Spatial distribution of the tourism carbon footprint in a Spanish region

Topic: Input-Output Analysis: Sustainable Production and Consumption Policies - VII
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Recent studies have focused on analysing the impact of tourism on sustainability from different perspectives (Cai, 2016; Cardenete et al., 2022; Lenzen et al., 2018; Sun et al., 2020). In this sense, the recent experience due to the pandemic and the lockdown has increased the need for in-depth studies of the consequences of changes to tourism patterns, particularly if this industry is to approach the sustainable goals set in the Glasgow Declaration on Climate Action in Tourism (50% less emissions by 2030, net zero before 2050).

Given the importance of tourism in Spain, there are several sources of information for this type of analysis. Expenditure surveys, such as EGATUR (for foreign tourism) and ETR/FAMILITUR (for domestic tourism) (INE, 2022), provide data according to different characteristics, like month, country of origin, region of destination, length of the stay and total expenditure for international tourist, while the characterisation of domestic tourism is even more detailed (month, region of origin, province of destination, some socioeconomic variables for the tourist, and the level and pattern of spending).

Data by the Satellite Tourism Account (STA, INE, last available data for 2021) bridges the gap between expenditure data from surveys and demand according to national accounts, so we can calculate the carbon footprint for both types of tourism, following the methodology in (Cadarso et al., 2022). We use a multiregional input output (MRIO) approach with the FIGARO database for 2020, including data for CO2 emissions. This database provides input-output data for 64 industries-46 regions, but it also has regional detail (55 industries), so a more precise calculation can be made that takes into account the specific production structure in a particular region, by nesting the regional IO data for that one region within the general model. To obtain our vector of demand, we allocate from the STA the tourism demand corresponding to the chosen region by considering the proportion it represents in the expenditure surveys.

That footprint is, however, not homogenously distributed within the territory. Locations receive vastly different amounts of tourists, from different origins, with varying levels and patterns of spending. Recently, the Spanish National Statistics Office (INE) has started to publish data based on the location of mobile phones, by municipality, of foreign and domestic mobile phones in their trips inside Spain. These experimental statistics use mass data from phone antennas together with algorithms to transform them into variables that measure tourism flows (INE, 2022).

The objective of this paper is to combine the granularity of these data with the calculation of the tourism carbon footprint using a MRIO approach to determine how the impact of domestic and foreign tourism is distributed within a particular Spanish region, Castilla-La Mancha. From the calculated carbon footprint (including specific regional IO data), number of tourists and nights, spending levels per nationality for foreign tourists from EGATUR and the detailed information on province of origin, level, and pattern for domestic tourists from the ETR/FAMILITUR, we will obtain a carbon footprint per tourist and night (according to their country or province of origin). We will then distribute that impact spatially according to the number of tourists and length of stay in the municipalities that make up the Castilla-La Mancha region from the data on mobile phones.

To our knowledge, this is the first instance that this type of data is combined with IO data to allocate the carbon footprint spatially by municipality. Our results show how most of the impact is in the main

tourist locations, particularly for international tourists, like Toledo. However, the relative effect in small municipalities attracting an increasing amount of national rural tourists is also relevant and should be taken into account when designing regional tourism promotion policies.

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