 2018; Katırcıoğlu et al., 2014; Solarin, 2014). Other, centered on smaller geographic scales, such as cities or regions as the one from Saenz-de-Miera and Rossello (2014) confirmed that the daily influx of tourists in Mallorca, Spain, is not only a significant predictor of air pollution concentration levels, but also a variable whose inclusion improves the overall significance of urban air pollution models, predicting that a 1% rise in tourist numbers can be associated with up to a 0.45% increase in PM10 concentration levels.

Literature on the relationship among noise pollution and tourism is scarce. Cengiz et al. (2023), who created noise maps by measuring the noise levels in Amasra, a small-scale tourist coastal town, found that the noise levels in areas where there is vehicle traffic, parking lots, shopping areas, and food and beverage establishments are predominantly high. Nofre et al. (2017), found that touristification and studentification in Barrio Alto, Lisbon, have caused tensions between lifelong residents and nightlife consumers due to the accumulation of trash on the streets and due to the noise generated by people mingling outside.

The main goal of this paper is to identify the effect of the peer-to-peer (P2P) accommodation demand on pollution or noise levels. To our knowledge, it is the inaugural paper on the subjects and combines several innovative datasets. Firstly, the data on the concentration levels of selected as atmospheric trace gases of gases as NO2, SO2,

O3 and CO[1] were extracted by satellite images coming from the Sentinel-5P mission and the Copernicus mission, dedicated to monitoring our atmosphere. These images have a spatial resolution of 5.5 km x 3.5 km and a daily time frequency. So that the identification of variability within time is very detailed, but geographically limited to district level.

Secondly, the original data on noise pollution at neighborhood level were obtained through the open data access portals of the corresponding city council of Madrid and Barcelona derived from data obtained through spatial interpolation of data measured by noise stations in both cities. Data on noise levels measured in A-weighted decibels (dbA)[2] is available at the minute level, although aggregated at a monthly level.

A kriging has been carried out in order to establish a solid correlation between the occupancy levels and noise levels. Kriging is a technique used in geospatial analysis to estimate values at unsampled locations within a geographic area (Aumond et al. 2018; Picheny et al. 2014; Sakata et al. 2006; Segura et al. 2016). The indicator is, therefore, noise level. Finally, to identify the density of P2P density through time, our third dataset is based on detailed web scrapped information of P2P density at monthly and listing level coming from AirDNA. All three dataset are available at monthly level for the time span, 2018- 2023.

To identify the effect of P2P demand on noise and pollution, we first run a series of regression models using our newly constructed census-tract level dataset. Our main explanatory variable is defined in diverse ways. First, we use the logarithm of the number of P2P listings by geographical area. Second, the logarithm of the number of P2P listings by the population of the area, and finally, the absolute number of P2P listings by area. At first, we perform fixed-effects models to remove unobserved heterogeneity across districts. As additional controls we employ variables that capture the type of listings, by estimating the average daily rates, the estimated number of users, and the percentage of P2P rooms offered in a shared apartment. Additionally, we define a set of control variables that explain differences in pollution and noise levels. To better capture the intensity of the P2P presence across the different parts of the city, we carried out a spatial interpolation of the different prices of P2P based on a Kriging algorithm (Sainaghi and Chica-Olmo, 2022). Our second identification strategy is close to a standard Difference in Differences approach, but with a continuous 'treatment' effect instead, the P2P density.

[1] Nitrogen dioxide, Sulfur dioxide, Ozone and Carbon monoxide, correspondingly.

[2] A measure used to quantify the noise level based on the response of the human ear to different frequencies.

In other words, we explore the difference in outcomes in areas with high presence of P2P demand with those with low presence of P2P density comparing the effects between both cities Barcelona and Madrid and both time periods: Covid-19 and before/after the pandemic. Another complexity is added by differentiating the P2P density of short-term and temporal stays.

Preliminary results show no impact of P2P density on pollution in general, nevertheless some heterogeneities across neighborhoods and pollution gases are identified. In terms of noise, a positive effect of P2P density on this outcome is observed, here as well are captured seasonal and area patterns.

This pioneering research not only sheds light on the intricate interplay between tourism dynamics and environmental outcomes but also underscores the imperative of adopting sustainable tourism practices to mitigate adverse environmental impacts. By unraveling the complexities of this relationship, policymakers and industry stakeholders can devise targeted interventions to foster a more sustainable tourism landscape.