



The impact of energy efficiency and economic productivity on CO₂ emission intensity in Portuguese tourism industries



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ABSTRACT

This study employs the decomposition analysis of CO₂ emissions for the period from 2000 to 2012. This technique computes five effects that drive changes in CO₂ emissions in five subsectors of the Portuguese tourism industry. The energy over fixed capital, the capital over labour productivity, and the tourism intensity are the most important effects in accommodation, food and beverage services. The carbonisation index constitutes an important effect in transports. The capital over labour productivity intensity effect has the strongest influence, while the carbonisation index exerts a positive influence upon CO₂ emissions in tour operators and travel agencies. The energy over gross fixed capital and tourism intensity effects predominate in cultural, sports and recreational services. The results of the econometric analysis further confirm the statistical significance of the aforementioned effects. Policy recommendations are provided.

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1. Introduction

The tourism industry has changed substantially in the past decade. The acceleration of environmental degradation combined with ever-growing demand for energy consumption has raised concerns about the adverse effects of energy use in tourism industry among policy makers. More recently, the potential future effects of climate change on tourism have attracted the attention of institutions at the global, regional and national levels, and in academia and research.

Indeed, tourism is responsible of about 5% of worldwide carbon dioxide emissions. The transport sector alone is responsible for 75% of total sector emissions, of which air transport accounts for 50%. By comparison accommodation services represent 21% and other tourism activities 4%. However, it should be remembered that the projections on the future tourism demand should change the point of view that the tourism industry is a clean and non-polluting sector, since pollutants and greenhouse gas emissions from tourism activities are expected to

duplicate up to 2035 (S. Gössling, 2002; Gössling & Hall, 2004; UNWTO, 2008).

According to a report published by the World Travel and Tourism Council (WTTC, 2011), the travel and tourism sector represents 7.8% of the total EU gross domestic product (hereafter, GDP) and is responsible for the creation of over 8.4% of the total employment in 2011. Tourism has made a significant contribution to the local economy and involves the transportation and hosting of tourism consumers. In fact, the travel and tourism sector depends on a wide range of infrastructure services, including ports, airports, roads, railways, and telecommunications. Another report released by the World Travel and Tourism Council (WTTC, 2013) states that the Portuguese tourism industry employs about 7% of the country's active population and its direct contribution to GDP is nearly 6% in the year 2012. The total contribution of the tourism industry to the Portuguese GDP represents about 16% and domestic tourism expenditures alone are responsible for the generation of about 36% of its GDP. Moreover, according to the Bank of Portugal (BP, 2013), based on data for the year 2012, tourism generated 8600 million euros and reached its best result in that year in terms of the annual revenue, recording an increase of about 5.6% over the year 2011, and 24.6% in the last three years. This outcome represents about 5.2% of GDP and it is the highest value ever reached over the last twelve years. In terms of international trade, 13% of total exports and over 45% of service exports are due to the Portuguese tourism sector.

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According to data available throughout the Tourism Satellite Accounts (TSA) published by the Portuguese National Statistics Institute (INE, 2013), between 2000 and 2008, internal tourism consumption¹ and Value Added Generated by Tourism (VAGT)² have registered an average annual growth of 4% and 4.4%, respectively. After 2003, internal tourism consumption has progressed year after year, at a growth rate higher than the growth rate of the national economy, and in 2008 it reached 10.5% of Portuguese GDP. As a matter of fact, the tourism consumption in the economic territory represents about 9% of GDP, the consumption of international visitor's accounts for about 56% of this specific consumption, while the consumption of domestic tourists reaches 39%. Housing services associated with own second homes are responsible for the remaining 5% of tourism consumption in Portugal (INE, 2011). The international tourist's arrivals in Portugal register an average annual growth of 1.1% in the period 1995–2010. The number of international tourist's arrivals reached a peak of 12.3 million in 2007 and represent 11.2 million individuals in 2010 (Idtour, 2012).

INE data indicates an increase of 1.6% in accommodation services for the period 2007–2009, and indicates a negative change in the food and beverages services subsectors (–7%), as well as for travel agencies and tour operators (–1.7%). The data available for the year 2009 indicates that 6178 enterprises are operating in accommodation services, 75,163 enterprises in food and beverage services and 1318 enterprises in travel agencies and tour operators. The data reflects the importance of the food and beverages services subsector in the overall structure of the tourism industry, and according to data for the year 2009 it represents 90.9% of the total number of enterprises in the tourism industry. By contrast, accommodation services account for 7.5%, and travel agencies and tour operators for only 1.6% of the total number of enterprises. These various subsectors are related to tourism and have different impacts on the level of emissions. Most of these emissions are produced by the transport of tourists and, in particular, air travel. However, energy consumption is largely related to road transport and it increased in the nineties due to steady growth of vehicle fleets and road travel volumes, reflecting GDP growth, higher family income levels and strong investments in road infrastructure (Chiesa & Gautam, 2009).

The reduction of carbon dioxide emissions and other atmospheric pollutants constitutes a foremost objective at a global scale. The tourism industry, linked with several sectors like trade, transport, accommodation, dining and attractions, contributes to climate change specifically by producing greenhouse gas (GHG) emissions. The rapid growth of tourism activities has caused a rise in tourism-related emissions, posing a great challenge to this industry (Scott et al., 2010). Several studies suggest that it is possible to make significant reductions in the pollution caused by these sectors. Specifically for the travel industry, the Intergovernmental Panel on Climate Change (IPCC) estimates that about 15% to 20% of emissions can be reduced cost-effectively by 2020 and an additional 10% emission reduction (around 6 Mt CO₂) would require around \$430 million investment (at an average abatement cost of \$75 per ton of CO₂). For the accommodation sector, some authors refer that it is possible to reduce carbon emissions particularly by using existing mature technologies in lighting, heating and cooling that significantly improve energy efficiency in hotels (Chiesa & Gautam, 2009).

The tourism industry is of crucial importance to the Portuguese economy which has to take it to its advantage along with the environmental goals and targets to whom Portugal is committed internationally. Consequently, it becomes important to analyse which are the effects

that contribute to the variation of CO₂ emissions in the Portuguese tourism industry, as well as to investigate which are the tourism subsectors that are more responsible for their increase. Before any analysis, there are some preliminary considerations that have to be taken into account. First and foremost, we need to know what factors increase pollution. Some of the possible factors on the list are energy consumption, increasing consumption of fossil fuels compared to renewable energy, and the increase of tourism consumption compared to value added. Overall we are motivated by this research because of the increasing role of tourism activities in the national economy. Then, we want to ascertain if there are Portuguese tourism activities with greater responsibility in the environmental impact. According to the data provided by the Portuguese National Statistical Institute (INE, 2013), tourism activities in Portugal account for about 10% of national CO₂ emissions. The transport sector alone represents 89% of CO₂ emissions from tourism, and accommodation, food and beverages services account for about 5% each. The remaining tourism activities have a negligible impact on air pollution. According to data from the tourism satellite accounts, accommodation services are the tourism subsector where the CO₂ emissions grew the most (from 2000 to 2008), with a growth rate of 48.4%, followed by food and beverages services, and cultural, sports and recreational services with a growth rate of 34% and 25%, respectively. Nonetheless, regarding the intensity of CO₂ emissions (emissions by value produced), all subsectors of the tourism industry improved their performance by reducing this indicator. For transport and travel agencies, it decreased significantly (–33.7% and –30.9%). The exceptions are accommodation services in which the emission intensity increased 5.6%.

This study attempts to answer the research question whether the policies applied to each subsector of the Portuguese tourism industry are in accordance with the most important factors that motivate their emissions. We can mention at least two important reasons for embarking on this empirical investigation. First, the European Union Emissions Trade System (EU ETS) does not include subsectors of tourism, with the exception of the aviation sector that has been included in 2012 (Directive 2008/101/EC). The shipping sector will only be covered by the first policy actions to reduce emissions in 2018. There is also a recent policy envisaged to reduce emissions from new cars to 95 g per kilometre in 2020 (EC, 2012). Second, there are very few studies that explore the relationship between tourism, economic activity, energy consumption and carbon emissions using econometric techniques and the decomposition analysis. The aim of this research is to identify the effects in which carbon dioxide emissions into tourism can be broken down to investigate empirically what are the main factors that drive CO₂ in the subsectors of the Portuguese tourism industry.

This paper is organised in the following way. In the introductory section we describe the research context, its objectives and main motivations. Next, in section 2, we review the relevant empirical literature to contextualise the central issue of this paper. In section 3 we describe the data handling and we introduce the research methods that include the mathematical model used for the decomposition analysis. We describe the econometric methods applied, based on panel corrected standard errors, to investigate the relationships among the intensity of CO₂ emissions and its main explanatory variables. In section 4, we present the results of the decomposition analysis and the econometric investigation. We report the empirical results for different time periods during 1996–2009 given the data availability and the quality of the data for the subsectors of the Portuguese tourism industry. Section 5 contains the concluding remarks and the policy recommendations.

2. Literature review

This section reviews previous studies that have adopted disaggregation techniques which can be referred to as index decomposition analysis (IDA) to study the impacts of structural change and the change of sectorial energy intensity, and trends of energy use, at the level of the industry. It is relevant for our analysis to start searching for studies that

¹ The internal tourism consumption is the tourism consumption made by residents and non-residents in Portugal. The internal tourism consumption is divided into inbound tourism consumption and domestic tourism consumption. The former is the expenditure by visitors from abroad as part of a tourist trip to Portugal, and the latter is the consumption expenditure incurred by resident visitors within a tourist trip inside the country.

² There is a difference between Gross Value Added (GVA) and Value Added Generated by Tourism (VAGT). Contrary to the former, the latter is concerned only with the value added of the tourism industry subsectors. Therefore, we find it more convenient to use VAGT instead of GVA.

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