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An integrated TSA and IO model for the estimation of the overall contribution of tourism: The example of Croatia[1]

Abstract

In current conditions in which the activity of tourism is growing, an analysis of the contribution of tourism to the economy and an understanding of the interrelations of activities related to tourism demand are an essential precondition for a successful economic policy. The aim of this paper is to give an overview of the role of tourism in the economy of Croatia, using a specific determinist model that integrates symmetrical input-output tables and the tables of the tourism satellite account. The paper starts from an advanced analytical base that enables a more detailed insight into the inter-sector relations of tourism than given by previous research. In 2019 the tourism satellite account became an integral component of official Croatian statistics; the input-output table for 2013 is also available. The methodological framework set up resulted in an estimation of the overall contribution of tourism of a gross domestic value of 16.9% of the gross value added of Croatia in 2016, in addition to recognized strong multiplicative effect from tourism consumption on non-tourism activities in the economy. At the same time, the imports of direct and indirect intermediate products generated by domestically produced internal tourism consumption generate 6.5% of the total (goods and services) imports of Croatia. It follows that the tourism contributes more than twice as much to gross valued added of Croatia than its direct and indirect intermediate imports participate in total imports.

Key words: tourism satellite account; input-output model; total contribution of tourism; import dependence; Croatia

Introduction

After more than a decade of the development of a statistical system for tourism oriented to the establishment of a methodological base for a measurement of the contribution of tourism to the Croatian economy compatible with international practice (Ivandić & Marušić, 2017), in 2019 the tourism satellite account became an integral part of official Croatian statistics. The Croatian Bureau of Statics, in collaboration with the Institute for Tourism, Croatia, published *Tourism Satellite Account for the Republic of Croatia, 2016* (Croatian Bureau of Statistics, 2019) in line with the international methodological framework for the tourism satellite account (United Nations, World Tourism Organization, Eurostat – Commission of the European Communities & Organisation for Economic Co-operation and Development, 2010). It was estimated that the direct gross domestic product of tourism in 2016 accounted for 11.4% of total gross domestic product, 1.0 percentage point bigger than in 2011, the last year for which comparable data are available (Ivandić, Marušić, Šutalo & Vuglar, 2014). The growth of the proportion of the direct gross domestic product of tourism is the result, above all, of the increase in internal tourism consumption and of faster growth in tourism than in the rest of the economy

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(Institute for Tourism, 2019). Gross value added (GVA) of the activity of providing accommodation and food preparation and serving in the 2011 to 2016 period recorded a nominal increase of 35.6%, while the equivalent figure for the economy as a whole was 2.3% (Croatian Bureau of Statistics, 2018).

In the methodological framework of the tourism satellite account (TSA) the contribution of tourism reflects the gross value added of tourism and other activities achieved by the direct supply of products and services to visitors, augmented by the related net taxes on products and imports. Such an estimate does not actually reflect the total contribution of tourism to the national economy, for tourism generates indirect effects as well, stemming from the economic activity of businesses that provide products and services to tourism. The estimate of the indirect and then of the total economic contribution of tourism to the economy presupposes the application of quantitative and above all deterministic but also stochastic models of economic analysis (Hara, 2008), while it is usual to use models connected with the national accounts system, such as the input-output (IO) model, the social accounting matrix (SAM) and the computable general equilibrium (CGE) model (Frechtling, 2013). Although the CGE model is considered to be the most complete (Song et al., 2012) and to have managed to overcome the restrictions of the input-output model (Dwyer, Forsyth & Spurr, 2004; Baggio, 2019), the CGE model does have weaknesses in comparison with IO models in terms of the criteria of transparency, efficacy and comparability (Pratt, 2015).

The need to understand the magnitude of the contribution of tourism to the economy and the interrelations of economic activities connected to tourism is the starting point of this paper that is aimed at acquiring an overview of the role of tourism in the economy of Croatia according to a specific methodological framework linking the tourism satellite account and the input-output model (after Ivandić & Šutalo, 2018). Because it is such an important segment of research into the economic impact of tourism (Comerio & Strozzi, 2019), the analysis is directed towards the measurement of the multiplicative effects of tourism consumption on other economic activities and estimate of the total contribution of tourism to the creation of the gross value added of Croatia as well as to ascertaining the import dependence of Croatian tourism. The essentially improved analytical base, which includes the availability of the tourism satellite account of Croatia for 2016 and the IO tables for Croatia for 2013 (Mikulić, 2018), has enabled some of methodological restrictions of previous researches (Jurčić, 1998; Jurčić 2000; Šutalo, Ivandić & Marušić, 2011; Ivandić & Šutalo, 2018) to be overcome. The paper is divided into six parts. After the introduction, the second chapter presents the key methodological issues of the input-output analysis. Chapter Three discusses the tourism satellite account, while Chapter Four sets out an integral model for the measurement of the total effects of tourism, linking the input-output model and the tourism satellite account. In the fifth chapter, the results of the computation of the import dependence of Croatian tourism and of the total contribution of tourism in 2016 are presented. Chapter Six concludes, synthesising the results of the analysis carried out and making recommendations for further research.

The methodological framework of IO analysis and tourism

An input-output table presents the procurement and sale of goods and services among activities of the economy in a monetary terms enabling the measurement of direct but also of indirect and induced effects. The source of an input-output model is the supply and use tables that show the creation of a product and its use in terms of activities based on two basic identities. One is the equalized output of activity and the sum of its intermediate consumption and gross value added. The second equalized supplies with the sum of uses.

A symmetric input-output table is a matrix showing how supply matches uses within a product-by-product or industry-by-industry framework compiling output and the detailed transactions of intermediate consumption and final uses (Eurostat, 2013). The most important segment of the input-output tables is the presentation of intersectoral relationships determined by the structure of intermediate consumption of pairs of a activities/products (deliveries of activity/product *i* to activity/product *j*), where a part of the production of products and services is also delivered to other parts of the economy the primary function of which is not production, rather final use, like the consumption of households or the state (Mikulić, 2018). Interdependence between any two activities/products *i* and *j* can be observed in the input-output table bilaterally, through direct exchange of intermediate deliveries and multilaterally through all the indirect deliveries through which activities/products *i* and *j* exchange their inputs-outputs through the mediation of all other activities (Croatian Bureau of Statistics, 2002). The technological coefficients matrix shows the system of production links among all the sectors (Sekulić, 1980), and it is possible to say that economies (and their statistics) are the more developed or technologically more complex the richer the structure of the IO intermediate consumption matrix (Mikulić, 2018).

In order to estimate the economic contribution of tourism it is possible to use the procedure of the fractionalisation (disaggregation) of IO tables into a tourism and a non-tourism part, that is, the procedure of detaching the tourism part of the output of some activity. The procedure is two-dimensional (outputs/inputs), and the established tourism vectors are aggregated in a separate tourism matrix (Croatian Bureau of Statistics, 2002). Assuming a linear transmission of tourism and non-tourism flows into outputs and inputs, that is, with the assumption of equal structures of inputs and value added of tourism and non-tourism segments of activities/products, it is possible to use an alternative procedure. This procedure, with previously separated domestic and import flows, enables compilation of tourism gross value added based on the product of the matrix multiplier and the vector column of tourism consumption. If the conditions are met, the results of the alternative procedure are the same as the procedure of the fractionalisation/disaggregation of the activity (Šutalo et al., 2011), along with the identification of the part of gross domestic product and other aggregates that can be related to the tourism demand (Frechtling, 2013).

Modelling the contribution of tourism according to an IO model is used in numerous studies (Khoshkhoo, Alizadeh & Pratt, 2017), but it is necessary to take account of the limitations of the model. The limitations are not linked only to fixed prices and fixed coefficients and an implicit assumption of the unrestricted supply of resources that can generate overvalued effects, but also to the fact that the analysis is oriented to the positive effects of tourism on economic activity as well as the restricted possibilities of use for analysis of various shocks and the need to distinguish domestic (transfer) from inbound (additional) expenditures (Dwyer et al., 2010).

The methodological framework for the calculation of the direct and indirect contribution of tourism to gross domestic value of Croatia in 2016 in this paper is founded on the product of the matrix multiplier of domestic flows and the vector column of domestically produced tourism consumption in basic prices, while induced effects resulting from the changes in incomes generated by the direct and indirect effects are not in the focus of the analysis. Starting from the basic form of the input-output system in the matrix expression shown in equation (1), the calculation of gross value added of tourism and the import contents of tourism can be presented in the following way (after Babić, 1982; Croatian Bureau of Statistics, 2002; Ivandić & Šutalo, 2018):

$$X = A\,X + Y \qquad (1)$$

where

- X is the vector of outputs in basic prices
- A is the coefficient matrix for intermediate consumption (domestic and import flows)
- Y is the vector of final demand that consists of expenditure for final consumption, gross capital formation and imports, and includes domestic and imported products and services.

Equation (1) can be shown with separate domestic and import flows of products and services in the following manner:

$$X = (A^d + M^{id})X + (Y^d + Y^m - M) \qquad (2)$$

where:

- A^d is the coefficient matrix of domestic intermediate demand
- M^{id} is the coefficient matrix of imported intermediate demand
- Y^d is the vector of domestically produced final demand
- Y^m is the vector of imported final demand
- M is the vector of total (intermediate and final) imports of goods and services.

Ascertainment of domestically produced final consumption (Y^d) implies the rearrangement of equation (2) into the form:

$$X = A^dX + Y^d + (M^{id}X + Y^m - M) \qquad (3)$$

Since the expression $(M^{id}X + Y^m - M)$ is equal to 0, it follows that equation (3) can be expressed in the following manner:

$$X = A^dX + Y^d \qquad (4)$$

from which equation (5) follows:

$$X = (I - A^d)^{-1}\,Y^d \qquad (5)$$

in which

- $(I - A^d)^{-1}$ is the matrix multiplier every element of which shows how much of the production in activity *i* is generated by final domestic deliveries of activity *j*.

Assuming equal production structures of tourism and non-tourism products of given activities, equation (5) constitutes a basis for the estimation of the magnitude of the production generated by tourism if it is transformed into equation (6), which shows the calculation of the part of total production of the economy generated by domestically produced internal tourism consumption:

$$X^T = (I - A^d)^{-1}\,Y^{dT} \qquad (6)$$

where

- X^T is the vector of production in basic prices generated by the tourism activity
- Y^{dT} is the vector of domestically produced internal tourism consumption in basic prices.

The calculation of the gross value added of tourism (GVA^{dT}) in disaggregated form is based on the following equation (7):

$$GVA^{dT}=\hat{d}\left[I-A^{d}\right]^{-1}Y^{dT}=HY^{dT} \qquad (7)$$

where

- GVA^{dT} is the vector of gross value added of each activity (in basic prices) generated by domestically produced internal tourism consumption in basic prices
- $(\hat{d})$ is the diagonalized coefficient matrix of gross value added
- $\hat{d}\left[I-A^{d}\right]^{-1}=H$ is the matrix multiplier that consists of elements representing gross value added of product *i* generated by unit value of internal tourism deliveries of product *j* and is obtained by the multiplication of the diagonalized matrix of coefficients of gross value added $(\hat{d})$ and the matrix multiplier $\left[I-A^{d}\right]^{-1}$.

In an analogous manner it is possible to calculate the import content of tourism (M^{T}) at the level of each pair of activities *i* and *j* per unit of final consumption of activity *j* according to equation (8) in which $(\hat{m})$ is the diagonalized matrix of A^{u} of import technological coefficients, that is where G is the import content matrix derived from the domestic technology matrix:

$$M^{T}=\hat{m}\left[I-A^{d}\right]^{-1}Y^{dT}=GY^{dT} \qquad (8)$$

where

- M^{T} is the vector of the import content of each activity (in basic prices) generated by domestically produced internal tourism consumption in basic prices
- $(\hat{m})$ is the diagonalized matrix of import coefficients, and
- $\hat{m}\left[I-A^{d}\right]^{-1}=G$ is the matrix multiplier consisting of elements that represent total import dependence of product *i* generated by the unit of value of domestically produced internal consumption of activity *j* and is obtained from the multiplication of the diagonalized matrix of import coefficients $(\hat{m})$ and the matrix multiplier $\left[I-A^{d}\right]^{-1}$.

The methodological framework of the tourism satellite account

Satellite accounts enable the elaboration and expansion of the analytical framework of the system of national accounts for the sake of the analysis and tracking of specific areas, in a span from products and activities to institutional sectors. Starting from clear definitions, a systematic accounting approach and links with basic concepts of national accounting, satellite accounts enable the measuring of specific variables in the context of the national economy (Eurostat, 2013). Since the definition of tourism is demand driven, that is, tourism is defined from the perspective of the buyer, tourism is one of those economic activities for which the compilation of a satellite account is recommended. Namely, tourism stems from the activities of visitors and their roles in the acquisition of goods and services, so from the supply side perspective, tourism is a set of productive activities that cater mainly to visitors (United Nations et al., 2010).

Despite its limitations (Smeral, 2006; Jones & Munday, 2008; Dwyer et al., 2010; Frechtling 2013), a TSA offers the most valid method of measuring the direct economic contribution of tourism to a national economy (Frechtling 2013), providing a number of possible benefits including improvement of the information base for conducting a national tourism policy and marketing strategy, a decision making process on a micro level as well as adjustments and fine-tuning of the system of tourism statistics (Frangialli, 2006; Ivandić & Marušić, 2009).

The importance of a tourism satellite account as one of the key analytical tools for measuring the magnitude and importance of tourism is brought out in Regulation (EU) No 692/2011 of the European Parliament and of the Council of July 6, 2011, concerning European statistics on tourism and repealing Council Directive 95/57/EC. But, a number of member states still do not measure the overall contribution of tourism to their economies (Eurostat, 2017). Due to the analytical advantages of understanding the features of tourism consumption and production, the *Strategy for the Development of the Tourism of the Republic of Croatia up to 2020* (Official Gazette, No. 55/2013) put the continuous compilation of a tourism satellite account among the priority measures for enhancing the competitiveness of Croatian tourism.

A tourism satellite account is a set of accounts presented in 10 interconnected tables correlated with the system of national accounts (United Nations et al., 2010) and with supply and demand tables. Tables can be placed into two groups. Group 1 consists of core tables that cover the consumption of goods and services (Tables 1, 2, 3 and 4), the supply of activities in which these goods and services are produced (Tables 5 and 6) and the non-monetary indicators (Table 10). Group 2 consists of Tables 7, 8 and 9 in which other aspects of tourism are analysed, such as employment, fixed capital formation and collective tourism consumption. The tables are organized to cover products according to the Central Product Classification, with a division of products characteristic of tourism (which in turn are subdivided into tourism characteristic products and country-specific tourism products and services) as well as other consumption products and valuables. TSA also includes five macro-aggregates of which tourism direct gross value added and tourism direct gross domestic product are considered as indicators of the direct economic contribution of tourism to the economy, although they do not consider components of total tourism demand such as tourism gross fixed capital formation and tourism collective consumption (United Nations et al., 2010; Ivandić & Marušić, 2017).

An integrated TSA and IO model for the estimate of the overall contribution of tourism: The example of available data for Croatia in 2016

The estimation of the overall contribution of tourism in this paper is based on a model that integrates symmetrical IO tables and the tables of the tourism satellite account via supply and use tables in current prices divided into domestic and import flows. The model is founded on the approach used in Ivandić and Šutalo (2018), which starts off from the aggregation of input-output tables to provide an approximate coverage of products in the tourism satellite account in order to enable the linking of the matrix multiplier derived from the input-output table and the vector column of tourism consumption of domestic origin in basic prices derived from the satellite account, the "authoritative source" for the estimation of the tourism direct gross domestic product (Frechtling, 2013).

The structure and process of producing the Croatian tourism satellite account for 2016 enabled its full linkage with tables of supply and use and with a calculation of gross domestic product for 2016, and adjustment to the specific features of tourism in Croatia, expressed through country-specific activities and products. This is particularly important as good description of the specific features of tourism, and a more detailed account of internal tourism consumption have been recognised as an important precondition for the improvement of research quality (Ivandić & Šutalo; 2018).

The Croatian TSA for 2016 shows visitors' activities according to tourism expenditures on characteristic tourism products and services and other consumption products and services (TSA table rows 1, 2, 4, 5

and 6) and the values of output, intermediate consumption and gross value added of tourism and other activities (TSA table columns 5 and 6). Classification of products and tourism activities were adjusted to available sources of official tourism statistics and the characteristics of Croatian tourism (Table 1).

Table 1
Classification of products and tourism activities in the Tourism Satellite Account of Croatia for 2016

Products and services	Activities
Characteristic tourism products	**Tourism activities**
1. Accommodation services for visitors	1. Accommodation for visitors
1.1. Hotel and other accommodation services for visitors other than 1.2.	1.1 Hotel and other accommodation services for visitors other than 1.2
1.2. Accommodation services associated with all types of vacation home ownership	1.2. Accommodation services associated with vacation home ownership (imputed rental)
2. Food-and beverage-serving services	2. Food- and beverage-serving activity
3. Railway passenger transport services	3. Railway passenger transport
4. Interurban road transport services of passengers	4. Road passenger transport
5. Water passenger transport services	5. Water passenger transport
6. Air passenger transport services	6. Air passenger transport
7. Travel agencies and other reservation services	7. Travel agencies and other reservation services activity
8. Cultural, sports and recreational services	8. Cultural, sports and recreational activities
9. Croatia-specific tourism characteristic product and service –consumption goods and services in retail trade	9. Croatia-specific tourism characteristic activity – retail trade and activities producing merchandise
10. Croatia-specific tourism characteristic service – mooring services of nautical ports in yachting tourism	10. Croatia-specific tourism characteristic activity – mooring services of nautical ports
11. Croatia-specific tourism characteristic service – nautical charter	11. Croatia-specific tourism characteristic activity – renting of vessels (nautical charter)
Other consumption products and services	**Other activities**

Source Croatian Bureau of Statistics (2019).

The classification of products and tourism activities in the Croatian TSA for 2016 differs somewhat from the internationally recommended classification of products and tourism activities (United Nations et al., 2010). Because of the lack of appropriate data, the services of culture, recreation and sport are treated as one and not two characteristic services/activities, while the category rental services concerning transport motor vehicles without an operator is included in the group of other products and services. On the other hand, groups of products and services specific to tourism in Croatia have been extracted, one group related to production of consumption goods and services in retail trade and two groups of products related to nautical tourism (mooring services and nautical chartering).

The input-output table for 2013 is symmetrical product/product table with 65 products according to national variant of Classification of Products by Activities (Official Gazette, No. 108/2008), with zero values in rows and columns of services of extra-territorial organizations and bodies, and separate tables for the use of domestic products and the use of imported goods and services (Mikulić, 2018).

Starting from the assumption of the stability of the technological coefficients in the medium term, the harmonization of the format of input-output tables for Croatia for 2013 and the TSA format for 2016 was accomplished by the aggregation of the domestically produced IO tables on a 10x10 format and vectors of domestically produced internal tourism consumption in basic prices on a 10x1 format in the following manner:

- The tourism activities of accommodation and food preparation and serving from the TSA are aggregated into one – the activity of accommodation and food available in the IO framework.

- The IO product of creative, artistic, cultural and entertainment activity and the product of sporting, entertainment and recreational services have been aggregated into one product, recreational, sporting and cultural services, harmonized with the TSA.
- The TSA product of consumption goods and services in retail trade is disaggregated into a retail trade segment and production of merchandise. The value of merchandise product is obtained from the supply table by aggregating over columns and rows for products for which positive trade and transport margins are recorded in the evaluation table (Central Product Classification A01 to C31_C32)
- The TSA products of rail and road passenger transport are aggregated into the product of land transport according to the production classification in the IO table. Assuming the identity of input and output structures of passenger and freight transport, the analysis uses technological coefficients of the activity of transportation from the IO table that cover both passenger and freight transport although the TSA activities of transport include only passenger transport.
- The TSA country specific tourism characteristic services of nautical mooring and chartering are allocated in the pertaining groups of products covered by the IO table because it was not feasible to disaggregate the IO products. The services of nautical mooring are divided into mooring services in nautical tourism ports, as part of recreational, cultural and sporting activities, and mooring services in ports of nautical transport as part of services in water transport. Charter services are allocated entirely into the group other products, like other services of rental of means of transportation without an operator.
- The vector of final internal consumption for 2016 is based on the TSA Table 4 and its transformation into the vector of domestically produced final internal tourism consumption in basic prices by a correction for imports, net taxes and trade and transportation margins with the assumption of their same share in tourism and non-tourism products, pursuant to information from TSA Table 6 (Croatian Bureau of Statistics, 2019).

The starting point of the analysis is the aggregation of 10x10 input-output table for domestic input at basic prices from which the matrix of technological coefficients a_{ij}^{d} (Table 2) is derived by dividing in columns the elements of intermediate consumption with the correlated outputs at basic prices.

The technological coefficients matrix shows that among the tourism characteristic and other products analysed, the lowest share of intermediate consumption, apart from imputed rent, is made by retail trade and the services of travel agencies. In the food and accommodation activity share of intermediate inputs is 35.4% of total output, and in the activity of the production of merchandise 43.1%.

Table 2
Matrix of technological coefficients (A^d) derived from domestic intermediate flows in Croatia

	Food and accommodation	Land transport	Water transport	Air transport	Travel agency services	Recreation, sport, culture	Retail trade	Imputed rent	Merchandise goods	Other
Food and accommodation	0.0037	0.0015	0.0029	0.0053	0.0079	0.0052	0.0006	0.0000	0.0005	0.0029
Land transport	0.0098	0.0461	0.0673	0.0671	0.0069	0.0093	0.0140	0.0000	0.0166	0.0096
Water transport	0.0008	0.0025	0.0166	0.0006	0.0002	0.0011	0.0003	0.0000	0.0024	0.0009
Air transport	0.0005	0.0006	0.0003	0.0018	0.0001	0.0023	0.0003	0.0000	0.0004	0.0008
Travel agency services	0.0056	0.0025	0.0007	0.0007	0.1102	0.0008	0.0001	0.0000	0.0004	0.0009
Recreation, sport, culture	0.0050	0.0007	0.0004	0.0000	0.0007	0.0551	0.0004	0.0000	0.0002	0.0006
Retail trade	0.0105	0.0074	0.0042	0.0044	0.0002	0.0022	0.0031	0.0000	0.0175	0.0056

Table 2 **Continued**

	Food and accommodation	Land transport	Water transport	Air transport	Travel agency services	Recreation, sport, culture	Retail trade	Imputed rent	Merchandise goods	Other
Imputed rent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Merchandise goods	0.1623	0.1193	0.1776	0.1601	0.0073	0.0341	0.0347	0.0152	0.2320	0.0508
Other	0.1560	0.2436	0.2170	0.4375	0.0246	0.2230	0.1015	0.0272	0.1610	0.2001
Total inputs	**0.3541**	**0.4241**	**0.4870**	**0.6775**	**0.1582**	**0.3331**	**0.1549**	**0.0424**	**0.4310**	**0.2720**

Source: Authors on the basis of Mikulić (2018).

Coefficients of imports and value added (table 3) are obtained from the aggregated input-output table by dividing in columns the values of imports and gross value added by the correlated outputs at basic prices.

The biggest direct share of gross value added, apart from imputed rent, comes from recreation, sport, culture (57%) and food and accommodation (56%), and the least of all from air transport (23%) and production of merchandise goods (36%). The coefficients of imports as indicators of direct import dependence, with the exception of imputed rent, range between 5% in water transport and 20% in production of merchandise goods. Food and accommodation obtain 7% of their total output through imports.

Table 3
Matrix of coefficients of imports and value added derived from domestic intermediate flows in Croatia

	Food and accommodation	Land transport	Water transport	Air transport	Travel agency services	Recreation, sport, culture	Retail trade	Imputed rent	Merchandise goods	Other
Imports	0.0721	0.0992	0.0483	0.0647	0.0634	0.0539	0.1161	0.0000	0.1975	0.1197
Gross value added	0.5602	0.4438	0.4256	0.2331	0.5192	0.5702	0.4859	0.9576	0.3594	0.4924

Source: Authors on the basis of the data of Mikulić (2018).

From the matrix of technological coefficients based on domestic intermediate flows (A^d) the matrix multiplier $(I - A^d)^{-1}$ is derived. Every element of this matrix ($r_{ij}^{\ d}$) gives the value of the production of the activity of the deliverer i generated by a unit of final products of the activities of recipient j. The sum of each column represents the output of the j^{th} activity, generated by unit final products of the whole economy (all activities), or, in other words, sum of each column gives the total output multiplier of the activity that consists of direct and indirect contributions. The direct influence is expressed by the diagonal element (r_{ij}^{d}, i=j), and the indirect influence is obtained by the vertical aggregation of non-diagonal elements ($\sum_i r_{ij}^{d}, i \neq j, za \forall j$) of matrix $(I - A^d)^{-1}$ (after Sekulić, 1980; Croatian Bureau of Statistics, 2002).

Table 4
Matrix multiplier derived from domestic intermediate flows $(I - A^d)^{-1}$ of Croatia

	Food and accommodation	Land transport	Water transport	Air transport	Travel agency services	Recreation, sport, culture	Retail trade	Imputed rent	Merchandise goods	Other
Food and accommodation	1.0047	0.0028	0.0043	0.0074	0.0091	0.0066	0.0011	0.0001	0.0016	0.0038
Land transport	0.0174	1.0558	0.0805	0.0819	0.0090	0.0152	0.0173	0.0008	0.0266	0.0147
Water transport	0.0017	0.0035	1.0181	0.0020	0.0003	0.0017	0.0007	0.0001	0.0036	0.0014

Table 4 **Continued**

	Food and accommodation	Land transport	Water transport	Air transport	Travel agency services	Recreation, sport, culture	Retail trade	Imputed rent	Merchandise goods	Other
Air transport	0.0008	0.0010	0.0008	1.0025	0.0002	0.0027	0.0004	0.0000	0.0008	0.0011
Travel agency services	0.0068	0.0034	0.0015	0.0018	1.1240	0.0014	0.0003	0.0001	0.0010	0.0014
Recreation, sport, culture	0.0056	0.0010	0.0008	0.0006	0.0009	1.0585	0.0005	0.0000	0.0005	0.0008
Retail trade	0.0162	0.0132	0.0118	0.0133	0.0010	0.0056	1.0051	0.0006	0.0251	0.0088
Imputed rent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
Merchandise goods	0.2333	0.1904	0.2733	0.2661	0.0171	0.0730	0.0582	0.0226	1.3273	0.0884
Other	0.2529	0.3640	0.3587	0.6307	0.0431	0.3184	0.1453	0.0390	0.2803	1.2755
Total inputs	**1.5393**	**1.6352**	**1.7497**	**2.0064**	**1.2048**	**1.4831**	**1.2289**	**1.0633**	**1.6667**	**1.3959**

Source: Authors on the basis of the data of Mikulić (2018).

The biggest multipliers of the total production of characteristic tourism and other products (table 4) are in the activities of air transport (2.0) and water transport (1.7), followed by land transport (1.6). Apart from imputed rents, the smallest multiplier effects are generated by travel agencies and retail trade. In other words, these are activities that have the smallest technological dependence on other activities, so these activities are weaker in attracting the production of other activities as a reaction to the increase of final demand.

As shown previously, IO analysis enables calculation of total import dependence and gross value added generated in all activities of the economy induced by the unit of final deliveries of an activity. If the diagonalised matrix of import coefficients ($\hat{m}$) from table 3 is multiplied by the matrix multipliers from domestic flows (table 4), the matrix of multipliers of total, direct and indirect, import dependence (G) is obtained according to equation (9), the sum of the columns of which is shown in table 5.

$$\hat{m}\left[I-A^{d}\right]^{-1}=G \qquad (9)$$

Table 5
Vector row of total import dependence of tourism characteristics and other products of Croatia

	Food and accommodation	Land transport	Water transport	Air transport	Travel agency services	Recreation, sport, culture	Retail trade	Imputed rent	Merchandise goods	Other
Multipliers of import dependence	0.153	0.188	0.156	0.203	0.082	0.113	0.147	0.009	0.302	0.173

Source: Authors on the basis of data of Mikulić (2018).

Total import dependence of characteristic tourism and other products (table 5) is greatest in the production of merchandise goods the technology of which requires 30.2% of direct and indirect import inputs obtained through all other activities and in air transport (20.3%). Final deliveries of food and accommodation require a total of 15.3% of imported inputs.

The matrix of multipliers of gross value added (H) is obtained in line with equations (10) and (7), as the product of the diagonal matrix of coefficients of gross value added ($\hat{d}$) and the matrix multiplier $\left[I-A^{d}\right]^{-1}$, in which every element $[h^{ij}]$ represents gross value added of product *i* generated by unit value of final deliveries of activity *j*. The sum of column elements of matrix H (table 6) gives the vector of total, direct and indirect, multipliers of gross value added of the whole economy generated by the unit of final deliveries, showing a backward linkage of products to gross value added while the sum of non-diagonal elements of columns ($\sum_j h_{ij}$, for $\forall\, i \neq j$) results in the backward linkage of one sector to gross value added of the rest of the economy (Ivandić & Šutalo, 2018).

$$\hat{d}\left[I-A^{d}\right]^{-1}=H \qquad (10)$$

Table 6
The matrix (H) of total (direct and indirect) gross value added in activity (i) generated by units of final deliveries of tourism-characteristic and other products (j) of Croatia, total multiplier of gross value added, and multiplier of gross value added on the rest of the economy

	Food and accommodation	Land transport	Water transport	Air transport	Travel agency services	Recreation, sport, culture	Retail trade	Imputed rent	Merchandise goods	Other
Food and accommodation	0.5628	0.0016	0.0024	0.0042	0.0051	0.0037	0.0006	0.0001	0.0009	0.0021
Land transport	0.0077	0.4686	0.0357	0.0363	0.0040	0.0068	0.0077	0.0004	0.0118	0.0065
Water transport	0.0007	0.0015	0.4333	0.0009	0.0001	0.0007	0.0003	0.0000	0.0015	0.0006
Air transport	0.0002	0.0002	0.0002	0.2337	0.0000	0.0006	0.0001	0.0000	0.0002	0.0002
Travel agency services	0.0035	0.0018	0.0008	0.0010	0.5836	0.0007	0.0002	0.0000	0.0005	0.0007
Recreation, sport, culture	0.0032	0.0006	0.0005	0.0003	0.0005	0.6036	0.0003	0.0000	0.0003	0.0005
Retail trade	0.0079	0.0064	0.0057	0.0065	0.0005	0.0027	0.4883	0.0003	0.0122	0.0043
Imputed rent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9576	0.0000	0.0000
Merchandise goods	0.0839	0.0684	0.0982	0.0956	0.0061	0.0262	0.0209	0.0081	0.4771	0.0318
Other	0.1245	0.1792	0.1766	0.3105	0.0212	0.1567	0.0716	0.0192	0.1380	0.6280
Total multiplier of gross value added	**0.7944**	**0.7283**	**0.7534**	**0.6890**	**0.6213**	**0.8018**	**0.5899**	**0.9857**	**0.6424**	**0.6747**
Multiplier of gross value added on the rest of the economy	**0.2316**	**0.2597**	**0.3201**	**0.4553**	**0.0377**	**0.1982**	**0.1016**	**0.0281**	**0.1653**	**0.0467**

Source: Authors on the basis of the data Mikulić (2018).

Products of recreation, sports and culture (0.80) and food and accommodation (0.79) have, along with imputed rents as a specific product, the greatest potential for generating gross value added (table 6). On the other hand, retail trade (0.59) and services of travel agencies (0.62) are the weakest generators of the economy's value added. When the influence on the generation of diagonal value added is excluded, it follows that the greatest potential for animating the economy is in air (0.46), maritime (0.32) and land transport (0.26) and then in food and accommodation (0.23) and recreation, sport and culture (0.20).

Total contribution of tourism to gross value added and imports of Croatia in 2016

The total contribution of tourism to the gross value added and imports of Croatia in 2016 is assessed by the product of the multiplier of gross value added (H) and domestically produced internal tourism consumption in basic prices according to equation (7).

The vector of domestically produced internal tourism consumption in basic prices in 2016 is assessed by aggregating internal tourism consumption in 2016 from the TSA table 4 on a comparable format with matrix H and correction for imports, net taxation and transport and trade margins on the basis of data from the table of supply and use for 2016. Correction of the transport and trade margins have been based on the relationships of transport and trade margins of the activity of retail trade and wholesale trade from the table of evaluation for 2013.

The transformation of internal tourism consumption in purchase prices that include transport costs, trade margins and taxes less subsidies on products into the domestically produced internal tourism

consumption in basic prices that exlude transport costs, trade margins and taxes less subsidies on product, resulted in the enlargement of the share of most tourism activities, while a reduction was recorded, above all as a reflection of imports, in the production of merchandise goods and land transport. The greatest relative share enlargement was recorded, apart from the specific products of imputed rent and retail trade, in the group of other products and water and air transport.

Table 7
Vector columns of internal tourism consumption in Croatia (in purchase prices) and of domestically produced internal consumption (in basic prices) in 2016 in million HRK

Products	Internal tourism consumption in Croatia in purchase prices			Domestically produced internal consumption in basic prices		
	Million HRK	Million EUR	%	Million HRK	Million EUR	%
Food and accommodation	36,522	4,851	46.5	32,501	4,317	49.4
Land transport	2,826	375	3.6	2,306	306	3.5
Water transport	1,638	218	2.1	1,715	228	2.6
Air transport	1,391	185	1.8	1,410	187	2.1
Travel agency services	3,150	418	4.0	2,981	396	4.5
Recreation, sport, culture	6,451	857	8.2	5,870	780	8.9
Retail trade	33	4	0.0	1,620	215	2.5
Imputed rent	1,661	221	2.1	1,661	221	2.5
Merchandise goods	17,283	2,295	22.0	6,941	922	10.5
Other	7,661	1,017	9.7	8,818	1,171	13.4
Total	**78,616**	**10,441**	**100.0**	**65,822**	**8,742**	**100.0**

Source: Authors on the basis of data of the Croatian Bureau of Statistics (2019), and Mikulić (2018).
Average annual exchange rate HRK/EUR=7.529383.

The product of matrix H (table 6) and vector columns of domestically produced internal consumption in basic prices in million EUR (table 7) according to equation (7) gives the vector column of gross value added directly or indirectly generated by tourism domestic final deliveries in basic prices.

The total contribution of tourism to gross domestic value per activity is assessed to the amount of 6,550 billion EUR (table 8), which is 16.9% of the gross valued added of Croatia in 2016, estimated to 38,696 billion EUR (according to the Croatian Bureau of Statistics, 2018 average annual exchange rate HRK/EUR=7.529282). In other words, tourism demand directly generates 10.9% of gross value added of Croatia (Croatian Bureau of Statistics, 2019) and indirectly additional 6.0%.

Food and accommodation products contribute most to gross value added (37.2% of total gross value added made by Croatian tourism) and then comes the group of what are called other products, with a share of 26.0%, production of merchandise goods with a share of 14.2%, and recreation, culture and sports activities, with a share of 7.4%. A comparison of the share of the values of domestically produced internal consumption of given products in basic prices in total deliveries (Table 7) and the share of total gross value added generated by tourism indicates there is an important multiplicative effect of visitor spending on gross value added of Croatia related to non-classic tourism products such as other products and the production of merchandise goods. Other products in domestic final deliveries have a share of 13.4% and made up 26% of total gross value added of tourism, while the production of merchandise goods has increased its share from 10.5% to 15.2%. On the other hand, the products of food and accommodation that account for almost half of the domestically produced internal consumption in basic prices account for 37% of the gross valued added of the tourism of Croatia.

Table 8
Vector columns of tourism gross valued added and tourism import dependence in basic prices in Croatia in 2016.

Products	Total gross valued added generated by domestically produced internal consumption			Total intermediate import (import dependence) generated domestically produced internal consumption		
	Million HRK	Million EUR	%	Million HRK	Million EUR	%
Food and accommodation	18,368	2,440	37.2	2,365	314	22.0
Land transport	1,649	219	3.3	369	49	3.4
Water transport	792	105	1.6	90	12	0.8
Air transport	344	46	0.7	95	13	0.9
Travel agency services	1,876	249	3.8	229	30	2.1
Recreation, sport, culture	3,657	486	7.4	346	46	3.2
Retail trade	1,221	162	2.5	292	39	2.7
Imputed rent	1,591	211	3.2	0	0	0
Merchandise goods	6,998	929	14.2	3,846	511	35.8
Other	12,827	1,704	26.0	3,118	414	29.0
Total	**49,321**	**6,550**	**100.0**	**10,750**	**1,428**	**100.0**

Source: Authors, Average annual exchange rate HRK/EUR=7,529383.

The product of matrix G (shown summarily in table 5) and the vector columns of domestically produced internal consumption in basic prices (table 7) according to equation (8) results in the vector column of direct and indirect intermediate imports (import dependence) per activity generated by tourism.

Direct and indirect intermediate imports generated by domestically produced internal consumption is estimated at 1,428 billion EUR (table 8), which makes 6.5% of total (goods and services) imports of Croatia amounting to 21,926 billion EUR in 2016 (Croatian Bureau of Statistics, 2018; Average annual exchange rate HRK/EUR=7.529383). It follows that tourism contributes more than twice as much to gross valued added of Croatia than its direct and indirect intermediate imports participate in total imports.

Conclusions and recommendations

Integration of the results of the tourism satellite account and input-output models has established an analytical framework that enables comprehension of the inter-activity relations. This comes in turn from an understanding of visitor demand for goods and services and their linkages with domestic production. Apart from measuring the total contribution of tourism to the national economy and calculation of intermediate import dependence of Croatian tourism, the established analytical framework also enables an analysis of the gap between the needs of visitors and the national production capacities as well as possibility for import substitution.

Ivandić and Šutalo in the 2018 paper established that the growth of the contribution of tourism to the economy in the period from 2005 to 2013 was preponderantly generated by a rise in domestically produced internal tourism consumption, by changes in the capability of GVA generation in the hospitality and transportation activities and by the GVA dynamics of the overall economy. The authors draw attention to the conclusion that tourism consumption has a stronger multiplicative effect on the non-tourism than on the tourism sectors of the economy.

The results of the analysis in this paper confirm those conclusions, and also give a more detailed insight into the inter-activity relations of tourism products and consumption and their effect on the economy

of Croatia, since they are founded on an improved methodological framework. This is particularly important in the conditions of tourism activity growth (for example, HNB/CNB, 2019) when, in the short and medium term, a contraction of the manufacturing sector is possible (Song et al., 2012).

With a methodological framework improved on that presented in Ivandić and Šutalo 2018 paper, this paper shows that the ratio between tourism generated gross value added (Table 8) and domestically produced internal consumption in basic prices (Table 7) is the largest in the other products and the production of merchandise goods. In other words, the multiplicative effect of tourism consumption on the creation of gross value added of the economy is greatest in 'non-classic' tourism products so the consumption of visitors in these activities is smaller than value added generated by the whole economy. On the other hand, the unit of domestically produced internal consumption of food and accommodation generates only 0.56 unit of gross value added of the economy. This confirms indirectly the hypothesis that tourism has a positive effect on growth (Brida, Cortes-Jimenez & Pulin, 2016) and also shows that optimising the effects of tourism implies developed domestic non-tourism economic activities (Payne & Mervar, 2010; Gwenhure & Odhiambo, 2017).

The importance of tourism can be also seen through the share of direct valued added of tourism in internal tourism expenditures as indicator of the potential that the tourism activity has for the generation of value added. Of European union (EU) countries for which data are accessible (Eurostat, 2017), 12 countries have a greater share of direct valued added of tourism in internal tourism expenditures than Croatia, three a smaller. This means that the economic structures of the tourism of 12 EU countries more successfully convert tourism expenditures into gross value added than Croatia. For example, Spain manages to generate 0.644 unit of gross value added per unit of internal tourism expenditures, Portugal 0.544, Austria 0.514. This means that Croatia, with a ratio of 0.412 (Croatian Bureau of Statistics, 2019), needs 56% more internal tourism expenditures than Spain for the generation of one unit of gross value added. So, it can be concluded that with a different economic structure and inter-activity relations of tourism-related activities, including the import components of tourism expenditures, indirect taxation and transport and trade tariffs, Croatia has the potential for substantially raising the gross domestic value of tourism without increasing physical tourism activity.

Improving the quality of research in the future entails further improvement of the statistical base by adjustment of the IO tables to the specific needs of tourism research and by more detailed elaboration of internal tourism consumption in the framework of the satellite account. Important segment of the expansion of the analysis is the need to link the tourism satellite account with the System of environmental-economic accounting (SEEA) and an environmentally extended input-output model. This would set up the framework for a parallel assessment of the positive contribution of tourism to the economy and the negative effects of tourism activity on the environment

Note

[1] This work is based on the results of the *Tourism Satellite Account for Croatia for 2016 and Estimation of Indirect and Total Contribution of Tourism* that was conducted during 2018 by the Institute for Tourism on behalf of and financed by the Ministry of Tourism of the Republic of Croatia.

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