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The Catalan tourism subsystem: applying the methodology of subsystems in the tourism sector

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ABSTRACT: The analysis of input-output is one of the methodologies most applied in tourism literature to the study of the impacts of tourism activity. In this article, we apply the input-output (IO) subsystems methodology. This methodology is a useful tool for studying the productive structure of the different sectors of an economy. Using it offers us the chance to renew the IO methodology, often used to calculate the economic impacts of tourism. In that sense, we have used this methodology to check two main things: first, the importance of every subsector in the tourism sector and the links between them and the rest of the economy as input supplier and, second, the existence of a tourism subsystem. When we analyse the relations between the subsectors, we found that strong economic links exist between them. The different subsectors operate as suppliers and in turn use the other subsectors as suppliers to offer their final products. Those give us some indications about the existence of a real subsystem between the tourism subsectors, which can give us more information about the tourism sector, the links between the different tourism subsectors, the evolution during recent years and the changes in the relations between subsectors. We chose Catalonia because tourism is one of the most important economic activities, contributing more than 10% of GDP and with a similar importance in jobs creation: more than 400 000 jobs directly related to tourism. Those data meant 17 million international arrivals during 2015.

KEYWORDS: direct effect, impacts, input-output analysis, subsector

Introduction

Over the past few decades, the tourism sector has emerged as one of the key drivers for economic growth across the world. Various organisations, including the World Travel and Tourism Council (https://wttc.org/Research/Economic-Impact), have calculated that tourism accounts for approximately 10.2% of global GDP. The tourism sector is of great importance to the Spanish economy, and in particular for the region of Catalonia. With more than 47 million tourist trips and 17 million international visitors, tourism generates 10.2% of the Catalonian GDP and more than 11% of total jobs.

Catalonia is a region of north-eastern Spain, with a population of over 7.5 million people and which accounted for 20.1% of the Spanish GDP in 2018. In terms of tourism, Catalonia was the first area to receive international tourists in the late 1940s, and this region focused on developing tourism-related activities during the 1950s, 1960s and 1970s. In 2018, Catalonia received more than 19 million international tourists, accounting for 23.1% of international tourist arrivals in Spain. Furthermore, Catalonia is the most popular destination for tourists from within Spain: in 2018 Catalonia received more than four million Spanish tourists and Catalans themselves took 20.4 million trips around Catalonia.

These figures translate into over 44 million tourist trips taken in Catalonia.

The increasing importance of the tourism and hospitality sector requires an important effort to obtain more knowledge about our sector. As stated by Lashley (2018), sometimes we focused our energy on "how to do", not on a deeper analysis of the reasons or to obtain a research knowledge of our sector. The tourism and hospitality industries, in the present and in the near future, need to increase critical thinking and the knowledge of their professionals and graduates.

The economic impacts of tourism is ever-present in the literature on tourism (Song et al., 2012; Tyrrell & Johnston, 2006), since many countries recognise the importance of accurate information about the impact of tourism on their respective economies. The main reason is that tourism is considered to be one of the key sectors when looking to develop a country's economy. Various researchers confirm that tourism is able to generate important economic impacts, leading to an increase in GDP and job creation (Duro & Rodriguez, 2011; Dwyer et al., 2006).

In that sense, recent research into tourism growth has focused on analysing the real link between economic growth and tourism. Chatziantoniou et al. (2013) present the main hypothesis and references drawn from this substantial body of work: A

tourism-led economic growth hypothesis (TLGH); economic-driven tourism growth (EDTG); bidirectional causality (BC); and a no causality hypothesis (NC). The study by Balaguer and Cantavella-Jordà (2002) was one of the first to present the TLGH theory, following by the export-led economic growth hypothesis (ELGH), as presented in Brida et al. (2016). Both theories are linked in that they conceptualise tourism as a type of export. The same authors included a broad review of the tourism-growth literature based around the TLGH theory, which included more than 100 research papers. A recurring theme throughout these papers is that tourism is one of the main determinants of economic growth. Regarding Spain, Perles-Ribes et al. (2017) presented an in-depth analysis of the relationship between tourism and economic growth in which they found that tourism and economic growth are demonstrably linked. The authors argue that the two phenomena are correlated through a bidirectional causality, which is significant for Spain given that the tourism sector is central to the national economy.

Over the next few paragraphs, we present a brief review of the literature on the methodologies employed in the analysis of the economic impacts of tourism. Various methodologies have been used to calculate the economic impacts of tourism. One widely used technique is the Keynesian multiplier methodology, developed by Archer (1977). With this methodology, we can calculate an exact number to quantify the economic impact of an increase in the demand in tourism. In recent years, researchers have used this technique to estimate or forecast the impacts of events on local areas, especially when there was limited data available (Llop & Arauzo-Carod, 2012). However, using Keynesian multipliers to analyse impacts over larger regions can be problematic, due to the difficulty in discerning intersectoral effects, and the choice of these relationships between sectors is very subjective (Fletcher, 1989). Other authors, for example Frechtling and Smeral (2010), apply alternative methodologies like econometrics models or structural equations models. But those methodologies do not easily offer consistent results with respect to the identification of the economic impacts of tourism (Assaker et al., 2010; Van Leeuwen et al., 2009).

Another widely-used methodology is input–output (IO) analysis. Archer (1977), Fletcher (1989) and Archer and Fletcher (1990) developed some applications for the tourism sector. The literature on tourism provides many examples of the use of the IO methodology to analyse economic impacts for a country or region. These include the studies conducted by Archer and Shea (1977) on the impacts of tourism for Wales, those carried out by Archer (1995) for the Bermuda islands and by Archer and Fletcher (1996) in their analysis of the impact of tourism on the Seychelles. For the Spanish regions, Polo and Valle (2008) provide an analysis of the economic impact of tourism on the Balearic Islands, and three studies for the specific case of Catalonia by Baró and Vilafaña (2005), Baró (2010) and another by Polo et al. (2008), specifically about the economic impact of hotels in the city of Barcelona.

Fletcher (1989), Briassoulis (1991) and Polo et al. (2008) describe the advantages of using the IO methodology as opposed to other methodologies. They argue that IO is a valuable methodology for the following reasons: First, it is capable of fully analysing the linkages between tourism and other sectors; second, it reveals the impacts of tourism activity on other economic sectors; third, it is a *neutral* methodology and does not imply previous considerations concerning the sector; and, finally, this methodology reveals all the effects, including direct, indirect and induced effects.

Miller and Blair (2009), in their seminal book, explain the limitations of the IO methodology which are based around several assumptions. First, the model supposes that the technical coefficients are fixed such that there are no economies of scale or externalities. In addition, it also assumes that the trade relationships between sectors, the economy and the rest of the world are stable. Secondly, resources are assumed to be infinite and able to cover all output requirements. Finally, regarding the job market, the method assumes that there is unemployment and, that, when the economy needs a labour force, it is easy to find it.

In recent years, this methodology has received various criticisms, and some authors prefer to apply social accounting matrix (SAM) models as an evolution of the IO model (Jones, 2010; Polo et al., 2008), or the computable general equilibrium models (CGE) to analyse the economic impact of tourism. Authors, including Dwyer et al. (2004), Blake (2009) and Pratt (2011), assert that IO methodology is not flexible enough to consider problems involving prices and the assumption of full factor availability, linearity in consumption and production functions and the difficulty with its application to long-term analysis, because the tables are prepared for a fixed point in time. However, CGE models also display serious limitations. These include the addition of a series of additional simplifying assumptions and the fact that they require significantly more information. This often leads to work with very low levels of sectoral disaggregation. Despite these limitations, according to Mules (2005), the application of input-output or CGE models leads to similar results. Recently, the appearance of Tourism Satellite Accounts (Diakomihalis & Lagos, 2011; Frechtling, 2010; Madsen & Zhang, 2010), following UN recommendations, has improved the level of information which can be extracted and applied through an IO methodology.

In this article, we apply a specific IO technique, the subsystem methodology, to study the sectoral interrelations of tourism activities. Subsystem analysis provides a highly detailed level of disaggregation on the linkages between branches within the subsystem, and outward connections from the subsystem branches to the rest of the economy. Following Alcántara and Padilla (2009), we apply a recent development in this methodology to the tourism sector, with the aim of estimating the empirical impacts of tourism on other sectors in the economy, and in the tourism sector itself. Similar and recent studies applying subsystems methodology, related to tourism but centred around cultural issues, such as Llop and Arauzo-Carod (2012) and others, apply similar methodologies to different activities. For example, Saari et al. (2013) look at agriculture, or Butnar and Llop (2010) consider health care institutions.

The application of this methodology allows us to separate activity caused by an increase in the final demand of the tourism sector into the activity produced in the tourism sector, the so-called internal component, as well as the spill-over component referring to the activity produced in external sectors. Applying this methodology to tourism has the added benefit of providing more information about the structure of that sector, which as mentioned above, is critical for the Catalonian economy. Baró and Vilafaña (2005) and Baró (2010) analysed the Catalonian tourism sector as a whole and does not consider the relationships between the different subsectors. Overall, the application of the subsystems methodology has

various advantages, it can provide a better understanding of the structure of the tourism sector in Catalonia, while also enabling us to observe the relationships between the various subsectors that make up the tourism system.

This methodology gives us the chance to estimate the impact that the tourist system has on other sectors. A wealth of existing literature, which includes Sinclair (1998), Balaguer and Cantavella-Jorda (2002), Durbarry (2004), Dritsakis (2004), Figini and Vici (2010) and Pablo-Romero and Molina (2013), among others, study how tourist activity helps economic development through the connections which exist between tourism and other key economic sectors. This has extended the literature on tourism-led economic growth (TLEG). As stated in Bastos and Rejowski (2015), more research in methodologies is needed in our research field and this article is an attempt to increase our knowledge and to have more tools to do research in tourism and hospitality.

One of the main problems which arises during research into tourism is how to precisely define the tourism sector, and we discuss this question in the following sections. Having established a definition, we ask what the optimal way is to use our categorisation to adjust the information taken from the input-output tables to discover the underlying configuration of the tourism sector. We can then adjust the information obtained by the input-output tables and make accurate calculations of the activity rate related to tourism. One clear example of this is the activity generated by tourism in the transport sector. The required data is contained in the input-output tables, but it is very difficult to distinguish which activity is driven by changes in the tourism market, and which not. This investigation is a first attempt to estimate the significance of the tourism subsector and its relevance in the overall national economy using this methodology. The structure of the article is as follows: the second section presents the methodology employed by the analysis. The third section presents the results and finally, the fourth section presents the conclusions.

Methodology

To start with, we will discuss our work on a key topic when investigating tourism, which is the definition of the activities which belong to the tourism sector. To form a coherent definition, we will discuss several previously conducted studies which focus on defining tourism. Tyrrell and Johnston (2006) report that tourism and other related elements have been defined in different ways and that the criteria applied may affect the results and conclusions of research into the tourism sector. We will highlight a few proposals from the existing literature alongside our own about the industries which we consider as belonging to the tourism sector.

Fletcher (1989), who studies the impacts of tourism in Spain using the IO methodology, defines five subsectors as belonging to the tourism sector: Hotels, catering, entertainment,[1] transport and other industrial sectors. In another study, Frechtling and Horváth (1999) identify key sectors as road, urban and suburban transport, the retail sector, with the exception of catering activities, car rental, accommodation and other entertainment services. These projects chose these sectors intuitively and none of them used clear logical or economic criteria to define the tourism sector.

Finally, in 2001, the UN Statistics Division, with the Eurostat, the Organisation for Economic Co-operation and Development (OECD) and the United Nations World Tourism Organisation (UNWTO) proposed the Tourism Satellite Account (TSA), giving rise to a list of the activities which can be considered to belong to the tourism sector and a guideline to define the tourism sector for researchers. The TSA includes 18 subsectors.[2] From these, the sector labelled "Other services" includes financial and insurance services, in addition to other rental services, and it is very difficult to identify which of these activities is strictly confined to the tourism sector. To do so, additional and more detailed statistics are required, which are not currently available. Finally, the TSA defines 12 tourism characteristic subsectors.[3]

In this article, we considered two options. The first is to follow the list outlined by the Spanish TSA, as defined by the Institute of Tourism Studies (IET, 2004), adapted to the input-output tables for Catalonia. These activities (accommodation, food and beverage, passenger transport, travel agencies and tourism guides, cultural, sports and other entertainment, and other services) have also been proposed by the UNWTO. The second potential option is to consider only the core tourism subsectors (accommodation, food and beverage, travel agencies, entertainment and leisure services). We opted for the second option as a tourism subsystem.[4] The main reason is that we have strong doubts about our ability to accurately estimate our model if we include transport activities as a subsector of the tourism system. Transport services include important activities not related to tourism, such as freight transport or dairy transport, and there is no precise way to separate these different activities, given the available data.

As we stated in the introduction, the aim of this article is to discover the real impacts of the tourism sector through an IO analysis of the tourism subsystem. The first researcher to use the subsystem method was Sraffa (1960) and, subsequently, so have Harcourt and Massaro (1964), Pasinetti (1980; 1986; 1988), Sinisalco (1982), Deprez (1990) and Heimler (1991). Alcántara (1995) adapted it to the analysis of different atmospheric emissions for Spain, and Alcántara and Padilla (2009) developed this methodology to analyse the CO_2 emissions of the services subsystem in Spain. To do so, the authors developed the IO methodology to find matrix equations which allowed them to mathematically decompose the CO_2 emissions generated to satisfy demand in the services sector into different components, determining the importance of each inter-sector connection and simultaneously the importance of links between each subsystem and external sectors. We will not analyse emissions, but we will use these authors' development of the IO methodology to examine tourism activity and discern which sectors are more affected by fluctuations in tourism demand. Readers not familiar with the IO methodology can obtain a solid understanding from the book by Miller and Blair (2009). There is a great amount of literature on how this methodology can be effectively applied to tourism, for example Briassoulis (1991) explains the fundamentals of using the IO methodology in tourism.

As stated by Alcántara and Padilla (2009, p. 906), "[i]n the framework of input-output analysis, the study of a particular sector, or a group of sectors, without delinking it from the rest of the system, might be made by treating this sector or sectors as a subsystem generating a single final output, the output of the sector or sectors". A leading advantage of this methodology is the ability to extract information on linkages

between subsectors and from each subsector to other areas of the national economy (Alcántara & Padilla, 2009; Navarro & Alcántara, 2010; Piaggio et al., 2013). This provides sufficient support for using this methodology and we think that it is a good method for estimating the importance of tourism isolated from the wider economy. It is common to run into problems when defining the tourism sector and its importance in comparison with other economic sectors, so this methodology allows us to analyse the importance of subsectors in isolation and across time.

This research tries to answer some questions about the tourism sector and to develop new research methodologies to increase the knowledge of tourism. Our research questions are:

- Can we use input-output subsystems as a methodology to study the tourism activity?;
- Is the tourism sector correctly explained by the relation between the tourism subsectors?;
- Does the economic importance of this sector come from the relation between the subsectors?; and
- Has the tourism sector significant relations with the other economic sectors?

To answer these questions, we present the methodology and our results. First, we define the variables, parameters and vectors used:

A = Matrix ($n \times n$) of technical coefficients of the Leontief model. The economic system is composed of n sectors that belong to set N.

N = (1, 2,…, m,…, n), where 1, 2,…, m are the m subsectors not belonging to the tourism sector and $m+1$,…, n are the t subsectors of the tourism sector ($t = n-m$).

I = Identity matrix

$B = (I-A)^{-1}$ Leontief inverse matrix

x^R = column vector ($m \times 1$) which denotes the production of the m subsectors which do not belong to the tourism sector.

x^T = column vector ($t \times 1$) which denotes the production of the t subsectors which belong to the tourism sector.

y^R = column vector ($m \times 1$) which denotes the final demand of the m subsectors which do not belong to the tourism sector.

y^T = column vector ($t \times 1$) which denotes the final demand of the t subsectors that belong to the tourism sector.

Production and final demand can be then expressed as:

$$x = \begin{pmatrix} x^T \\ x^R \end{pmatrix} \text{ is the production vector}$$

$$y = \begin{pmatrix} y^T \\ y^R \end{pmatrix} \text{ is the demand vector}$$

We can present the tourism subsystem model in its different components. We adapt the Leontief matrix:

$$\begin{pmatrix} A_{TT} & A_{TR} \\ A_{RT} & A_{RR} \end{pmatrix} \begin{pmatrix} x^T \\ x^R \end{pmatrix} + \begin{pmatrix} y^T \\ y^R \end{pmatrix} = \begin{pmatrix} x^T \\ x^R \end{pmatrix} \tag{1}$$

Where the first element is the matrix A; separated according to the relationship of its coefficients with the tourist and the other sectors. We operate with this model until we obtain expression (2):

$$\left[\begin{pmatrix} A_{TT}^D & 0 \\ 0 & A_{RR}^D \end{pmatrix} + \begin{pmatrix} A_{TT}^O & A_{TR}^O \\ A_{RT}^O & A_{RR}^O \end{pmatrix} \right] \begin{pmatrix} B_{TT} & B_{TR} \\ B_{RT} & B_{RR} \end{pmatrix} \begin{pmatrix} y^T \\ 0 \end{pmatrix} + \begin{pmatrix} y^T \\ 0 \end{pmatrix} = \begin{pmatrix} x_T^T \\ x_T^R \end{pmatrix}$$

We then obtain:

$$A_{TT}^D B_{TT} y^T + A_{TR}^O B_{RT} y^T + A_{TT}^O B_{TT} y^T + y^T = x_T^T \tag{3}$$

$$A_{RR}^D B_{RT} y^T + A_{RR}^O B_{RT} y^T + A_{RT}^O B_{TT} y^T + 0 = x_T^R \tag{4}$$

Expression (3) gives us the vector of tourism production for the tourism subsystem, that is, the tourism production needed to satisfy the final demand of the tourism subsystem, and so gives us the internal effects of tourism. The second expression (4) gives us the production necessary in all additional sectors to cover the tourism sector demand, and so indicates the external effects of an increase in demand in the tourism sector.

The impact of each of the tourism subsectors on other service branches, in regard to their structural relationships with non-tourism sectors, is determined by diagonalising . Where:

$A_{TT}^D B_{TT} \hat{y}^T$ indicates the quantity of own inputs that each tourism subsector purchases to obtain its own final demand, aka the internal own component.

$A_{TR}^O B_{RT} \hat{y}^T$ indicates the input production that tourism produces for the non-tourism sectors, so that these obtain the output that the tourism sector demands to them, aka the feed-back component.

$A_{TT}^O B_{TT} \hat{y}^T$ indicates the production required by tourism subsectors from other subsectors of the tourism subsystem, aka the internal spill-over component.

Some examples:

Internal-own component: A travel agency places an order for rooms at an accommodation company to create tourist packages. In that case, the travel agency demands inputs (rooms) to create its outputs (trips).

Feed-back component: A travel agency sells trips to an architecture business to draw the plans for a hotel.

Internal spill-over component: A hotel asks an events company to organise a special event. In that case, the hotel does not need inputs from the events business, the hotel wants an output created by an events company. And $\hat{y}^T$ is the demand volume component, which indicates the final demand of the sectors that belong to the tourism sector. And the different parts of the component of the second equation (spill-over component), which show the spill over on the rest of the economy, are:

$A_{RR}^D B_{RT} \hat{y}^T$ captures the demand of within-sector inputs for a non-tourism sector, due to demand from the tourism sector.

$A_{RR}^O B_{RT} \hat{y}^T$ captures the input quantities of non-tourism sectors purchased by the other non-tourism sectors, to cover demand from the tourism sector.

$A_{RT}^O B_{TT} \hat{y}^T$ indicates the input production of the non-tourism sector allocated to the tourism sector.

Those vectors give us the strength of the connections between the tourism subsystem and the rest of the economy and for the connections between the economic branches which constitute the tourism subsystem. Thus, it allows for a better understanding of the subsystem itself, and the size of shocks to any given branch on the subsystem itself and on the rest of the economy. The following are some specific examples:

Case 1: A hotel needs inputs from the textile industry, and the textile industry orders ink from the chemical industry.

Case 2: A restaurant needs food and asks a farmer to cover the inputs, the farmer in turn asks a transport service to deliver the product.

Case 3: An event business orders flowers from a florist to be used for decoration.

We decided to analyse the internal tourism subsystem, as specified in equation 3, because the interest of this article is to demonstrate the existence of a tourism subsystem in itself. In the next section, we will present our research on the Catalonia case study.

Results

This article has one main objective: to estimate the size of the internal effects on the tourism sector and the external effects on other sectors of the economy derived from fluctuations in the demand and supply of products in the tourism sector. In Table 1, we present the different subsectors and the weight of their influence on other subsectors of the tourism sector and over the other non-tourism sectors (feedback).

During the first calculation process, we see that the main impacts come from the demand side (), with a minimum of 90% of the origin of the activity. Those results show that demand in a subsector is mainly driven from within that subsector. But the most significant results come from the analysis of other impact components, the internal own component, the feed-back component and the internal spill-over component. The economic activities explained by those effects are of little importance, but the research into the tourism subsystem structure provides some interesting results.

(1) The main effects over the accommodation subsector come from the internal spill-over component in two of the input-output tables (2001 and 2011).[6] The accommodation subsector uses other subsectors as a supplier for its activities, for example the entertainment or food and beverage industries. Accommodation has some restrictions in its capacity to meet demand and, sometimes, needs to trade with other subsectors to offer a complete product. For example, when a hotel hosts a large conference, the catering services need help from other companies.

(2) Food and beverages, travel agencies and entertainment obtain the most significant results for the internal own component, except for one observation (Food and beverage year 2001). These results are intuitive since they simply confirm traditional working patterns for these subsectors. For example, retail travel agencies purchase inputs from wholesale travel agencies, or entertainment service providers contract other entertainment companies.

(3) The feedback component shows little significance. The tourism subsectors are not often used as inputs by non-tourism subsectors, but we can provide some preliminary results. Over recent years the number of events such as congresses or business fairs organised by non-tourism subsectors has increased globally.[7] This leads to a considerable increase in input demand for the accommodation and food and beverage subsectors. In the case of Barcelona, the number of large meeting events increased from 373 in 1990 to 2 134 in 2017 (Barcelona council, 2017). Some of these events are organised by businesses not related to tourism, for instance for incentives or courses, many of them organised by the companies on its own or by the sector related to the event. The medical sector is one of the most active, to the point where the medical association of Barcelona has its own events manager[8] as part of one medical educational foundation. In contrast, travel agencies have seen a reduction in demand as a result of the boom in e-commerce and the popularity of buying flights online. Over the last few years, the increasing presence of the internet in our lives has made the purchase of these types of products (accommodation, flights, rentals, tourist guides, etc.) very accessible and simple (Xiang et al., 2015). This has ultimately led to a large reduction in the size of the travel agency market.

Another important issue to consider is the importance of the outsourcing. Research conducted by Espino-Rodríguez and Padrón-Robaina (2004), Hjalager (2006) and Lamminmaki (2011), among others, presented some general facts about the accommodation sector. Most accommodation companies had started a process of outsourcing some services in their hotel and accommodation business. The main reason was to reduce costs. For example, some services such as laundry or cleaning services have been outsourced to external companies. These, however, are not the only services to be outsourced as we also find evidence of similar practices in food and beverages and entertainment. This represents a change for these subsectors as activities which were traditionally performed in-house are now performed by other subsectors in tourism. This may explain some of the changes during the period analysed.

It is true, according to Kirschner (2015), that accommodation and entertainment services are not sectors which report a high percentage of outsourcing in the European Union-28 (EU-28), just 19% and 18% of their production respectively. This is significantly less than other sectors, such as construction (38%) (Kirschner, 2015). The internal own component shows increasing values over the years studied, which means that the different subsectors increase the use of inputs from other subsectors to create their final output. This provides additional supporting evidence for the increasing importance of outsourcing in the tourism sector.

The other hypothesis of the article is about the structure of the tourism subsystem itself. We are interested in showing that a set of different subsectors, all offering a service related to tourism, constitute a subsystem. Table 2 provides the values from the input-output tables and it is clear that the majority of links between different subsectors has strengthened over the last ten years.

As highlighted previously, the largest fraction of activity comes from the demand side of the market, however, the use of other subsectors as input suppliers is also worth mentioning. For example, under the internal own component results, three of the subsectors (food and beverages, travel agencies and entertainment) report the highest values when the different tourism subsectors sell inputs to the other tourism subsectors. In addition, when we consult the final column, the internal spill-over component, we see high levels of output generated by tourism subsectors for other tourism subsectors. The links between the subsectors are strong and demonstrate that tourism subsectors are cooperating between themselves and beyond the travel agency subsector.

Conclusion

This article looks to provide new tools to improve research into the economic impacts of tourism. There is well-established literature about the impact of tourism and how to apply

TABLE 1: Internal own, internal spill-over and feedback values

Subsector	Internal own		Feedback		Internal spill over	
	2001	2011	2001	2011	2001	2011
Accommodation	6.60%	17.80%	6.30%	11.40%	87.10%	70.80%
Food and beverage	27.30%	58.20%	12.10%	11.20%	60.60%	30.60%
Travel agencies	73.20%	77.20%	10.50%	0.70%	16.40%	22.10%
Entertainment*	71.10%	85.50%	11.80%	7.10%	17.10%	7.40%

*The entertainment subsector has been divided in two different subsectors in the 2011 input–output table, being impossible to operate with the different subsectors, we preferred to continue with just the entertainment subsector to maintain the comparison between the different input-output tables.

TABLE 2: Destinations and basic prices

Subsector	2001 € million	2011 € million	2001 € million	2011 € million	2001 € million	2011 € million	2001 € million	2011 € million
Accommodation	13.1	45.2	1.1	6.5	275.9	185.8	44.2	42
Food and beverage	2.4	33.7	25.2	240.5	51.5	165.8	12.7	36
Travel agencies	12.5	34.5	–	0.9	180.7	122.8	8.7	10
Entertainment	25.9	22.0	21.0	1.0	1.8	0	448.9	928

the input-output methodology. Despite this, the use of this methodology to study the impacts of tourism specifically is relatively underdeveloped and this article contributes by offering a valid methodology to estimate the real impact of the tourism activity, beyond simply providing descriptive evidence or estimating multipliers. Then, IO subsectors is an interesting methodology to increase the knowledge in our field.

Second, we defined the tourism sector around four subsectors. Namely, accommodation, food and beverages, travel agencies and entertainment activities. Future research should include the transport sector in this subsystem. However, to do so, we need additional literature and tools which will give us an indication about how to separate tourism from non-tourism transport activity.

Third, we have shown that the tourism sector is made up of different subsectors which each have strong links between them. The subsystem methodology provides accurate and relevant information about the cooperation between these subsectors. Tourism subsectors are regular suppliers for other tourism subsectors. The results demonstrate that there does exist a subsystem in the tourism sector and that considerable economic activity flows across this subsystem. If the transport sector can be effectively included into this subsystem, then this work will be advanced even further due to the obvious relevance of transport for tourists. Therefore, our research questions 2 and 3 are well explained by the use of the IO subsystem methodology. We found that tourism is defined by four sectors and the economic importance lies in the relation between them.

The last research question is: Are the relations with the other sectors significant? This question requires a deeper analysis, because we saw that it has economic importance, but not as big as the relationship between the economic subsectors. As we said, we focused in the intra relations and we will continue the research, expanding the calculations to the rest of the economic sectors.

As we stated in previous sections, Alcántara and Padilla (2009) developed this research to know the CO$_2$ emissions, so maybe this methodology could be used to know the environmental impact of tourism and the hospitality sector and to obtain ways to reduce the environmental impact of our sector.

Notes

1   Cinemas, theatres, museums and galleries, sports, bullfights, radio and TV channels and others.
2   Find the complete list at http://www.ine.es/metodologia/t35/metosateln.pdf
3   Accommodation, second home ownership (imputed), food and beverages, passenger transport services by rail, passenger transport services by road, maritime transport services of passengers, air transport services of passengers, additional services for the carriage of passengers, vacation goods passenger, travel agencies and similar, cultural services, services for sports and other recreational activities.
4   When we obtained the first results through option 1, including transport, they were very inconsistent, showing that the inclusion of transport in the subsystem generates some inconsistent results. We had some data constraints and to try to differentiate between the transport related to tourism and the transport related to other activities had the potential to give us some insurmountable methodological problems.
5   The 2005 input-output Catalan table is an update from the 2001 input-output table, and it can give some results differing from the other years (2001–2011).
6   In 2014, the UN World Tourism Organization presented a document *Tourism Highlights* (https://www.e-unwto.org/doi/pdf/10.18111/9789284416226), which reflected the growing importance of the events subsector.
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References

Alcántara, V. (1995). *Economía y contaminación atmosférica: hacia un nuevo enfoque desde el anàlisis input-output*. Doctoral thesis, Universitat de Barcelona, Spain.

Alcántara, V., & Padilla, E. (2009). Input-output subsystems and pollution: An application to the service sector and CO2 emissions in Spain. *Ecological Economics, 68*, 905–914. https://doi.org/10.1016/j.ecolecon.2008.07.010

Archer, B. H. (1977). *Tourism Multipliers: The State of the Art*. University of Wales Press.

Archer, B. H. (1995). Importance of tourism in the economy of Bermuda. *Annals of Tourism Research, 22*(4), 918–930. https://doi.org/10.1016/0160-7383(95)00018-1

Archer, B. H., & Shea, S. (1977). *Manpower in tourism: the situation of Wales*. Wales Tourist Board.

Archer, B. H., & Fletcher, J. (1990). Tourism: its economic importance. In: M. Quest (ed) *Horwath Book of Tourism* (pp. 10–25). MacMillan. https://doi.org/10.1007/978-1-349-11687-4_2

Archer, B. H., & Fletcher, J. (1996). The economic impact of tourism in the Seychelles. *Annals of Tourism Research 23*(1), 32–47. https://doi.org/10.1016/0160-7383(95)00041-0

Assaker, G., Vinzi, V. E., & O'Connor, P. (2010). Structural equation modeling in tourism demand forecasting: A critical review. *Journal of Travel and Tourism Research (Online), 1*. https://site.adu.edu.tr/jttr/files/JTTR-2010_1_.pdf

Balaguer, J., & Cantavella-Jorda, M. (2002). Tourism as a long-run economic growth factor: the Spanish case. *Applied Economics, 34*(7), 877–884. https://doi.org/10.1080/00036840110058923

Barcelona council (2017). *Tourism activity report*. Turisme de Barcelona. https://professional.barcelonaturisme.com/storage/medias/files/UFXcJf3qFeMsVf526b9PE0G80pxpF4KIBadit2Kt.pdf

Baró, E. (2010). *Estimació de l'impacte total de la despesa turística corrent a Catalunya en el conjunt de l'economia i en els seus principals sectors d'activitat. Aplicació d'una metodologia input-output* [Estimating the total impact of current tourism spending in Catalonia in the economy as a whole and in its main sectors activity. Application of an input-output methodology]. Observatori del turisme de Catalunya.

Baró, E., & Villafaña, C. (2005). *L'impacte econòmic del turisme receptor sobre l'economia catalana i sectorialització per branques d'activitat: aplicació d'una metodologia input-output* [The economic impact of receiving tourism on the Catalan economy and sectorialization by branches of activity: application of an input-output methodology]. Observatori del turisme de Catalunya.

Bastos, S. & Rejowski, M. (2015). Scientific research in hospitality studies in Brazil: challenges to finding a theoretical framework, *Research in Hospitality Management, 5*(1), 45–55. https://doi.org/10.1080/22243534.2015.11828327

Blake, A. (2009). The dynamics of tourism's economic impact. *Tourism Economics, 15*(3), 615–628. https://doi.org/10.5367%2F000000009789036576

Briassoulis, H. (1991). Methodological issues: tourism input-output analysis. *Annals of Tourism Research, 18*, 485–495. https://doi.org/10.1016/0160-7383(91)90054-F

Brida, J. G., Cortes-Jimenez, I., & Pulina, M. (2016). Has the tourism-led growth hypothesis been validated? A literature review. *Current Issues in Tourism, 19*(5), 394–430. https://doi.org/10.1080/13683500.2013.868414

Butnar, I., & Llop, M. (2010). Structural decomposition analysis and input-output subsystems: An application to Spanish CO$_2$ emissions. Working paper. https://www.recercat.cat/bitstream/handle/2072/151546/201011.pdf?sequence=3

Chatziantoniou, I., Filis, G., Eeckels, B., & Apostolakis, A. (2013). Oil prices, tourism income and economic growth: A structural VAR approach for European Mediterranean countries. *Tourism Management, 36*, 331–341. https://doi.org/10.1016/j.tourman.2012.10.012

Deprez, J. (1990). Vertical integration and the problem of fixed capital. *Journal of Postkeynesian Economics 13*, 47–64. https://doi.org/10.1080/01603477.1990.11489830

Diakomihalis, M. N., & Lagos, D. G. (2011). An empirical approach to coastal leisure shipping in Greece and an assessment of its economic contribution. *Tourism Economics, 17*(2), 437–456. https://doi.org/10.5367%2Fte.2011.0038

Dritsakis, N. (2004). Tourism as a long-run economic growth factor: an empirical investigation for Greece using causality analysis. *Tourism Economics, 10*(3), 305–316. https://doi.org/10.5367%2F0000000041895094

Durbarry, R. (2004). Tourism and economic growth: the case of Mauritius. *Tourism Economics, 10*(4), 389–401. https://doi.org/10.5367%2F0000000042430962

Duro, J. A., & Rodríguez, D. (2011). *Estimació del PIB turístic per Catalunya, marques i comarques 2005–2010* [Estimation of tourism GDP for Catalonia, brands and counties 2005–2010]. Industry and Territory Research Group (GRIT), Universitat Rovira i Virgili, Tarragona.

Dwyer, L. M., Forsyth, P., & Spurr, R. (2004). Evaluating tourism's economic effects: new and old approaches. *Tourism Management, 25*(3), 307–317. https://doi.org/10.1016/S0261-5177(03)00131-6

Dwyer et al. (2006). Assessing the economic impacts of events: a computable general equilibrium approach. *Journal of travel research 45*(1) 59–66 https://doi.org/10.1177/0047287506288907

Espino-Rodríguez, T. F., & Padrón-Robaina, V. (2004). Outsourcing and its impact on operational objectives and performance: a study of hotels in the Canary Islands. *International Journal of Hospitality Management, 23*(3), 287–306. https://doi.org/10.1016/j.ijhm.2003.11.004

EUTDH (2013). *Índex UAB d'Activitat Turística. Previsions estiu 2013* [UAB Tourism Activity Index. Summer 2013 forecasts]. https://issuu.com/eutdh/docs/indexuab2013

Figini, P., & Vici, L. (2010). Tourism and growth in a cross section of countries. *Tourism Economics, 16*(4), 789–805. https://doi.org/10.5367%2Fte.2010.0009

Fletcher, J. E. (1989). Input-output analysis and tourism impact studies. *Annals of Tourism Research 16*(4), 514–529. https://doi.org/10.1016/0160-7383(89)90006-6

Frechtling, D. C. (2010). The tourism satellite account: A primer. *Annals of Tourism Research, 37*(1), 136–153. https://doi.org/10.1016/j.annals.2009.08.003

Frechtling, D. C., & Horváth, E. (1999). Estimating the multiplier effects of tourism expenditures on a local economy through a regional input-output model. *Journal of Travel Research, 37*(4), 324–332. https://doi.org/10.1177%2F004728759903700402

Frechtling, D. C. & Smeral, E. (2010). Measuring and interpreting the economic impact of tourism: 20/20 hindsight and foresight. In D. G. Pearce & R. Butler (Eds), *Tourism research: A 20:20 vision* (pp. 67–79). Goodfellow Publishing.

Harcourt, G. C., & Massaro, V. G. (1964). A note on Mr. Sraffa's subsystems. *The Economic Journal 74*, 715–722. https://doi.org/10.2307/2228337

Heimler, A. (1991). Linkages and vertical integration in the Chinese economy. *Review of Economics and Statistics, 73*, 261–267. https://doi.org/10.2307/2109516

Hjalager, A. M. (2006). The marriage between welfare services and tourism—a driving force for innovation? *Journal of Quality Assurance in Hospitality & Tourism, 6*(3–4), 7–29. https://doi.org/10.1300/J162v06n03_02

Instituto de Estudios Turísticos [Institute of Tourism Studies]. (2004). *Cuenta satélite del Turismo* [Tourism Satellite Account]. http://www.ine.es/metodologia/t35/metosatel.pdf

Jones, S. (2010). The economic contribution of tourism in Mozambique: Insights from a Social Accounting Matrix. *Development Southern Africa, 27*(5), 679–696. https://doi.org/10.1080/0376835X.2010.522831

Kirschner, S. (2015). Who performs outsourcing? A cross national comparison of companies in the EU-28. In J. Drahokoupil (Ed.), *The outsourcing challenge Organizing workers across fragmented production networks* (pp. 25–45). European Trade Union Institute for Research.

Lamminmaki, D. (2011). An examination of factors motivating hotel outsourcing. *International Journal of Hospitality Management, 30*(4), 963–973. https://doi.org/10.1016/j.ijhm.2010.10.010

Lashley, C. (2018). What do about how to do: Reflections on the future direction of hospitality education and research. *Research in Hospitality Management, 8*(2), 79–84. https://doi.org/10.1080/22243534.2018.1553368

Llop , M. & Arauzo-Carod, J. M. (2012). Economic impact of a new museum on the local economy: "The Gaudi Centre". *Letters in Spatial and Resource Sciences, 5*(1), 17–23. https://doi.org/10.1007/s12076–011–0061–0

Madsen, B. & Zhang, J. (2010). Towards a new framework for accounting and modelling the regional impacts of tourism and culture. *Economic Systems Research, 22*(4), 313–340 https://doi.org/10.1080/09535314.2010.529067

Miller, R. E. & Blair, P. D. (2009). *Input-Output Analysis: Foundations and Extension*. 2nd edn. Cambridge University Press

Mules, T. (2005). Economic impacts of national park tourism on gateway communities: the case of Kosciuszko National Park. *Tourism Economics, 11*(2), 247–259. https://doi.org/10.5367%2F0000000054183513

Navarro, F., & Alcántara, V. (2010). Emissions of methane (CH_4) in the Catalan agro-food subsystem: An alternative input-output analysis. *Agricultural and Resource Economics, 10*(2), 25–39. https://doi.org/10.7201/earn.2010.02.02

Pablo-Romero, M. D. P., & Molina, J. A. (2013). Tourism and economic growth: A review of empirical literature. *Tourism Management Perspectives, 8*, 28–41. https://doi.org/10.1016/j.tmp.2013.05.006

Pasinetti L. (1980). The notion of vertical integration in economic analysis. In: L. Pasinetti (ed.), *Essays on the Theory of Joint Production* (pp. 16–43). Palgrave Macmillan. https://doi.org/10.1007/978–1–349–05201–1_2

Pasinetti, L. (1986). Sraffa's circular process and the concept of vertical integration. *Political Economy, 2*, 3–16. http://www.centrosraffa.org/pe/2,1/2,1.1.%20Pasinetti.pdf

Pasinetti, L. (1988). Growing subsystems, vertically hyper-integrated sectors and the labour theory of value. *Cambridge Journal of Economics, 12*, 125–134. https://doi.org/10.1093/oxfordjournals.cje.a035041

Perles-Ribes, J. F., Ramón-Rodríguez, A. B., Rubia, A., & Moreno-Izquierdo, L. (2017). Is the tourism-led growth hypothesis valid after the global economic and financial crisis? The case of Spain 1957–2014. *Tourism Management, 61*, 96–109. https://doi.org/10.1016/j.tourman.2017.01.003

Piaggio, M., Alcántara, V., & Padilla, E. (2013). *The materiality of the immaterial. Services sectors and CO2 emissions in Uruguay.* https://ddd.uab.cat/record/132446

Polo, C. & Valle, E. (2008). An assessment of the impact of tourism in the Balearic Islands. *Tourism Economics 14*(3), 615–630. https://doi.org/10.5367%2F000000008785633604

Polo, C., Ramos, V., Rey-Maquiera, J., Tugores, M., & Valle, E. (2008). The potential effects of a change in the distribution of tourism expenditure on employment. *Tourism Economics, 14*(4), 709–725. https://doi.org/10.5367%2F000000008786440210

Pratt, S. (2011). Economic linkages and impacts across the TALC. *Annals of Tourism Research, 38*(2), 630–650. https://doi.org/10.1016/j.annals.2010.11.014

Saari, M. Y., Shuja, N., & Rahman, I. A. (2013). Evaluation of impacts of the rise in energy prices on costs of production and living expenses in Malaysia. *Malaysian Journal of Economic Studies, 50*(1), 1–20.

Sinclair, M. T. (1998). Tourism and economic development: A survey. *The Journal of Development Studies, 34*(5), 1–51. https://doi.org/10.1080/00220389808422535

Sinisalco, D. (1982). *Il sistema produttivo: anàlisi per industria e susbsistemi* [The production system: analysis by industry and subsystems]. *Ricerche Economiche, 4*, 475–488.

Song, H., Dwyer, L., Li, G., & Cao, Z. (2012). Tourism economics research: A review and assessment. *Annals of Tourism Research, 39*(3), 1653–1682. https://doi.org/10.1016/j.annals.2012.05.023

Sraffa, P. (1960). *Production of Commodities by Means of Commodities*. Cambridge University Press.

Tyrrell, T. J. & Johnston, R. J. (2006). The economic impact of tourism: A special issue. *Journal of Travel Research, 45*, 3–7. https://doi.org/10.1177%2F0047287506288876

Van Leeuwen, E. S., Nijkamp, P., & Rietveld, P. (2009). A meta-analytic comparison of regional output multipliers at different spatial levels: economic impacts of tourism. In Á. Matias P. Nijkamp, and M. Sarmento (Eds), *Advances in tourism economics* (pp. 13–33). Physica-Verlag HD https://doi.org/10.1007/978–3–7908–2124–6_2

Xiang, Z., Magnini, V. P., & Fesenmaier, D. R. (2015). Information technology and consumer behavior in travel and tourism: Insights from travel planning using the internet. *Journal of Retailing and Consumer Services, 22*, 244–249. https://doi.org/10.1016/j.jretconser.2014.08.005