



# Chapter 4

## Cointegration and Causality Analysis of Portuguese Tourism and Air Quality: Differences Among International Tourism Markets


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### ABSTRACT

*This chapter aims to fill the knowledge gap regarding the relationship between tourism and air quality, specifically in the Portuguese tourism industry, with a focus on tourist nationality. It examines whether this relationship differs according to tourist origin. This study uses an air pollutant, PM10, with a strong impact on human health that has been highly neglected in the literature. Despite the great use of CO2 in assessing the causal relationship between tourism and the environment, this is not the best indicator of air quality (AQ). This chapter presents results by applying vector autoregressive models (VAR) with monthly data for the period of 2007-2017, considering the nationality of tourists that visit Portugal. Results suggest that PM10 levels and tourism are negatively correlated (in the Pearson sense) with a link between them in the long run. This relationship is confirmed by the four methodologies tested. The negative relation in Pearson and cointegration results suggests that tourism can be affected by AQ in Portugal and may lead to better AQ.*

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## **INTRODUCTION**

There is a growing concern about the two-way relationship between tourism and air quality. If on one hand, air quality has a direct impact on certain touristic regions, affecting not only the tourism industry but also other economic activities, on the other hand, tourism has adverse impacts on the environment, namely through the emissions of greenhouse gases (GHG), waste production and natural resources consumption. Therefore, there is a rising awareness from the tourism industry to adapt and change in face of these two-way effects.

The relationship between tourism and environmental variables has been studied by different authors. Most of these studies use CO<sub>2</sub> emissions, climate change, environmental pollution and air quality variables. Air pollution is a particular environmental problem nowadays, being responsible for many premature deaths. Almost all tourism activities have polluting impacts, but there is a consensus that the consumption of transport services, mainly road and air transport, have relevant impacts on air quality (WTO, 2003). On the other hand, air quality is a central factor in the selection of tourist destinations (Hu and Wall, 2005, Mihali, 2000, Zhang et al. 2015). First, because air pollution causes considerable health risks, as mental and emotional depression, and respiratory and cardiovascular diseases (Hadley et al., 2018, Szyszkowicz et al., 2016, Trasande and Thurston, 2005), and second, because air pollution considerably harms visibility, reducing the aesthetic satisfaction and pleasure obtained by tourists, affecting their willingness to travel (Mace et al., 2004, Poudyal et al., 2013). The seeking for fresh air can become a critical motivational stimulator for spatial mobility at the international level that may ultimately affect international tourism flows and outbound tourism demand (Wang et al., 2018).

Moreover, the tourist origin may affect this relationship, that is, the country of origin can influence, either the tourist's environmental behavior either the impact of the air quality in travel decisions (Xu and Dong, 2020; Valeri, 20216; Valeri and Baggio, 2020a; 2020b; 2020c; 2021; Baggio and Valeri, 2021). Tourist behavior is greatly shaped by social norms and values, which are closely contingent on geographical locations (Pizam and Milman, 1986). Moreover, the pulling effects of attributes involved in selecting among alternative tourism destinations correspond closely to the evolving environment tourists have in their place of residence (Santos et al., 2021a; 2021b). The influence of air quality on the tourism demand of people with high disposable income will be lower than that on people with low disposable income (Wang et al., 2018). Therefore, tourist origin is a relevant variable to be considered when studying the two-way relationship between tourism and air quality.

To investigate the link between these two variables - tourism and air quality – the present study intends to assess this relationship, specifically in the Portuguese tourism industry, examining whether this relationship differs according to tourist origin (nationality). PM<sub>10</sub> is used as the air pollutant driver – since it is one with highest impact on human health, using monitoring monthly data collected for the period of 2007-2017.

The contribution to the literature is made in several aspects. First, this chapter studied the relationship between tourism demand and air quality using Vector Autoregressive (VAR) models, provided these allow for simultaneous relationships among variables and their lagged values. It is relevant to analyze this subject, given that no studies are known that, through cointegration and causality methods, examine the relationship between tourism flows and one of the most relevant air pollutants (PM<sub>10</sub>) in Portugal. As mentioned, the number of studies analyzing the relationship between tourism and PM<sub>10</sub> is still very scarce (Eusébio et al., 2020). Second, this study measures the causality between these two variables by

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