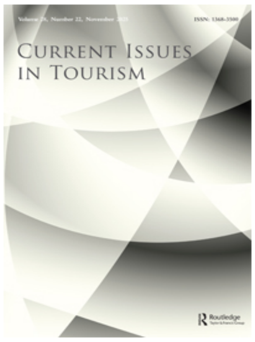

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Give me a number. Evaluating economic impacts of tourism

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ABSTRACT

Tourism's economic contribution is not explicitly included in the System of National Accounts and its direct contribution is usually computed via the Tourism Satellite Accounts. The total economic contribution of tourism, including indirect and induced impacts, is not estimated by official statistics but only by public and private institutions through different approaches, leading to heterogeneous results that limit their potential for policy-making. To address those limitations, this study: (i) presents a semi-automated procedure to compute time series of tourism's total contribution based on official statistics, and (ii) compares them with those estimated by the World Travel & Tourism Council and the Tourism Industrial Ecosystem approach of the European Commission to assess the robustness of estimates to the use of different procedures. Practical implications consist in obtaining a reliable methodology to estimate tourism's economic impact in a timely manner, which can inform policy-making and support tourism development.

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Economic impact; Tourism Satellite Accounts; Input-Output; multiplier; European Union; European Free Trade Association

1. Introduction

When media entertainers talk about, or journalists and columnists write an article on tourism, they typically start by saying that 'tourism is an important economic activity, contributing to x% of national GDP'. Yet, behind this number x lies a world hiding definitional ambiguities, partial estimates, unofficial data and unreliable figures. These numbers, driven by unpredictable media dynamics, occasionally make their path to the top of the political agenda, shaping the public discourse. The uncertainty surrounding the value of tourism contribution to the economy stems from tourism being an activity defined by demand, not explicitly included in the System of National Accounts (SNA), thereby necessitating the use of different approaches and methodologies to assess its economic value.

Although international organisations and national statistics agencies have established, since 1994, an official methodology to be used, according to which tourism's economic contribution must be computed via the Tourism Satellite Accounts (TSA), it is well known that this approach has two main limitations: (i) implementing TSA requires important human and financial resources, and results are typically published by National Statistics Offices (NSOs) with a lag (2-3 years from Eurostat for the European Union Member states) and low frequency (only 30% of EU Member States has annual production in the period 2019–2022 – Table A7) that is incompatible with the

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policy agenda; (ii) TSA only captures the direct contribution of tourism to total value added or GDP, hence omitting indirect and induced effects. Moreover, the computation of national TSA requires the tackling of several issues linked to the measurement of specific economic aggregates and the imputation of missing data. As the solutions of these methodological puzzles are left to individual statistics offices, international comparison can be difficult or imprecise.

To address the limitations of the TSA framework, institutional and business practices have increasingly turned to complementary approaches for evaluating the total economic contribution of tourism. Among the most prominent, the World Travel & Tourism Council (WTTC) applies a mix of Input–Output and macroeconometric estimates to compute the total economic contribution as a share of GDP for all countries in the world, including those that do not compile TSA (WTTC, 2025). Recently, the European Commission's Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) has undertaken the computation of a novel economic aggregate, known as the 'Industrial Ecosystem', by considering different NACE (Nomenclature statistique des Activités économiques dans la Communauté Européenne, Revision 2, Eurostat, 2008) codes that are part of, or connected to, 14 industrial ecosystem, including tourism (European Commission, 2021). Other private research institutes or think-tanks employ alternative methods to generate meaningful figures that can be relevant to policy makers.

In this complex picture, the present work aims at tackling the two main limitations of TSA and presents estimates of tourism's total economic contribution (including indirect and induced effects) in a way that is fully consistent with the TSA and SNA methodologies. Specifically, this study aims at: (i) Introducing and presenting a semi-automated routine to compute the direct and total contribution of tourism for countries where I-O tables and basic information related to tourism expenditure are available. This approach, which builds upon previous works of Figini and Patuelli (2022) and the Joint Research Centre (Figini et al. 2022) also allows to estimate values for years in which the NSOs do not compute TSA. This methodology is applied to EU member states and European Free Trade Association (EFTA) countries, leveraging data collected by NSOs and presented in official statistics. Estimates can be compared to official TSA figures for those countries and years in which they exist, to test the reliability of the proposed methodology; (ii) Comparing the obtained estimates with those computed by other organisations (namely the WTTC and European Commission's DG GROW) with different methodologies, to evaluate the sensitivity of results to the use of alternative approaches.

In doing so, the novel contribution of this paper to the literature and to policy makers is threefold. Methodologically, it explicitly incorporates the induced effects into the analysis, thereby covering a component that was overlooked in Figini and Patuelli (2022) and in the previous literature (e.g. Eurostat, 2009; Smeral, 2005, 2006). This allows for a more comprehensive estimation of tourism's total economic impact by using official data, and provides an easy-to-apply methodology to acknowledge the broader ripple effects of tourism within the economy.

Empirically, it applies this enhanced methodology to all EU member states for which data are available. Doing so, not only does the paper provide valuable empirical insights for a set of important European destinations, but also demonstrates the robustness and adaptability of the methodology across different national contexts, at the same time revealing comparability issues that may arise when relying on individual national TSAs only.

Analytically, it compares results with those derived from other established approaches, highlighting the strengths and limitations of each method, and offering a nuanced understanding of tourism's economic impact. The discussion of both methodology and empirical findings provides suggestions and recommendations for policy makers and statisticians, especially at the European Union level, to enhance the collection, processing, and use of tourism data (including the TSA) in the near future, to support evidence-based tourism policies.

Having said that, the main policy implication of this work is straightforward: the best way to help policy makers to address problems within the tourism industry is to equip them with precise, reliable, and ready-to-use statistics on tourism's economic contribution. Instead of relying on unofficial estimation procedures (sometimes based on black-box methodologies), a procedure that is fully consistent with the TSA and relies only on official data (such as those available from Eurostat for EU Member States) should be used, to complement TSA. The methodology proposed in this paper aims at providing reliable and consistent estimates for the total contribution of tourism, including for years when official TSAs are not available.

The remainder of the paper is organised as follows. Section 2 reviews the various methods used to compute the economic contribution of tourism, while Section 3 outlines the proposed approach, including key assumptions and procedures for addressing data imputation and interpretation challenges. Section 4 presents the estimations and compares them with the alternative figures provided by the WTTC and by the European Commission's DG GROW. Section 5 discusses the implications of the findings and concludes.

2. A review of the different methods used to compute tourism's economic contribution

Tourism-related consumption, like any form of final demand, generates multiple economic effects, affecting output, value added, employment, trade balances, and more. Specifically, tourism-related consumption exerts three main types of economic influence: (i) direct effects, arising from tourist spending in sectors where goods and services are sold directly to visitors; (ii) indirect effects, which originate upstream, from the supply chain supporting these sectors; and (iii) induced effects, which stem downstream, from the re-spending of income earned through tourism-related activities on other goods and services in the economy.

Capturing the full extent of these impacts is methodologically challenging because tourism is not a standalone industry within the SNA. Instead, it is a demand-side phenomenon, spanning a diverse array of goods and services (from accommodation and dining to cultural attractions and transport) many of which are also consumed by residents. For this reason, tourism is not explicitly defined within standard industrial classifications, making its economic footprint difficult to isolate without specialised methods. To address this challenge, statistical agencies rely on the TSA framework (Eurostat, 2021; United Nations, 2010; UNWTO, 2010), which integrates tourism-specific data (often derived from surveys) with national accounts to estimate the portion of domestic output attributable to tourism. TSA tables provide detailed figures on production and expenditure, and in particular, TSA Tables 5 and 6 cross-reference tourism-related demand with SNA industry classifications. This allows for the computation of tourism's direct contribution to value added and its share of overall Gross Value Added (GVA).

However, the TSA framework has two principal limitations, which are well-known since its introduction and that triggered a flourishing literature (see, among many, Frechtling, 1999; Smeral, 2005, 2006; Smith & Wilton, 1997). First, compiling a TSA requires substantial time, financial investment, and skilled personnel, which means it is seldom computed annually and that a number of idiosyncrasies exist in the implementation of its standard and the interpretation and treatment of certain key concepts, thereby limiting the comparability of TSA estimated by different NSOs (Libreros et al., 2006).

Second, TSAs capture only direct effects, excluding indirect and induced impacts (Smeral, 2006). To estimate these, additional modelling techniques are needed, most commonly Input-Output (I-O) models or Computable General Equilibrium (CGE) models. Both approaches are well established in the economic impact assessment literature (Briassoulis, 1991; Dwyer et al., 2004, 2007; Fletcher, 1989; Frechtling, 2010, 2011; Klijs et al., 2012), and each carries specific assumptions. I-O models are built on fixed technical coefficients and consumption proportions, typically reflecting short-run conditions where prices and technology remain unchanged. These models do not account for feedback effects such as crowding-out phenomena. For an earlier discussion and application of I-O models to the TSA see Eurostat (2009) for EU member states, and Smeral (2005, 2006) for the pioneering case of Austria.

By contrast, CGE models offer a more flexible, long-run framework that incorporates price adjustments, sector interactions, and resource reallocation. However, their use relies on stringent assumptions, including perfectly competitive markets, with market-clearing prices, full employment, accurate elasticity estimates, and fixed international prices (Dwyer et al., 2007; Pham & Dwyer, 2013). As a result, the robustness of CGE estimates depends heavily on the plausibility of their underlying assumptions, which may diverge from real-world market behaviour. Despite these methodological differences, both models share the drawback of being data-intensive and analytically demanding. In summary, Input-Output models are generally considered appropriate for analysing short-term impacts of external shocks under the assumption of fixed prices and technology, whereas Computable General Equilibrium models are better suited for capturing long-term dynamics, including price adjustments, technological shifts, and crowding-out effects (for an in-depth discussion of the two models, we refer to Dwyer et al. (2020) especially chapters 8 and 9).

National statistical systems tend to support I-O modelling through the production of symmetric I-O tables, while CGE models are more commonly employed by policy departments and research institutes engaged in economic forecasting and scenario analysis. In tourism economics, two alternative approaches to impact assessment have gained prominence and will serve as benchmarks for comparison in this paper: the WTTC methodology, which integrates I-O analysis with macroeconomic modelling (WTTC, 2025) and the European Commission's DG GROW 'Industrial Ecosystem' approach, which aggregates economic activities linked to tourism through selected NACE codes (European Commission, 2021).

2.1 Estimation of total tourism impact from the WTTC

The WTTC produces (through Oxford Economics, a private research institute) and publishes what is often considered the most reliable estimate of the total economic impact of tourism. Figures, that are currently available for 185 countries, are updated annually on the WTTC's research hub (WTTC, 2025). Their methodology, that was originally based on macroeconometric models and hence criticised for non-adhering to UN statistical definitions and standards (Smith & Wilton, 1997), is now more consistent with the TSA framework and makes strong use of I-O tables. It has been refined in 2020 and its latest methodological notes (Oxford Economics, 2023) state that:

> the underlying approach is to use existing data on Travel & Tourism wherever possible, and to fill in the gaps by supplementing data with estimates derived from the typical relationship between the missing information and other economic and Travel & Tourism indicators where necessary. Using actual and estimated data, we apply the UNWTO Statistics Division-approved TSA methodology (TSA:RMF 2008) to quantify the direct contribution of Travel & Tourism. But we are also interested in measuring the wider economic impacts of Travel & Tourism. So, we also compile indirect impacts from the supply chain of Travel & Tourism suppliers and Travel & Tourism investment, and induced impacts as direct and indirect workers in the Travel & Tourism sector spend their income. (Oxford Economics, 2023, p. 1)

In short, after 2020 the WTTC follows an approach that starts by inputting data from national TSA, when existing, and then extend the analysis to estimate the tourism's indirect and induced impacts with the help of I-O tables. A series of assumptions and macroeconometric estimations are then used for producing missing data or for estimating values for countries not producing TSA tables. Noticeably, they prefer relying on sources such as IMF balance of payments rather than using inbound tourists spending from TSA, although they state that in most cases figures are very similar.

2.2 The tourism industrial ecosystem approach from the European Commission

The Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs of the European Commission (DG GROW) follows a completely different approach, mostly tied to the supply-side, and that pivots around the 'Industrial Ecosystems' methodology, which aims at capturing sectoral interlinkages and interdependencies between various economic actors. The European Commission (2021) states that:

> Industrial ecosystems encompass all players involved in the achievement of a certain socio-economic goal: from the smallest start-ups and the largest companies cooperating to satisfy a new market need, the research activities supporting industrial innovation, the regulators steering economic activity through conducive policies, to the services providers and suppliers. (European Commission, 2021, p. 72)

This approach accounts for the structural significance of intersectoral linkages, both horizontal and vertical, between economic actors. So far, 14 industrial ecosystems across the EU have been identified, each with their own core activities and characteristics. The industrial ecosystem aims at returning numbers that represent the size of a certain group of economic activities by using 'supply-side' available data, hence abstracting from the complexity of collecting further data about demand and mixing them with SNAs (which is the main limitation of satellite accounts). Hence, each industrial ecosystem is identified by core activities. Although the idea of industrial ecosystem is not referred to in any official statistics dataset or methodology, its policy importance is growing, especially at the EU level. For example, the Transition Pathway for Tourism, the strategic document for EU tourism policy (European Commission, 2022), is built on the concept of the tourism ecosystem, which accounts, at the EU level, for a GVA of € 849.6 billion and a total employment of 20.3 million workers. Similarly, the EU Tourism Dashboard (European Commission, 2023), the official online knowledge tool of the European Commission on tourism, monitors a set of indicators relevant for the European tourism ecosystem. The policy relevance of the Tourism Industrial Ecosystem should not hide its methodological and interpretative shortcomings, for which under no circumstances these figures should replace any TSA since it is clearly stated, among other things, that 'tourism ecosystem does not differentiate between the activities of visitors and residents' (European Commission, 2023, Section 7).

3. Data and methodology

The approach developed herein extends Figini and Patuelli (2022) and Figini et al. (2022), and aims at producing direct and total (including direct, indirect, and induced effects) tourism's economic impacts for all EU Member States, for the period 2019–2023. Thanks to interaction with Eurostat, TSA data have been obtained for year 2019 from NSOs belonging to EU Member States and European Free Trade Association (EFTA) countries (Switzerland, Iceland, Liechtenstein, Norway), specifically for TSA Tables 1 (inbound tourism expenditure), 2 (domestic tourism expenditure), 4 (internal tourism consumption), 7 (employment) and 10 (tourism arrivals and overnights) with a breakdown, when available, between same-day visitors and tourists. The request returned 22 datasets from EU member states (the only missing countries were Cyprus, Greece, Ireland, Malta, and the Netherlands) and 2 datasets from EFTA countries (Switzerland and Norway, while Iceland and Liechtenstein were not available). The datasets shared an ad-hoc template to facilitate the input and elaboration of data in the subsequent analysis.

Other relevant information was downloaded from the Eurostat database, including national I-O tables, Exchange rates, Consumer Price Indices, and Arrivals and Overnight stays in official accommodation establishments. I-O tables are available and freely downloadable from the Eurostat database, meaning that data are organised according to the same template (64 products/industries), speeding up the subsequent process of data organisation. Since I-O tables are needed to calculate the technical coefficients of production, which are assumed not to change in the short-term, the most recent (2019) I-O tables were used when available, otherwise the 2015 base was considered.

Exchange rates (the series TEC00033 in the Eurostat dataset) were used to transform in Euro the TSA tables that were compiled in local currency (Poland, Sweden, Switzerland), while Harmonised Consumer Price Indices for all countries (TEC00027) allowed the estimation of values for subsequent years (2020–2023). The series about Arrivals (TOUR_OCC_ARNRAW) and overnight stays

(TOUR_OCC_NINRAW) in official accommodation establishments were used to estimate their corresponding rates of change in subsequent years (2020–2023).

The proposed procedure aims at two goals: (i) generating TSA data for the years in which official TSA are not available (see Eurostat, 2016, 2019, 2023 for data availability in the EU); (ii) generating estimates of the total contribution of tourism (including indirect and induced effects). The following sub-sections describe each of the two tasks, while Appendix A.3 provides a more technical and exhaustive description of the whole procedure.

3.1 Completing the time series: estimation of tourism expenditure for years in which TSA data are not available

To proceed towards this goal, it should be recalled that TSA includes tourism consumption of all types of tourists, including same-day visitors and tourists staying in second homes or visiting friends and relatives. Hence, the numbers of total arrivals and overnight stays reported in TSA Table 10 are higher (sometimes more than double) than those appearing in accommodation statistics, which include only tourists staying in official accommodation establishments. These latest figures are available for each year, while the total number of visitors is available only when the TSA is computed. It is therefore needed to input figures for the total number of arrivals and overnight stays for years 2020–2023. The procedure requires 3 steps:

- Step 1: the computation of the rate of change of arrivals and overnight stays in official accommodation establishments, for both domestic and inbound tourists, for 2020–2023 compared to 2019;
- Step 2: the rate of change computed in Step 1 has been applied to the respective categories included in TSA Table 10 for 2019, thereby building the time series of tourism flows for the 2020–2023 period. In other words, the underlying assumption is that the rate of change of tourists staying in official accommodation establishments was the same of tourists staying in own properties or visiting friends and relatives. It was hence abstracted from one of the most discussed consequences of the pandemic, which was the surge in holidays outside official accommodation establishments, at least in 2020 and 2021, but it could not be done otherwise without further dedicated data.
- Step 3: the 2019 values of tourism expenditure were multiplied by the rate of change of the respective category (e.g. tourism expenditure of inbound tourists was multiplied by the rate of change of inbound overnight stays, being expenditure roughly proportional to nights spent). It was also multiplied by the rate of change in the Consumer Price Index, to reproduce the current value of tourism expenditure. The implicit assumption of this procedure is that the expenditure structure of each category of tourism does not change over time, so that total tourism consumption changes only because of inflation and the change in the number of visitors, and not because tourists modify the composition of their consumption pattern. Again, this is a reasonable assumption to consider in the short run when relative prices and preferences are stable, although it might not hold in 2020 and, partially, in 2021 due to the impact of COVID-19 pandemic. Within these guidelines, several adjustments were necessary. For instance, although the Eurostat database also includes figures for same-day visitors (dataset tour_dem_sdva), most of the figures are missing or unreliable, and it was hence assumed that the number of same-day visitors changed in line with the rate of change in tourism arrivals to the official accommodation establishments. To estimate changes in other types of consumption (TSA Table 4.2), a weighted change rate of total overnight stays was applied, with the weights corresponding to inbound and domestic overnight stays.

Based on this procedure, the TSA Tables 1, 2, 4 and 10 have been generated for the years 2020–2023, and added to the (real) 2019 TSA values. All computations were carried out using a routine built in Stata.

3.2 Estimation of direct and total contribution of tourism to value added

One of the main complexities to estimate total impact through TSA is that its classification of products and activities does not completely match the one of SNA and I-O tables. For example, accommodation services and food and beverage services are two separate products in the TSA but they are merged as one product in the NACE rev. 2 classification, on which I-O tables are based. Since the procedure aimed at avoiding the complexity of building and calculating Tables 5 and 6 of TSA, which are its core, tourism products had to be paired with I-O sectors through a few assumptions:

- First, it is assumed that the production structure of the economy did not change from year to year. This is the typical assumption entailing the economic concept of 'short-term' and that is assumed by I-O tables. However, it is important to highlight that when the economy is hit by an important shock, the production structure can abruptly change, and hence new I-O tables should be computed. This is exactly what happened in 2020 because of the economic disruption generated by the pandemic and the lockdown. Hence, an extra flag of caution should be raised when presenting the estimates for 2020 (and partially 2021), which might be less reliable compared to other years, exactly because the last available I-O tables might not precisely fit the change of the production structure in those years.
- Second, for sectors shared between tourists and residents, the rate of conversion of output to value added was assumed to be the same. In other words, if in the food and beverage sector the value added was 40% of total production, the direct contribution of tourism to value added in that sector accounted for 40% of total tourism consumption.
- Third, a few countries do not disaggregate specific sectors in the exact ways required by the TSA (for example, cultural and sport activities may be reported jointly, or transport services may not be disaggregated between rail, road, water, and air in some countries). In such cases, it is reported pro-quota the specific values according to the respective values of production. In other words, if the value of production for cultural activities was double the value of sport and leisure activity in the I-O tables, the value X of tourism expenditure in these two products were broken down so that the value of tourism expenditure in cultural services would be (2/3)X and in sport and leisure services will be (1/3)X.
- Fourth, tourism expenditure on non-characteristic products (and in valuables, when data are available) were matched with the retail trade sector, following the international recommendations and methodology (United Nations, 2010).

The matching of I-O coefficients of conversion between total production and value added allows to estimate the direct economic contribution of tourism. Despite the direct effects were also available in the official TSA for the base year (2019), these figures have been re-estimated for three purposes: (i) they were needed to compute total effects for 2019; (ii) they guaranteed internal consistency in the estimation procedure, thereby bypassing individual countries' specificities in the TSA computation; (iii) they allowed to double check the degree of consistency of the procedure with the TSA computations of each country.

Subsequently, a specific coding procedure carried out in R (following Figini & Patuelli, 2022) was prepared to match the TSA values for 2019–2023 with I-O tables to identify the indirect and induced effects, thereby allowing to compute the total contribution of tourism (Appendix A.3) in particular, for each national TSA, we consider tourists expenditure presented in Tables 1–2, plus Column 4.2 of Table 4 ('Other components of tourism consumption') and sum them by commodity. Following the simplifications discussed above, we matched the resulting tourism consumption vector, first without induced effects to a 64×1 demand vector D consistent with the number of industries or products (depending on availability) used in Eurostat I-O tables. Clearly, such a demand vector will contain zeros in most cells. In parallel, we computed, from the same I-O tables, the standard technical coefficients matrix A, as well as the 64×1 vector containing the coefficients for the quota of value added over production (by industry or product), a_w. We obtain Leontief's inverse matrix as $L = (I–A)^{-1}$ and the vector of income multipliers as $a_w^T \cdot L$, where T is the transpose. Multiplying this vector by D provides the total income effect generated by demand. When including induced effects, matrix A is expanded by one row and one column, adding households as the 65th industry or commodity (household services), having consumption as an input and value added as an output. L becomes a 65×65 matrix as well, from whose last row we can directly pull the vector of income multipliers to be multiplied by D, as above.

4. Results

TSA tables have been obtained for 22 EU Member States (missing countries were Cyprus, Greece, Ireland, Malta, and the Netherlands) and 2 EFTA countries (Switzerland and Norway). However, I-O tables were not available for Bulgaria and Switzerland, while they were not fully accessible (for confidentiality reasons) for Luxembourg and Poland, hence bringing the total number of available countries to 20, 19 EU Member States plus Norway. For different reasons, Belgium and Latvia produced partial results, explained below, hence the total number of 'reliable' computations are related to a final list of 18 countries. Section 4.1 presents and comments on the main results of the estimates; Section 4.2 compares the estimates with those of WTTC and European Commission's DG GROW.

4.1 The estimation procedure's main findings

Table 1 shows the figures estimated through the proposed procedure for the 2019–2023 period and for each country-year pair. Values of the direct and total (direct + indirect + induced) tourism VA, in absolute values (million EUR, Table 1) and as a share to Gross Value Added (GVA, Table 2) are reported. Values of 2023 are also shown in maps (Figure 1), while disaggregated values for direct, indirect, and induced VA are reported in the Appendix (Table A1).

The estimates capture the drop in value added generated by the tourism sector in 2020, due to the COVID-19 crisis, and the gradual increase in the following years. In 2023, the direct value added generated by tourism generally overpassed the 2019 values, finally bringing the COVID-19 impact to an end. On average, nominal figures of tourism direct value added in 2023 were about 21% higher than in 2019, which means almost a balance in real terms, as inflation was on aggregate around 22% over the whole period. In absolute numbers, the country with the lowest tourism direct value added in 2023 was Estonia (EUR 1,124 million), while the highest figure was for Germany (EUR 179,060 million). In terms of share of gross value added, the direct tourism contribution in 2023 ranged from 1.8% of GVA in Romania to 12% in Croatia (Table 2). This procedure also allowed to estimate the economic impact that COVID-19 had on the direct value added generated by tourism (Table A1 in the Appendix). Value added in 2020 was as low as 34% of its 2019 figure in Hungary and as high as 67% in Norway (values are around 60% for all Nordic EU countries), averaging around 52% in the sample under investigation.

When merging TSA values with I-O tables to include the indirect and induced value added generated by tourism, the share to GVA typically more than doubles: focusing on 2023, it can be noted that the total VA share of tourism ranged from 5.6% (Czechia) to 33.3% (Croatia). Shares of total tourism VA were over 25% also for Spain and Portugal (Table 2, Figure 1).

The estimation of total value added generated by tourism also allowed to compute ratio and income multipliers, of both type I and type II (Figure 2 and Table A.2 in the Appendix), providing answers to questions such as: 'How much total value added is generated from 1 Euro of direct value added?' or 'How much income is generated by 1 Euro spent by tourists?'. Type I multipliers consider the indirect economic impact only, while type II multipliers consider both indirect and induced impact into the analysis. Coherently with the specific literature, the type I ratio multiplier

Table 1. Direct and total value added in the tourism sector, in million EUR (current prices).

Country	2019	2020	2021	2022	2023
Direct VA in tourism					
Austria	19,431	12,589	11,138	20,011	23,686
Belgium[a]	6,422	3,247	4,942	7,559	7,942
Croatia	6,080	2,799	4,875	6,852	7,627
Czechia	4,706	2,503	2,608	4,954	6,223
Denmark	8,285	5,313	6,539	10,176	10,779
Estonia	995	409	433	926	1,124
Finland	6,507	3,988	4,948	6,740	7,748
France	96,314	54,681	70,199	104,957	113,906
Germany	151,056	92,899	98,048	157,586	179,060
Hungary	3,905	1,342	1,764	4,074	5,204
Italy	88,868	43,690	61,256	93,040	106,267
Latvia[b]	430	169	101	287	381
Lithuania	1,628	770	896	1,682	1,959
Norway	6,629	4,482	5,318	7,539	8,173
Portugal	17,478	6,747	9,592	18,880	21,939
Romania	4,149	2,088	3,363	4,436	5,328
Slovakia	2,938	1,637	1,409	2,473	3,194
Slovenia	2,197	1,230	1,545	2,395	2,677
Spain	94,262	36,470	66,864	117,742	129,512
Sweden	11,411	6,749	8,793	12,503	13,588
Total VA in tourism					
Austria	44,455	28,901	25,626	45,838	54,196
Belgium[a]	16,575	8,609	13,207	19,663	20,549
Croatia	16,820	7,786	13,523	18,972	21,121
Czechia	11,802	6,202	6,451	12,355	15,565
Denmark	18,436	11,891	14,635	22,665	23,988
Estonia	2,213	903	954	2,054	2,496
Finland	17,360	10,510	12,992	17,863	20,631
France	237,337	133,482	171,355	258,163	280,610
Germany	406,270	249,197	262,957	423,349	481,306
Hungary	9,013	3,096	4,069	9,402	12,011
Italy	256,765	126,978	177,747	268,965	306,855
Latvia[b]	1,283	503	299	856	1,136
Lithuania	3,450	1,641	1,910	3,574	4,162
Norway	14,929	10,269	12,205	17,069	18,454
Portugal	52,140	20,109	28,592	56,318	65,450
Romania	13,409	6,816	10,963	14,390	17,260
Slovakia	6,897	3,850	3,318	5,811	7,503
Slovenia	4,721	2,733	3,412	5,181	5,754
Spain	259,255	103,073	188,789	329,542	362,026
Sweden	29,408	17,422	22,695	32,234	35,022

[a]Belgium figures are only related to the Brussels region, not to the whole country.
[b]Latvia estimates are computed by only using values for inbound tourism, as domestic tourism does not appear in Latvia's TSA.

is defined as the ratio between the direct and indirect economic impact over the direct impact only. Similarly, the type II ratio multiplier is the ratio between the total economic impact (including direct, indirect, and induced effects) over the direct impact. The income multipliers, on the contrary, are determined by the ratios between the total economic impact and the original tourism consumption. Hence, the income multiplier of type I is the ratio between the direct + indirect value added generated and the original tourism consumption, while the income multiplier of type II is the ratio between the direct + indirect + induced value added generated and the original tourism consumption.

Type-I and II multipliers can be interpreted, following the view of Armstrong and Taylor (2000) and others, as the two computable extremes of a fork and they represent the minimum and maximum possible impacts of an initial event. It is important to note that, among the several applications of the multiplier concept (to output, employment, etc.) we only consider income multipliers throughout the paper.

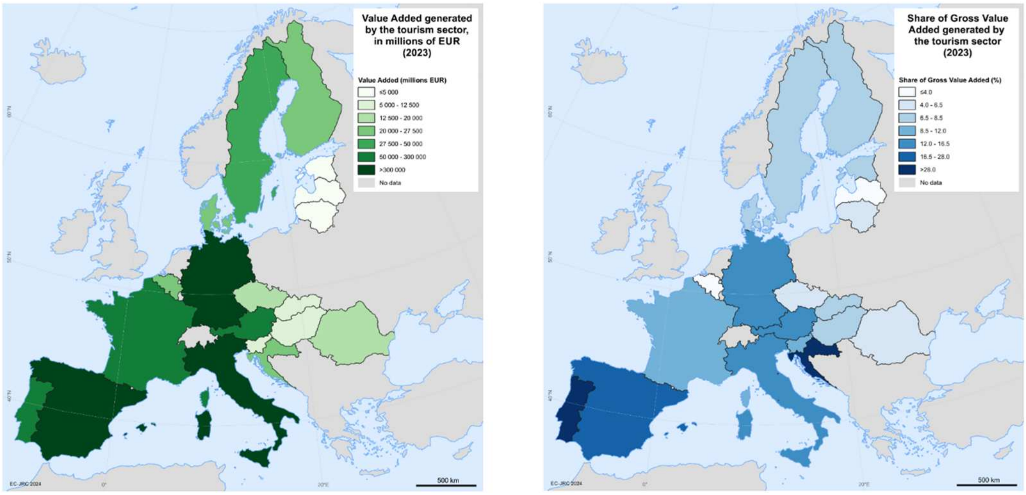

Figure 1. Maps of total value added generated in the tourism sector, in absolute values (left), and as share of Gross Value Added (right).

The values of the type I ratio multiplier (excluding Latvia because of the lack of domestic tourism data) range from 1.29 (Lithuania, 2019) to 1.84 (Belgium 2021, Romania 2020, 2021), with an average of 1.61. The values of the type II ratio multiplier range from 2.12 (Lithuania, 2019) to 3.25 (Romania 2020, 2021), with an average of 2.56. As a result, the value added generated by tourism more than doubles the direct contribution when considering indirect and induced effects.

In terms of income multipliers, every Euro of tourism consumption generated 1.16 Euro of income on average, after indirect and induced effects are considered. However, there is wide variability in this indicator, as the value of the type II income multiplier goes from 0.76 (Norway, 2019 and 2023) to 1.63 (Spain, 2019). It is important to note that the value of the income multiplier shows a very polarised distribution: the most important tourism destinations show very high income multipliers (Spain (>1.60), France (>1.30), Croatia (1.36), Italy (1.56), Portugal (1.59)), very few countries present values between 1.1 and 1.3 (Austria, 1.19, Germany 1.23), while many countries have a net deficit when comparing the tourism monetary input and the income output (Belgium, around 0.88; Czechia, around 0.98; Denmark, around 0.99; Estonia, 0.93; Hungary, 0.99; Slovenia, 0.99). Such a difference probably stems from the different proportion of imports, or the intensity of labour use. A potential explanation could be that some countries, such as Italy, France or Spain, are characterised by the consumption of goods (e.g. typical food or other local products), that have more local linkages and generate greater indirect effects, especially if those products are labour-intensive, compared to Northern Europe, where the tourism industry might be more dependent on the imports and, hence, generate lower indirect effects. To better support this hypothesis, further insights into the data would be needed.

4.2 Comparing estimates with official TSA figures, WTTC and the tourism ecosystem approach

A first comparison is made between the estimates presented in Section 4.1, those produced by NSOs, DG GROW (Tourism Industrial Ecosystem approach) and WTTC for 2019 (Figure 3 and Table A3 in the Appendix) and, when available, for subsequent years (Figure 4 and Table A3 in the Appendix). In general, the estimation procedure returned values like those computed in official TSA tables or in National Statistical Offices (NSOs) datasets. On average, the estimates were only 6% higher than the TSA ones in terms of absolute values, and 1% higher in terms of GVA share. However, the

Table 2. Share of direct and total Value Added in the Tourism sector over Gross Value Added.

Country	2019	2020	2021	2022	2023
Share of direct tourism VA over GVA					
Austria	5.5%	3.7%	3.1%	5.0%	5.5%
Belgium[a]	1.5%	0.8%	1.1%	1.5%	1.5%
Croatia	13.3%	6.6%	10.1%	12.0%	12.0%
Czechia	2.3%	1.3%	1.2%	2.0%	2.2%
Denmark	3.1%	2.0%	2.2%	3.0%	3.3%
Estonia	4.1%	1.7%	1.6%	2.9%	3.4%
Finland	3.1%	1.9%	2.3%	2.9%	3.2%
France	4.4%	2.6%	3.2%	4.5%	4.5%
Germany	4.8%	3.0%	3.0%	4.5%	4.8%
Hungary	3.2%	1.2%	1.4%	2.8%	3.1%
Italy	5.5%	2.9%	3.7%	5.3%	5.7%
Latvia[b]	1.6%	0.6%	0.4%	0.8%	1.1%
Lithuania	3.7%	1.7%	1.8%	2.7%	3.0%
Norway	2.0%	1.6%	1.4%	1.4%	2.0%
Portugal	9.4%	3.9%	5.1%	9.0%	9.5%
Romania	2.1%	1.0%	1.5%	1.7%	1.8%
Slovakia	3.5%	2.0%	1.6%	2.5%	2.9%
Slovenia	5.2%	3.0%	3.4%	4.8%	4.8%
Spain	8.3%	3.6%	6.1%	9.6%	9.7%
Sweden	2.7%	1.6%	1.8%	2.5%	2.8%
Share of total tourism VA over GVA					
Austria	12.5%	8.5%	7.1%	11.4%	12.6%
Belgium[a]	3.9%	2.1%	2.9%	4.0%	3.9%
Croatia	36.7%	18.5%	28.0%	33.3%	33.3%
Czechia	5.8%	3.2%	3.0%	4.9%	5.6%
Denmark	6.8%	4.4%	4.9%	6.8%	7.2%
Estonia	9.1%	3.8%	3.5%	6.5%	7.5%
Finland	8.4%	5.1%	6.0%	7.7%	8.5%
France	10.9%	6.5%	7.7%	10.9%	11.2%
Germany	13.0%	8.1%	8.0%	12.1%	12.8%
Hungary	7.3%	2.7%	3.1%	6.6%	7.1%
Italy	15.9%	8.5%	10.9%	15.4%	16.4%
Latvia[b]	4.8%	1.9%	1.0%	2.5%	3.2%
Lithuania	7.8%	3.7%	3.8%	5.8%	6.4%
Norway	4.6%	3.6%	3.1%	3.3%	4.6%
Portugal	28.1%	11.5%	15.3%	26.8%	28.3%
Romania	6.6%	3.4%	5.0%	5.5%	5.9%
Slovakia	8.2%	4.6%	3.7%	5.9%	6.7%
Slovenia	11.1%	6.6%	7.4%	10.3%	10.3%
Spain	23.0%	10.1%	17.1%	26.9%	27.2%
Sweden	6.9%	4.1%	4.7%	6.4%	7.1%

[a]Belgium figures are only related to the Brussels region, not to the whole country.
[b]Latvia estimates are computed by only using values for inbound tourism, as domestic tourism does not appear in Latvia's TSA.

procedure systematically overestimated the official one in some countries, underestimated in others, while for some countries there was a difference across the years. This result highlights that our procedure is not systematically biased and indicates that individual countries avail of more precise information about the internal structure of tourism, likely tackling measurement issues in idiosyncratic ways. For example, as remarked in Figini et al. (2022), some countries do not estimate the other components of tourism consumption (TSA Table 4.2), while others have specific estimation procedures to compute the share of tourism consumption in non-characteristic tourism sectors, which could make a difference overall.

The second comparison is carried out between the estimates of the proposed methodology of direct impact with those from the WTTC and the tourism industrial ecosystem, in which the economic impact of tourism is estimated without using TSA, but only considering supply-side information coming from SNA structural and short-term business statistics and I-O tables (Figure 3, Table A4 and A5 in the Appendix).

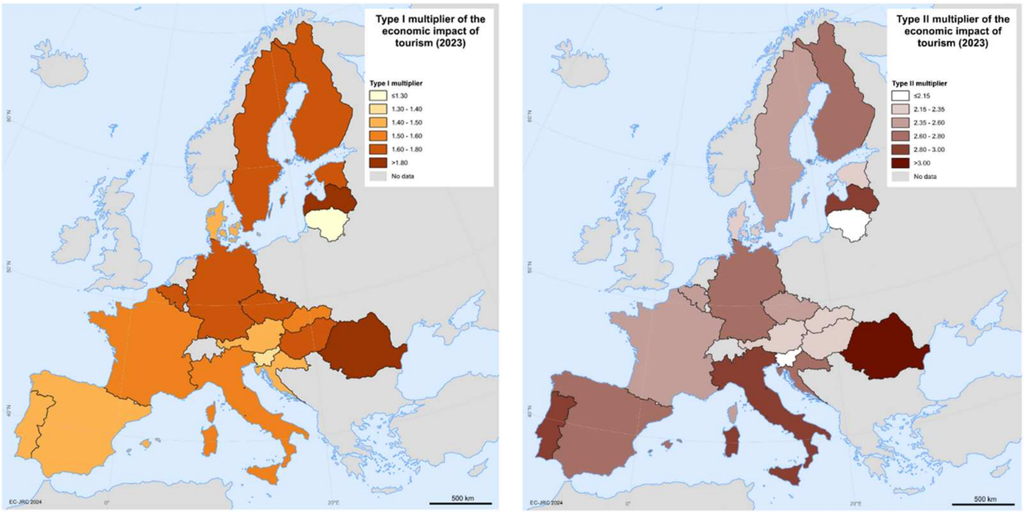

Figure 2. Maps of type I (left) and type II (right) ratio multipliers of the economic impact of tourism.

On average, the Tourism Industrial Ecosystem approach returns figures that are slightly higher than the ones of the proposed method for several countries (Austria, France, Slovakia, Hungary, Finland, Denmark, Sweden, Czechia, Romania) but significantly lower for the four most important countries according to the tourism contribution to GVA (Croatia, Portugal, Spain, Italy). For these four countries, the Tourism Ecosystem estimations return values (for 2019) of 7.8%, 7%, 7.3%, 5%, of GVA for respectively Croatia, Portugal, Spain, Italy. For the same countries, the estimates of the proposed method (which are also closer to official TSA values) were, respectively, 13.3%, 9.4%, 8.3%, 5.5%. In 2023 (Table A.5 in the Appendix), the differences were slightly diminishing: Croatia (7.7% Tourism Ecosystem vs 12% of the estimates), Portugal (8.5% vs 9.4%), Spain (8.3% vs 9.7%), and Italy (5.5% vs 5.7%). The WTTC instead returns higher figures for few countries (Austria, Estonia, Sweden, Czechia, Romania, Latvia and Belgium), while lower for the majority (Croatia, Portugal, Spain, Italy, Slovenia, Germany, France, Lithuania, Slovakia, Hungary, Finland, Denmark), indicating no systematic bias.

Unsurprisingly, the gap between the four estimations approaches is also time and country dependent (Figure 4): specifically, the proposed procedure is too severe in counting the drop of tourism in 2020 and 2021 in Italy, Portugal and Sweden. This is the consequence of the assumption that

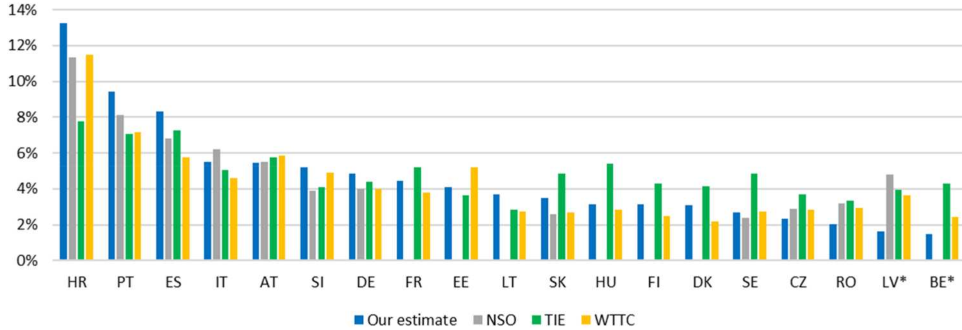

Figure 3. Share of direct value added generated by tourism in 2019: NSO = National Statistics Office, TIE = Tourism Industrial Ecosystem, WTTC = World Travel & Tourism Council. * = For Belgium and Latvia the estimates are based on partial information. They do not include regions outside Bruxelles for BE, and international tourists for LV.

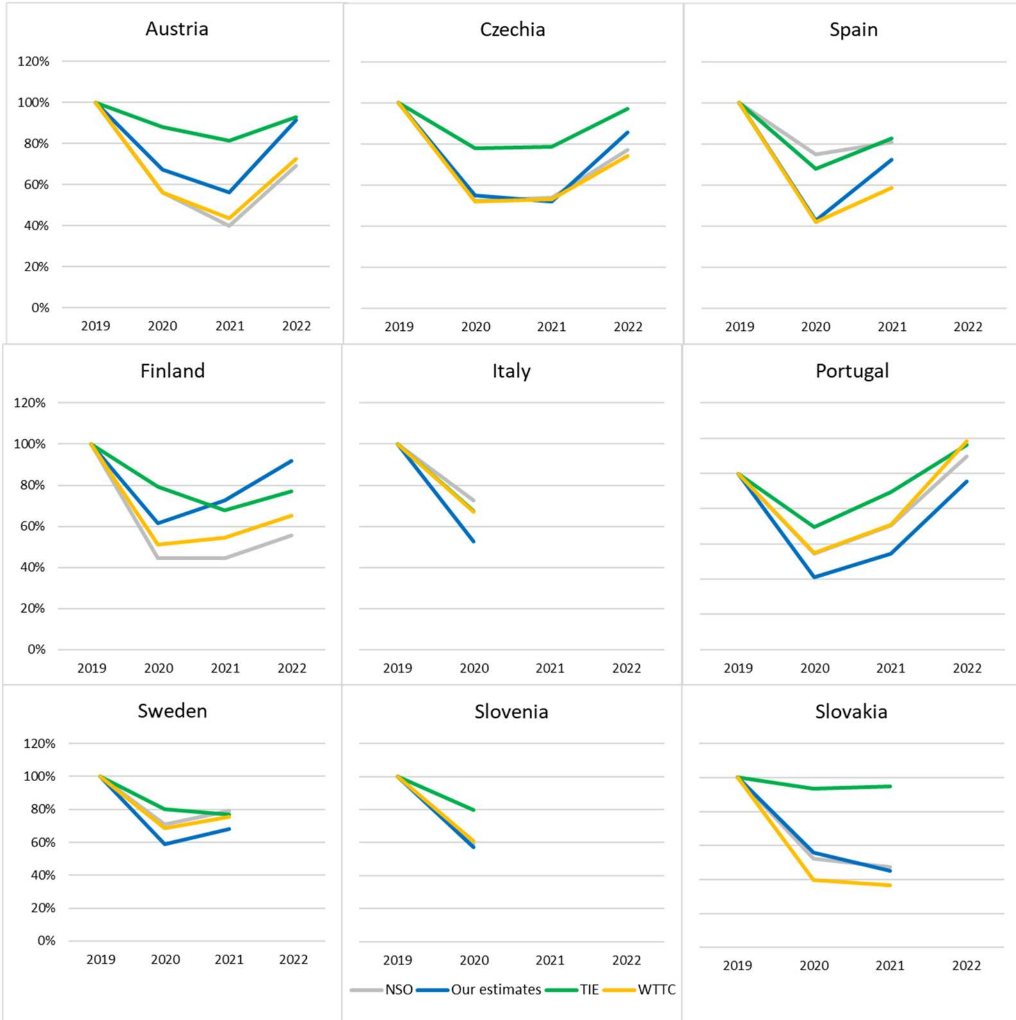

Figure 4. Direct value added generated in the tourism sector indexed to 2019. NSO = National Statistical Office, TIE = Tourism industrial ecosystem. Only countries for which at least two years were available in the NSOs website are shown in the figure.

expenditure pattern did not change, and that the number of total tourists followed the trend of the variation in official accommodation establishments. Individual countries had the possibility to resort to different ways to measure or estimate specific changes in the expenditure pattern in 2020 (and partially 2021). Other ad hoc refinements from individual NSOs might also explain the differences in results. In general, the proposed procedure was unable to discover the specificity of every country but, on the other hand, was consistent across countries, with benefits for international comparisons.

The estimates of the total value added generated by tourism (including indirect and induced effects) are then compared with the one generated by WTTC (Figure 5 and Table A6 in the Appendix). Given that the base of available data is rich and consistent for EU countries, it was expected that the WTTC procedure (partially explained in Oxford Economics, 2023) delivered estimates like those obtained in the proposed methodology. Indeed, the results of the two procedures are quite aligned, excluding the four countries with highest tourism's contribution (Croatia, Portugal, Spain, Italy), for which the estimates of the proposed methodology (the WTTC) tend to overestimate (underestimate) the total impact.

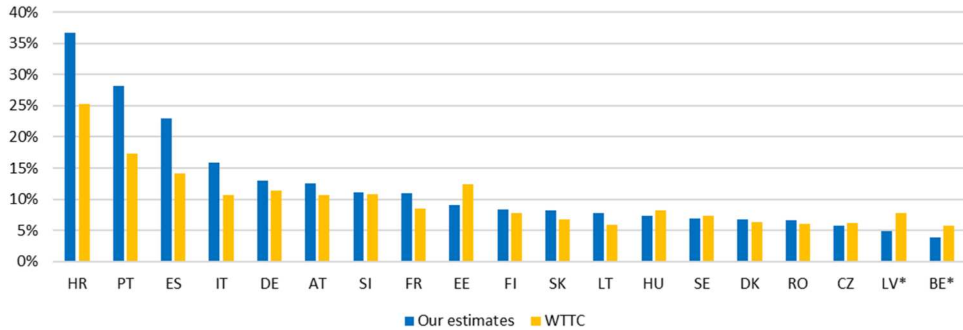

Figure 5. Share of total value added (in our estimates), and of GDP (in WTTC figures) generated in the tourism sector in 2019. WTTC data can be found on WTTC's research hub https://researchhub.wttc.org/.

While the methodology and the results presented herein only scratch the surface of the economic impacts of tourism, they also allow to highlight a few interesting remarks that will be worth investigating deeper in the near future: (i) in most country-year pairs, the estimates of our procedure showed a more relevant contribution of tourism, thereby suggesting that the WTTC uses some forms of downward adjustment; (ii) such downward adjustment is country-specific, as the countries for which the estimates were the most optimistic are the most important tourism destinations (in Spain, 2019, the share of total VA over GVA was 9 points higher than the WTTC estimate, in Croatia 11 points, in Italy 5 points, and in Portugal almost 11 points); (iii) for most of the other countries, the difference was in the range of 1–2 percentage points, which might be due to the fact that WTTC considers GDP, not VA figures in the ratio; (iv) the estimates overweighted the drop in tourism in 2020 and 2021 (except Czechia, Estonia, and Slovakia), suggesting that WTTC introduced some adjustment to tackle the tourism impact of the pandemic.

5. Discussion and conclusions

Tourism policymakers need timely, up-to-date and reliable information on the tourism industry, including the value of the economic impact generated by the sector. The international standard gathered by UN Tourism (formerly known an UNWTO), together with the system of national statistics offices, pivots around the Tourism Satellite Accounts (TSA), which have two main limitations: (i) they need consistent financial and human resources, and results are usually published with significant lags (2–3 years) after the end of the investigated period; (ii) they only include tourism's direct impact, thereby neglecting indirect and induced effects, which might be quite relevant to policymakers, experts, and stakeholders.

It is unsurprising that, in such a framework, several alternative methods have recently gained attention and entered the public discourse. Among the many, two sets of figures deserve attention: the estimate of total tourism and travel contribution to the GDP published by the WTTC, and the concept of Tourism Industrial Ecosystem, introduced by the European Commission's Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) to ascertain different indicators (including value added) generated by tourism. This paper contributes by presenting an umbrella procedure, built upon Figini et al. (2022) and Figini and Patuelli (2022) to generate yearly estimates of tourism direct and total value added for countries with a minimum set of recent TSA data and valid I-O table.

Focusing on the 19 EU Member States and 1 EFTA country (Norway) for which the minimum set of TSA and I-O data was available, it has been found that: (i) Many countries face data issues or have tackled measurement problems with ad-hoc solutions in their TSAs, meaning that some of the estimates presented here might not be fully reliable, particularly for Belgium and Latvia; (ii) Striking a balance between the precision of national estimates (ensured by the national TSA produced by the NSO) and the need for timely and internationally comparable figures (which would be achieved through this procedure, or international standards like those from the WTTC or the European Commission's Industrial Ecosystems approach), is challenging.

The set of results presented in this paper allows to highlight the following remarks: (a) there is too much heterogeneity in estimates produced by different approaches, and currently there is no assurance that a specific set of figures can estimate the 'correct' but unknown values; (b) when the estimates generated by the proposed methodology are compared with both the WTTC's values and the Tourism Industrial Ecosystem values, no evidence of a systematic bias was found, meaning that, apart from the general set of rules that are applied cross-sectionally, individual countries address specific problems linked to data issues or their economic structure with ad-hoc procedures; (c) at the current level of development, the procedure developed for this paper seems to systematically overestimate (with a few exceptions) the drop in tourism following the COVID-19 pandemic and related lockdowns. This is consistent with the theory for which the stable technical coefficients derived from the I-O tables do not correctly describe the structural change that tourism, and more in general the national economic systems, experienced during the pandemic; (d) both the WTTC estimates of the total value and the Tourism industrial ecosystem estimates of the direct value generated by tourism are more conservative than our estimates for those countries in which tourism is a relevant economic activity.

The procedure herein presented is far from complete, and a few refinements might improve its reliability and application. Specifically, while the focus is currently on value added, the employment impacts could be implemented in the procedure to compute the employment multipliers, given that the number of direct, indirect and induced jobs generated by tourism is a political relevant matter. Nevertheless, even in its current form, the procedure has the potential to offer a timely, up-to-date, and reliable routine that provides direct, indirect and induced impacts of tourism for a wide set of countries, covering every year. This would significantly enhance the availability of information on tourism's economic contribution and its fruitful use at the policy level.

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Author contributions

CRediT: **Paolo Figini:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft; **Roberto Patuelli:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft; **Riccardo Curtale:** Conceptualization, Project administration, Visualization, Writing – review & editing; **Filipe Batista e Silva:** Conceptualization, Project administration, Resources, Writing – review & editing.

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References

Armstrong, H., & Taylor, J. (2000). *Regional Economics and Policy*. https://revistas.um.es/areas/article/download/87201/83931/355731
Briassoulis, H. (1991). Methodological issues. Tourism input-output analysis. *Annals of Tourism Research*, *18*(3), 485–495. https://doi.org/10.1016/0160-7383(91)90054-F
Dwyer, L., Forsyth, P., & Dwyer, W. (2020). *Tourism economics and policy* (2nd ed.). Multilingual Matters & Channel view publications.
Dwyer, L., 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, L., Forsyth, P., & Spurr, R. (2007). Contrasting the uses of TSAs and CGE models: Measuring tourism yield and productivity. *Tourism Economics*, *13*(4), 537–551. https://doi.org/10.5367/000000007782696096
European Commission. (2021). *Annual Single Market Report* 2021. https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:52021SC0351
European Commission. (2022). *Transition pathway for tourism*. Publications Office of the European Union. https://op.europa.eu/en/publication-detail/-/publication/404a8144-8892-11ec-8c40-01aa75ed71a1/language-en
European Commission. (2023). *The EU Tourism Dashboard*. https://tourism-dashboard.ec.europa.eu/?lng = en&ctx = tourism
Eurostat. (2008). *NACE Rev. 2: Statistical classification of economic activities in the European Community*. Office for Official Publications of the European Communities.
Eurostat. (2009). *Tourism Satellite Accounts in the European Union - Volume 1*. https://ec.europa.eu/eurostat/web/products-statistical-working-papers/-/ks-ra-09-021
Eurostat. (2016). *Tourism Satellite Accounts in Europe 2016 Edition*. Publications Office of the European Union. https://doi.org/10.2785/666986
Eurostat. (2019). *Tourism satellite accounts in Europe 2019 Edition*. Publications Office of the European Union. https://doi.org/10.2785/78529
Eurostat. (2021). *Tourism Satellite Accounts in the European Union: Methodological manual on TSA*. Publications Office of the European Union.
Eurostat. (2023). *Tourism Satellite Accounts in Europe 2023 Edition*. Publications Office of the European Union. https://doi.org/10.2785/78529.
Figini, P., & Patuelli, R. (2022). Estimating the economic impact of tourism in the European union: Review and computation. *Journal of Travel Research*, *61*(6), 1409–1423. https://doi.org/10.1177/00472875211028322
Figini, P., Patuelli, R., Curtale, R., & Batista E Silva, F. (2022). *Socio-economic impacts of tourism in the European Union – A pilot estimation framework based on Tourism Satellite Accounts, EUR 31304 EN*. Publications Office of the European Union. https://doi.org/10.2760/633006
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. (1999). The tourism satellite account: Foundations, progress and issues. *Tourism Management*, *20*(1), 163–170. https://doi.org/10.1016/S0261-5177(98)00103-4
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. (2011). *Exploring the full economic impact of tourism for policy making: Extending the use of the tourism satellite account through macroeconomic analysis tools*.
Klijs, J., Heijman, W., Maris, D. K., & Bryon, J. (2012). Criteria for comparing economic impact models of tourism. *Tourism Economics*, *18*(6), 1175–1202. https://doi.org/10.5367/te.2012.0172
Libreros, M., Massieu, A., & Meis, S. (2006). Progress in tourism satellite account implementation and development. *Journal of Travel Research*, *45*(1), 83–91. https://doi.org/10.1177/0047287506289517
Oxford Economics. (2023, May). *Travel & tourism economic impact research methodology*.
Pham, T. D., & Dwyer, L. (2013). Tourism satellite accounts and their applications in CGE modelling. In Clement A. Tisdell (Ed.), *Handbook of tourism economics: Analysis, New applications and case studies* (pp. 493–521). World scientific. https://doi.org/10.1142/9789814327084_0022
Smeral, E. (2005). The economic impact of tourism: Beyond satellite accounts. *Tourism Analysis*, *10*(1), 55–64. https://doi.org/10.3727/1083542054547949

Smeral, E. (2006). Tourism satellite accounts: A critical assessment. *Journal of Travel Research*, *45*(1), 92–98. https://doi.org/10.1177/0047287506288887

Smith, S. L. J., & Wilton, D. (1997). Tsas and the WTTC/WEFA methodology: Different satellites or different planets? *Tourism Economics*, *3*(3), 249–263. https://doi.org/10.1177/135481669700300304

United Nations. (2010). Tourism satellite account: Recommended methodological framework 2008. In *Tourism satellite account: Recommended methodological framework 2008*. OECD. https://doi.org/10.1787/9789264274105-en

UNWTO. (2010). *TSA data around the world.* www.unwto.org

WTTC. (2025). *WTTC's research hub*. https://researchhub.wttc.org/

Appendix

A.1 Tourism industrial ecosystem

The Tourism industrial ecosystem is identified by the following economic activities, when looking at it under NACE Revision 2:

- H491 - Passenger rail transport, interurban
- H493 - Other passenger land transport
- H501 - Sea and coastal passenger water transport
- H503 - Inland passenger water transport
- H511 - Passenger air transport
- I55 - Accommodation
- I56 - Food and beverage service activities
- N79 - Travel agency, tour operator and other reservation service and related activities
- N82 - Office administrative, office support and other business support activities
- R90 - Creative, arts and entertainment activities
- R91 - Libraries, archives, museums and other cultural activities
- R92 - Gambling and betting activities
- R93 - Sports activities and amusement and recreation activities

On top of that, several economic activities are horizontal in nature and contribute to the well-functioning of all industrial ecosystems. To take into account their contribution, these economic activities have been distributed across ecosystems using I-O tables, thereby allowing to calculate how much each horizontal activity is used by the rest of the industrial ecosystems (see European Commission, 2021, Annex 4 for the full explanation of the weighting formula. Those activities, which contribution is calculated for each year, country and indicator, are listed below:

- C25 - Manufacture of fabricated metal products, except machinery and equipment;
- C28 - Manufacture of machinery and equipment n.e.c.;
- C33 - Repair and installation of machinery and equipment;
- E36 - Water collection, treatment and supply;
- E37 - Sewerage;
- E38 - Waste collection, treatment and disposal activities; materials recovery;
- E39 - Remediation activities and other waste management services;
- M69 - Legal and accounting activities;
- M70 - Activities of head offices; management consultancy activities;
- M71 - Architectural and engineering activities; technical testing and analysis;
- M72 - Scientific research and development,
- N77 - Rental and leasing activities;
- N78 - Employment activities.

It should be noted that the list of "horizontal" economic activities does not include financial and insurance services, which are of importance for industrial ecosystems, but was opted for exclusion as the methodology aims to focus only on the industrial components of the industrial ecosystems. For a full description of the ecosystem procedure, see European Commission (2021; 2022b).

A.2 Additional tables

Table A1. Direct and Total VA generated by tourism (Million EUR) and share of Gross Value Added

Country	Year	Value Added in Tourism			Share of VA in Tourism over Gross Value Added		
		Direct	Direct and Indirect	Total	Direct	Direct and Indirect	Total
AT	2019	19431	28561	44455	5.47%	8.05%	12.53%
AT	2020	12589	18568	28901	3.68%	5.43%	8.45%
AT	2021	11138	16465	25626	3.07%	4.54%	7.07%
AT	2022	20011	29449	45838	4.99%	7.35%	11.44%
AT	2023	23686	34820	54196	5.52%	8.12%	12.63%
*BE**	*2019*	6422	11431	16575	1.50%	2.67%	3.88%
*BE**	*2020*	3247	5937	8609	0.78%	1.44%	2.08%
*BE**	*2021*	4942	9108	13207	1.09%	2.01%	2.92%
*BE**	*2022*	7559	13560	19663	1.52%	2.73%	3.96%
*BE**	*2023*	7942	14172	20549	1.51%	2.70%	3.92%
CZ	2019	4706	8329	11802	2.31%	4.09%	5.79%
CZ	2020	2503	4377	6202	1.27%	2.23%	3.16%
CZ	2021	2608	4553	6451	1.20%	2.10%	2.98%
CZ	2022	4954	8719	12355	1.98%	3.48%	4.93%
CZ	2023	6223	10984	15565	2.22%	3.92%	5.55%
DE	2019	151056	259808	406270	4.83%	8.30%	12.98%
DE	2020	92899	159360	249197	3.01%	5.16%	8.07%
DE	2021	98048	168160	262957	2.99%	5.13%	8.03%
DE	2022	157586	270729	423349	4.49%	7.71%	12.06%
DE	2023	179060	307793	481306	4.75%	8.17%	12.78%
DK	2019	8285	12744	18436	3.07%	4.73%	6.84%
DK	2020	5313	8219	11891	1.96%	3.04%	4.40%
DK	2021	6539	10117	14635	2.19%	3.39%	4.90%
DK	2022	10176	15667	22665	3.03%	4.67%	6.76%
DK	2023	10779	15950	23988	3.25%	4.80%	7.22%
EE	2019	995	1601	2213	4.09%	6.59%	9.10%
EE	2020	409	653	903	1.70%	2.71%	3.75%
EE	2021	433	690	954	1.58%	2.53%	3.49%
EE	2022	926	1486	2054	2.91%	4.67%	6.46%
EE	2023	1124	1806	2496	3.38%	5.43%	7.50%
ES	2019	94262	138193	259255	8.34%	12.23%	22.95%
ES	2020	36470	54942	103073	3.57%	5.38%	10.09%
ES	2021	66864	100632	188789	6.05%	9.10%	17.07%
ES	2022	117742	175659	329542	9.61%	14.33%	26.89%
ES	2023	129512	192973	362026	9.72%	14.48%	27.17%
FI	2019	6507	11289	17360	3.14%	5.45%	8.37%
FI	2020	3988	6834	10510	1.93%	3.31%	5.10%
FI	2021	4948	8448	12992	2.28%	3.88%	5.97%
FI	2022	6740	11615	17863	2.88%	4.97%	7.65%
FI	2023	7748	13416	20631	3.19%	5.53%	8.50%
FR	2019	96314	145756	237337	4.44%	6.72%	10.94%
FR	2020	54681	81976	133482	2.64%	3.96%	6.45%
FR	2021	70199	105235	171355	3.17%	4.75%	7.73%
FR	2022	104957	158546	258163	4.45%	6.71%	10.93%
FR	2023	113906	172331	280610	4.52%	6.85%	11.15%
HR	2019	6080	9046	16820	13.27%	19.74%	36.70%
HR	2020	2799	4187	7786	6.64%	9.93%	18.46%
HR	2021	4875	7273	13523	10.09%	15.05%	27.98%
HR	2022	6852	10204	18972	12.01%	17.89%	33.26%
HR	2023	7627	11360	21121	12.02%	17.91%	33.29%
HU	2019	3905	6276	9013	3.15%	5.07%	7.28%
HU	2020	1342	2156	3096	1.15%	1.85%	2.66%
HU	2021	1764	2833	4069	1.35%	2.17%	3.12%
HU	2022	4074	6547	9402	2.84%	4.56%	6.55%

HU	2023	5204	8364	12011	3.06%	4.91%	7.06%
IT	2019	88868	136603	256765	5.52%	8.48%	15.93%
IT	2020	43690	67554	126978	2.91%	4.50%	8.45%
IT	2021	61256	94564	177747	3.74%	5.78%	10.86%
IT	2022	93040	143094	268965	5.31%	8.17%	15.36%
IT	2023	106267	163251	306855	5.66%	8.70%	16.35%
LT	2019	1628	2096	3450	3.70%	4.76%	7.84%
LT	2020	770	997	1641	1.72%	2.23%	3.67%
LT	2021	896	1161	1910	1.77%	2.30%	3.78%
LT	2022	1682	2171	3574	2.74%	3.54%	5.83%
LT	2023	1959	2528	4162	3.01%	3.89%	6.40%
*LV***	*2019*	430	814	1283	1.62%	3.06%	4.82%
*LV***	*2020*	169	319	503	0.64%	1.21%	1.91%
*LV***	*2021*	101	190	299	0.35%	0.65%	1.03%
*LV***	*2022*	287	542	856	0.84%	1.58%	2.50%
*LV***	*2023*	381	722	1136	1.07%	2.03%	3.20%
NO	2019	6629	11379	14929	2.04%	3.50%	4.60%
NO	2020	4482	7828	10269	1.55%	2.71%	3.55%
NO	2021	5318	9303	12205	1.37%	2.39%	3.14%
NO	2022	7539	13010	17069	1.44%	2.48%	3.26%
NO	2023	8173	14067	18454	2.02%	3.48%	4.56%
PT	2019	17478	26171	52140	9.42%	14.11%	28.10%
PT	2020	6747	10094	20109	3.86%	5.78%	11.51%
PT	2021	9592	14351	28592	5.13%	7.67%	15.28%
PT	2022	18880	28268	56318	9.00%	13.47%	26.84%
PT	2023	21939	32851	65450	9.47%	14.18%	28.25%
RO	2019	4149	7567	13409	2.05%	3.73%	6.61%
RO	2020	2088	3846	6816	1.04%	1.92%	3.41%
RO	2021	3363	6186	10963	1.54%	2.83%	5.02%
RO	2022	4436	8120	14390	1.70%	3.11%	5.52%
RO	2023	5328	9740	17260	1.81%	3.30%	5.85%
SE	2019	11411	19935	29408	2.69%	4.71%	6.94%
SE	2020	6749	11810	17422	1.58%	2.77%	4.08%
SE	2021	8793	15384	22695	1.83%	3.20%	4.73%
SE	2022	12503	21850	32234	2.49%	4.36%	6.43%
SE	2023	13588	23740	35022	2.76%	4.83%	7.12%
SI	2019	2197	3057	4721	5.19%	7.21%	11.14%
SI	2020	1230	1770	2733	2.96%	4.26%	6.58%
SI	2021	1545	2209	3412	3.37%	4.81%	7.43%
SI	2022	2395	3355	5181	4.77%	6.68%	10.32%
SI	2023	2677	3726	5754	4.78%	6.65%	10.27%
SK	2019	2938	4536	6897	3.48%	5.37%	8.17%
SK	2020	1637	2532	3850	1.95%	3.02%	4.60%
SK	2021	1409	2183	3318	1.57%	2.44%	3.71%
SK	2022	2473	3822	5811	2.53%	3.91%	5.94%
SK	2023	3194	4935	7503	2.85%	4.41%	6.70%

Notes: Countries are listed alphabetically according to their official two-digit code: AT=Austria, BE=Belgium, CZ= Czech Republic; DE=Germany, DK=Denmark, EE=Estonia, ES=Spain, FI=Finland, FR=France, HR=Croatia, HU=Hungary, IT=Italy, LT=Lithuania, LV=Latvia, NO=Norway, PT=Portugal, RO=Romania, SE=Sweden, SI=Slovenia, SK=Slovakia. Absolut values are expressed in Million EUR (current prices). The values of Tourism VA are estimated through the procedure described in Section 3. Shares are computed over the values of Gross Value Added available in ARDECO. All figures are in current values. * Belgium figures are only related to the Brussels region, not to the whole country. ** Latvia estimates are computed by only using values for inbound tourism, as domestic tourism does not appear in its TSA.

Table A2. Ratio and income multipliers, type I and II

Country	Year	Ratio multipier I	Ratio multipier II	Income multipier I	Income multipier II
AT	2019	1.470	2.288	0.768	1.196
AT	2020	1.475	2.296	0.765	1.191
AT	2021	1.478	2.301	0.763	1.188
AT	2022	1.472	2.291	0.767	1.194
AT	2023	1.470	2.288	0.768	1.196
BE	2019	1.780	2.581	0.611	0.886
BE	2020	1.829	2.652	0.599	0.869
BE	2021	1.843	2.673	0.596	0.864
BE	2022	1.794	2.601	0.607	0.881
BE	2023	1.784	2.587	0.610	0.884
CZ	2019	1.770	2.508	0.694	0.983
CZ	2020	1.749	2.478	0.708	1.003
CZ	2021	1.746	2.474	0.709	1.005
CZ	2022	1.760	2.494	0.700	0.992
CZ	2023	1.765	2.501	0.697	0.987
DE	2019	1.720	2.690	0.788	1.233
DE	2020	1.715	2.682	0.792	1.238
DE	2021	1.715	2.682	0.792	1.239
DE	2022	1.718	2.686	0.790	1.235
DE	2023	1.719	2.688	0.789	1.234
DK	2019	1.538	2.225	0.695	1.005
DK	2020	1.547	2.238	0.678	0.981
DK	2021	1.547	2.238	0.678	0.981
DK	2022	1.540	2.227	0.692	1.001
DK	2023	1.480	2.225	0.668	1.005
EE	2019	1.610	2.225	0.679	0.938
EE	2020	1.598	2.210	0.669	0.925
EE	2021	1.596	2.205	0.666	0.920
EE	2022	1.605	2.218	0.674	0.931
EE	2023	1.606	2.221	0.675	0.934
ES	2019	1.466	2.750	0.871	1.635
ES	2020	1.507	2.826	0.857	1.608
ES	2021	1.505	2.823	0.858	1.609
ES	2022	1.492	2.799	0.863	1.618
ES	2023	1.490	2.795	0.863	1.620
FI	2019	1.735	2.668	0.694	1.068
FI	2020	1.714	2.635	0.704	1.082
FI	2021	1.707	2.626	0.707	1.087
FI	2022	1.723	2.650	0.699	1.076
FI	2023	1.731	2.663	0.696	1.071
FR	2019	1.513	2.464	0.804	1.308
FR	2020	1.499	2.441	0.806	1.313
FR	2021	1.499	2.441	0.806	1.313
FR	2022	1.511	2.460	0.804	1.309
FR	2023	1.513	2.464	0.804	1.308
HR	2019	1.488	2.766	0.731	1.359
HR	2020	1.496	2.781	0.728	1.353
HR	2021	1.492	2.774	0.729	1.356
HR	2022	1.489	2.769	0.731	1.358
HR	2023	1.489	2.769	0.731	1.358
HU	2019	1.607	2.308	0.687	0.987
HU	2020	1.606	2.307	0.687	0.987
HU	2021	1.607	2.307	0.687	0.987
HU	2022	1.607	2.308	0.687	0.987
HU	2023	1.607	2.308	0.687	0.987
IT	2019	1.537	2.889	0.833	1.566

IT	2020	1.546	2.906	0.831	1.562
IT	2021	1.544	2.902	0.831	1.563
IT	2022	1.538	2.891	0.833	1.565
IT	2023	1.536	2.888	0.833	1.566
LT	2019	1.288	2.120	0.832	1.369
LT	2020	1.294	2.130	0.815	1.342
LT	2021	1.295	2.131	0.814	1.340
LT	2022	1.291	2.125	0.822	1.354
LT	2023	1.290	2.124	0.825	1.358
*LV**	*2019*	*1.893*	*2.982*	*0.625*	*0.984*
*LV**	*2020*	*1.890*	*2.977*	*0.625*	*0.985*
*LV**	*2021*	*1.882*	*2.965*	*0.626*	*0.985*
*LV**	*2022*	*1.890*	*2.981*	*0.625*	*0.986*
*LV**	*2023*	*1.892*	*2.978*	*0.625*	*0.984*
NO	2019	1.717	2.252	0.577	0.757
NO	2020	1.746	2.291	0.575	0.754
NO	2021	1.749	2.295	0.574	0.754
NO	2022	1.726	2.264	0.576	0.756
NO	2023	1.721	2.258	0.577	0.756
PT	2019	1.497	2.983	0.795	1.585
PT	2020	1.496	2.981	0.800	1.594
PT	2021	1.496	2.981	0.800	1.593
PT	2022	1.497	2.983	0.796	1.585
PT	2023	1.497	2.983	0.795	1.584
RO	2019	1.824	3.232	0.619	1.097
RO	2020	1.842	3.264	0.620	1.099
RO	2021	1.839	3.260	0.620	1.099
RO	2022	1.831	3.244	0.619	1.098
RO	2023	1.828	3.239	0.619	1.097
SE	2019	1.747	2.577	0.709	1.046
SE	2020	1.750	2.582	0.703	1.037
SE	2021	1.750	2.581	0.704	1.038
SE	2022	1.748	2.578	0.708	1.044
SE	2023	1.747	2.577	0.708	1.045
SI	2019	1.391	2.149	0.637	0.984
SI	2020	1.439	2.221	0.630	0.972
SI	2021	1.430	2.209	0.631	0.974
SI	2022	1.401	2.163	0.636	0.982
SI	2023	1.392	2.149	0.637	0.984
SK	2019	1.544	2.348	0.772	1.174
SK	2020	1.547	2.353	0.771	1.172
SK	2021	1.549	2.355	0.771	1.171
SK	2022	1.546	2.350	0.772	1.173
SK	2023	1.545	2.349	0.772	1.174

Table A3. Direct VA generated by tourism (absolute values in Million EUR and GVA share): a comparison with official estimates

Country	Year	Direct tourism VA		Direct Tourism VA share over GVA		Difference (in percentage points) between the two approaches
		Our estimate	Official TSA	Our estimate	Official TSA	
AT	2019	19431	21895	5.47%	5.50%	-0.03%
AT	2020	12589	11711	3.68%	3.10%	0.58%
AT	2021	11138	8858	3.07%	2.20%	0.87%
AT	2022	20011	16992	4.99%	3.80%	1.19%
BE	2019	6422	-	1.50%	-	-
BE	2020	3247	-	0.78%	-	-
BE	2021	4942	-	1.09%	-	-
BE	2022	7559	9500	1.52%	2.60%	-1.08%
CZ	2019	4706	5639	2.31%	2.87%	-0.56%
CZ	2020	2503	2900	1.27%	1.50%	-0.23%
CZ	2021	2608	3307	1.20%	1.55%	-0.35%
CZ	2022	4954	5468	1.98%	2.22%	-0.24%
DE	2019	151056	123833	4.83%	3.99%	0.84%
DE	2020	92899	-	3.01%	-	-
DE	2021	98048	-	2.99%	-	-
DE	2022	157586	-	4.49%	-	-
DK	2019	8285	-	3.07%	-	-
DK	2020	5313	-	1.96%	-	-
DK	2021	6539	-	2.19%	-	-
DK	2022	10176	6129	3.03%	1.80%	1.23%
EE	2019	995	-	4.09%	-	-
EE	2020	409	-	1.70%	-	-
EE	2021	433	-	1.58%	-	-
EE	2022	926	-	2.91%	-	-
ES	2019	94262	77663	8.34%	6.80%	1.54%
ES	2020	36470	54278	3.57%	5.10%	-1.53%
ES	2021	66864	64490	6.05%	5.50%	0.55%
ES	2022	117742	-	9.61%	-	-
*FI**	*2019*	6507	5659	3.14%	2.70%	0.44%
*FI**	*2020*	3988	2937	1.93%	1.20%	0.73%
*FI**	*2021*	4948	3279	2.28%	1.20%	1.08%
*FI**	*2022*	6740	4125	2.88%	1.50%	1.38%
FR	2019	96314	-	4.44%	-	-
FR	2020	54681	-	2.64%	-	-
FR	2021	70199	-	3.17%	-	-
FR	2022	104957	-	4.45%	-	-
HR	2019	6080	5191	13.27%	11.35%	1.92%
HR	2020	2799	-	6.64%	-	-
HR	2021	4875	-	10.09%	-	-
HR	2022	6852	-	12.01%	-	-
HU	2019	3905	-	3.15%	-	-
HU	2020	1342	-	1.15%	-	-
HU	2021	1764	-	1.35%	-	-
HU	2022	4074	10872	2.84%	6.20%	-3.36%
IT	2019	88868	99903	5.52%	6.20%	-0.68%
IT	2020	43690	67600	2.91%	4.50%	-1.59%
IT	2021	61256	-	3.74%	-	-
IT	2022	93040	-	5.31%	-	-
LT	2019	1628	1295	3.70%	-	-
LT	2020	770	740	1.72%	-	-
LT	2021	896	904	1.77%	-	-
LT	2022	1682	1349	2.74%	-	-
*LV***	2019	430	-	1.62%	4.80%	-3.18%
*LV***	2020	169	-	0.64%	3.50%	-2.86%
*LV***	2021	101		0.35%	2.60%	-2.25%
*LV***	2022	287	-	0.84%	-	-
NO	2019	6629	13003	2.04%	-	-
NO	2020	4482	8475	1.55%	-	-
NO	2021	5318	9771	1.37%	-	-
NO	2022	7539	-	1.44%	-	-
PT	2019	17478	15092	9.42%	8.10%	1.32%
PT	2020	6747	7708	3.86%	4.40%	-0.54%
PT	2021	9592	10601	5.13%	5.70%	-0.57%
PT	2022	18880	18308	9.00%	8.90%	0.10%
RO	2019	4149	6412	2.05%	3.20%	-1.15%

RO	2020	2088	-	1.04%	-	-
RO	2021	3363	-	1.54%	-	-
RO	2022	4436	-	1.70%	-	-
SE	2019	11411	8390	2.69%	2.40%	0.29%
SE	2020	6749	5541	1.58%	1.70%	-0.12%
SE	2021	8793	7161	1.83%	1.90%	-0.07%
SE	2022	12503	-	2.49%	-	-
SI	2019	2197	1632	5.19%	3.90%	1.29%
SI	2020	1230	952	2.96%	2.30%	0.66%
SI	2021	1545	-	3.37%	-	-
SI	2022	2395	-	4.77%	-	-
SK	2019	2938	2123	3.48%	2.60%	0.88%
SK	2020	1637	1095	1.95%	1.36%	0.59%
SK	2021	1409	1076	1.57%	1.23%	0.34%
SK	2022	2473	-	2.53%	-	-

Notes: Absolut values are expressed in Million EUR (current prices), *: In our estimates, the TSA values refer to GDP, not GVA; ** The TSA values are likely to also include the effect of domestic tourism, which is not available in our dataset, “-“ indicates not available data

Table A4. Direct VA and GDP generated by tourism (absolute values in Million EUR and share of total GVA and GDP): comparison of our estimates and WTTC. WTTC data can be found on WTTC's research hub https://researchhub.wttc.org/

Country	Year	Direct VA (our estimation)	Direct GDP (WTTC estimation)	Direct share of GVA (our estimation)	Direct share of GDP (WTTC estimation)	Difference (in percentage points) between the two approaches
AT	2019	19431	27092	5.47%	5.85%	-0.38%
AT	2020	12589	14214	3.68%	3.28%	0.40%
AT	2021	11138	11571	3.07%	2.55%	0.52%
AT	2022	20011	20292	4.99%	4.24%	0.75%
BE	2019	6422	13318	1.50%	2.41%	-0.91%
BE	2020	3247	8350	0.78%	1.58%	-0.80%
BE	2021	4942	11287	1.09%	2.02%	-0.93%
BE	2022	7559	12803	1.52%	2.20%	-0.68%
CZ	2019	4706	8514	2.31%	2.83%	-0.52%
CZ	2020	2503	4196	1.27%	1.47%	-0.20%
CZ	2021	2608	4465	1.20%	1.51%	-0.31%
CZ	2022	4954	6409	1.98%	2.10%	-0.12%
DE	2019	151056	167513	4.83%	4.01%	0.82%
DE	2020	92899	71373	3.01%	1.79%	1.22%
DE	2021	98048	70412	2.99%	1.70%	1.29%
DE	2022	157586	145313	4.49%	3.47%	1.02%
DK	2019	8285	7380	3.07%	2.19%	0.88%
DK	2020	5313	5207	1.96%	1.58%	0.38%
DK	2021	6539	5605	2.19%	1.58%	0.61%
DK	2022	10176	7121	3.03%	1.98%	1.05%
EE	2019	995	16878	4.09%	8.1%	-4.01%
EE	2020	409	5897	1.70%	3.1%	-1.40%
EE	2021	433	10029	1.58%	4.9%	-3.32%
EE	2022	926	14670	2.91%	6.8%	-3.89%
ES	2019	94262	83265	8.34%	5.76%	2.58%
ES	2020	36470	31116	3.57%	2.42%	1.15%
ES	2021	66864	46459	6.05%	3.38%	2.67%
ES	2022	117742	79940	9.61%	5.48%	4.13%
*FI**	*2019*	6507	6651	3.14%	2.48%	0.66%
*FI**	*2020*	3988	3320	1.93%	1.27%	0.66%
*FI**	*2021*	4948	3636	2.28%	1.35%	0.93%
*FI**	*2022*	6740	4416	2.88%	1.62%	1.26%
FR	2019	96314	103471	4.44%	3.78%	0.66%
FR	2020	54681	66477	2.64%	2.63%	0.01%
FR	2021	70199	76220	3.17%	2.82%	0.35%
FR	2022	104957	101089	4.45%	3.64%	0.81%
HR	2019	6080	7810	13.27%	11.47%	1.80%
HR	2020	2799	3818	6.64%	6.10%	0.54%
HR	2021	4875	6593	10.09%	9.36%	0.73%
HR	2022	6852	8317	12.01%	11.03%	0.98%
HU	2019	3905	5276	3.15%	2.83%	0.32%
HU	2020	1342	2098	1.15%	1.18%	-0.03%
HU	2021	1764	2572	1.35%	1.35%	0.00%
HU	2022	4074	4094	2.84%	2.06%	0.78%
IT	2019	88868	92246	5.52%	4.58%	0.94%
IT	2020	43690	56276	2.91%	3.07%	-0.16%
IT	2021	61256	68501	3.74%	3.43%	0.31%
IT	2022	93040	88885	5.31%	4.25%	1.06%
LT	2019	1628	1820	3.70%	2.72%	0.98%
LT	2020	770	765	1.72%	1.14%	0.58%
LT	2021	896	895	1.77%	1.26%	0.51%
LT	2022	1682	1343	2.74%	1.84%	0.90%
*LV***	2019	430	1353	1.62%	3.62%	-2.00%
*LV***	2020	169	987	0.64%	2.74%	-2.10%
*LV***	2021	101	1082	0.35%	2.82%	-2.47%
*LV***	2022	287	1387	0.84%	3.51%	-2.67%
NO	2019	6629	14705	2.04%	3.66%	-1.62%
NO	2020	4482	10509	1.55%	2.66%	-1.11%
NO	2021	5318	10130	1.37%	2.47%	-1.10%
NO	2022	7539	13387	1.44%	3.17%	-1.73%
PT	2019	17478	18274	9.42%	7.17%	2.25%
PT	2020	6747	9247	3.86%	3.96%	-0.10%
PT	2021	9592	12573	5.13%	5.09%	0.04%
PT	2022	18880	22433	9.00%	8.49%	0.51%

RO	2019	4149	9215	2.05%	2.93%	-0.88%
RO	2020	2088	4418	1.04%	1.46%	-0.42%
RO	2021	3363	5098	1.54%	1.59%	-0.05%
RO	2022	4436	7656	1.70%	2.30%	-0.60%
SE	2019	11411	13911	2.69%	2.71%	-0.02%
SE	2020	6749	9342	1.58%	1.86%	-0.28%
SE	2021	8793	10875	1.83%	2.05%	-0.22%
SE	2022	12503	13961	2.49%	2.59%	-0.10%
SI	2019	2197	2881	5.19%	4.91%	0.28%
SI	2020	1230	1669	2.96%	2.98%	-0.02%
SI	2021	1545	2001	3.37%	3.30%	0.07%
SI	2022	2395	2764	4.77%	4.42%	0.35%
SK	2019	2938	3167	3.48%	2.70%	0.78%
SK	2020	1637	1214	1.95%	1.07%	0.88%
SK	2021	1409	1180	1.57%	0.99%	0.58%
SK	2022	2473	1739	2.53%	1.44%	1.09%

Note: Absolut values are expressed in Million EUR (current prices). *: In our estimates Belgium's figures are only related to the Brussels region, not to the whole country. **: In our estimates Latvia's estimates are computed by only using values for inbound tourism, as domestic tourism does not appear in its TSA.

Table A5 A comparison of Tourism industrial ecosystem values with our estimates (absolute values in Million EUR and GVA share)

Country	Year	Tourism Direct VA (our estimate)	Tourism industrial ecosystem VA	Tourism Direct VA (share of GVA)	Tourism industrial ecosystem VA (share of GVA)	Difference (in percentage points) between the two approaches
AT	2019	19431	20391	5.47%	5.74%	-0.27%
AT	2020	12589	17298	3.68%	5.06%	-1.38%
AT	2021	11138	16962	3.07%	4.68%	-1.61%
AT	2022	20011	21361	4.99%	5.33%	-0.34%
AT	2023	23686	24265	5.52%	5.65%	-0.13%
BE*	2019	6422	18432	1.50%	4.31%	-2.81%
BE*	2020	3247	12751	0.78%	3.08%	-2.30%
BE*	2021	4942	16020	1.09%	3.54%	-2.45%
BE*	2022	7559	20315	1.52%	4.09%	-2.57%
BE*	2023	7942	21832	1.51%	4.16%	-2.65%
CZ	2019	4706	7463	2.31%	3.66%	-1.35%
CZ	2020	2503	5614	1.27%	2.86%	-1.59%
CZ	2021	2608	6237	1.20%	2.88%	-1.68%
CZ	2022	4954	8933	1.98%	3.57%	-1.59%
CZ	2023	6223	9461	2.22%	3.37%	-1.15%
DE	2019	151056	138256	4.83%	4.41%	0.42%
DE	2020	92899	102307	3.01%	3.31%	-0.30%
DE	2021	98048	121509	2.99%	3.71%	-0.72%
DE	2022	157586	160896	4.49%	4.59%	-0.10%
DE	2023	179060	164211	4.75%	4.36%	0.39%
DK	2019	8285	11178	3.07%	4.15%	-1.08%
DK	2020	5313	9403	1.96%	3.48%	-1.52%
DK	2021	6539	22133	2.19%	7.40%	-5.21%
DK	2022	10176	39310	3.03%	11.73%	-8.70%
DK	2023	10779	12802	3.25%	3.85%	-0.60%
EE	2019	995	886	4.09%	3.65%	0.44%
EE	2020	409	785	1.70%	3.26%	-1.56%
EE	2021	433	851	1.58%	3.11%	-1.53%
EE	2022	926	1188	2.91%	3.73%	-0.82%
EE	2023	1124	1417	3.38%	4.26%	-0.88%
ES	2019	94262	82098	8.34%	7.27%	1.07%
ES	2020	36470	50424	3.57%	4.93%	-1.36%
ES	2021	66864	66366	6.05%	6.00%	0.05%
ES	2022	117742	90129	9.61%	7.36%	2.25%
ES	2023	129512	111139	9.72%	8.34%	1.38%
FI	2019	6507	8850	3.14%	4.27%	-1.13%
FI	2020	3988	6972	1.93%	3.39%	-1.46%
FI	2021	4948	6311	2.28%	2.91%	-0.63%
FI	2022	6740	7696	2.88%	3.30%	-0.42%
FI	2023	7748	8202	3.19%	3.38%	-0.19%
FR	2019	96314	113113	4.44%	5.22%	-0.78%
FR	2020	54681	81522	2.64%	3.95%	-1.31%
FR	2021	70199	95170	3.17%	4.29%	-1.12%
FR	2022	104957	121338	4.45%	5.13%	-0.68%
FR	2023	113906	127986	4.52%	5.08%	-0.56%
HR	2019	6080	3567	13.27%	7.78%	5.49%
HR	2020	2799	1934	6.64%	4.58%	2.06%
HR	2021	4875	2859	10.09%	5.92%	4.17%
HR	2022	6852	4148	12.01%	7.28%	4.73%
HR	2023	7627	4885	12.02%	7.70%	4.32%
HU	2019	3905	6695	3.15%	5.41%	-2.26%
HU	2020	1342	4556	1.15%	3.91%	-2.76%
HU	2021	1764	5737	1.35%	4.40%	-3.05%
HU	2022	4074	6900	2.84%	4.81%	-1.97%
HU	2023	5204	9422	3.06%	5.53%	-2.47%
IT	2019	88868	80959	5.52%	5.03%	0.49%
IT	2020	43690	51040	2.91%	3.40%	-0.49%
IT	2021	61256	64108	3.74%	3.92%	-0.18%
IT	2022	93040	86470	5.31%	4.94%	0.37%
IT	2023	106267	103392	5.66%	5.50%	0.16%
LT	2019	1628	1249	3.70%	2.84%	0.86%
LT	2020	770	1128	1.72%	2.52%	-0.80%
LT	2021	896	1576	1.77%	3.12%	-1.35%
LT	2022	1682	2055	2.74%	3.35%	-0.61%
LT	2023	1959	2523	3.01%	3.88%	-0.87%
LV**	2019	430	1052	1.62%	3.95%	-2.33%

LV**	2020	169	703	0.64%	2.67%	-2.03%
LV**	2021	101	881	0.35%	3.02%	-2.67%
LV**	2022	287	1236	0.84%	3.60%	-2.76%
LV**	2023	381	1364	1.07%	3.84%	-2.77%
NO	2019	6629	-	2.04%	-	-
NO	2020	4482	-	1.55%	-	-
NO	2021	5318	-	1.37%	-	-
NO	2022	7539	-	1.44%	-	-
NO	2023	8173	-	2.02%	-	-
PT	2019	17478	13062	9.42%	7.04%	2.38%
PT	2020	6747	8559	3.86%	4.90%	-1.04%
PT	2021	9592	11744	5.13%	6.28%	-1.15%
PT	2022	18880	17155	9.00%	8.18%	0.82%
PT	2023	21939	19660	9.47%	8.49%	0.98%
RO	2019	4149	6768	2.05%	3.33%	-1.28%
RO	2020	2088	5433	1.04%	2.72%	-1.68%
RO	2021	3363	6681	1.54%	3.06%	-1.52%
RO	2022	4436	8583	1.70%	3.28%	-1.58%
RO	2023	5328	9707	1.81%	3.29%	-1.48%
SE	2019	11411	20570	2.69%	4.86%	-2.17%
SE	2020	6749	16627	1.58%	3.90%	-2.32%
SE	2021	8793	17856	1.83%	3.72%	-1.89%
SE	2022	12503	20637	2.49%	4.12%	-1.63%
SE	2023	13588	21611	2.76%	4.39%	-1.63%
SI	2019	2197	1730	5.19%	4.08%	1.11%
SI	2020	1230	1357	2.96%	3.27%	-0.31%
SI	2021	1545	1736	3.37%	3.78%	-0.41%
SI	2022	2395	2151	4.77%	4.29%	0.48%
SI	2023	2677	2417	4.78%	4.31%	0.47%
SK	2019	2938	4089	3.48%	4.84%	-1.36%
SK	2020	1637	3791	1.95%	4.52%	-2.57%
SK	2021	1409	4105	1.57%	4.59%	-3.02%
SK	2022	2473	4972	2.53%	5.08%	-2.55%
SK	2023	3194	5112	2.85%	4.56%	-1.71%

Note: Absolut values are expressed in Million EUR (current prices). *: In our estimates Belgium's figures are only related to the Brussels region, not to the whole country. **: In our estimates Latvia's estimates are computed by only using values for inbound tourism, as domestic tourism does not appear in its TSA, "-" indicates not available data.

Table A6 Total VA and GDP generated by tourism (absolute values in Million EUR and share of total GVA and GDP): comparison of our estimates and WTTC. WTTC data can be found on WTTC's research hub https://researchhub.wttc.org/

Country	Year	Total VA (our estimation)	Total GDP (WTTC estimation)	VA share of GVA (our estimation)	Tourism share of GDP (WTTC estimation)	Difference (in percentage points) between the two approaches
AT	2019	44455	48628	12.53%	10.74%	1.79%
AT	2020	28901	27685	8.45%	6.69%	1.76%
AT	2021	25626	24428	7.07%	5.85%	1.22%
AT	2022	45838	45941	11.44%	9.35%	2.09%
*BE**	*2019*	*16575*	*30365*	*3.88%*	*5.72%*	-1.84%
*BE**	*2020*	*8609*	*18761*	*2.08%*	*3.81%*	-1.73%
*BE**	*2021*	*13207*	*23973*	*2.92%*	*4.72%*	-1.80%
*BE**	*2022*	*19663*	*30791*	*3.96%*	*5.23%*	-1.27%
CZ	2019	11802	18559	5.79%	6.22%	-0.43%
CZ	2020	6202	9205	3.16%	3.33%	-0.17%
CZ	2021	6451	9287	2.98%	3.36%	-0.38%
CZ	2022	12355	14674	4.93%	4.62%	0.31%
DE	2019	406270	448554	12.98%	11.42%	1.56%
DE	2020	249197	266086	8.07%	7.21%	0.86%
DE	2021	262957	262493	8.03%	7.15%	0.88%
DE	2022	423349	424967	12.06%	10.11%	1.95%
DK	2019	18436	21267	6.84%	6.38%	0.46%
DK	2020	11891	15751	4.40%	4.94%	-0.54%
DK	2021	14635	15961	4.90%	4.85%	0.05%
DK	2022	22665	22258	6.76%	5.86%	0.90%
EE	2019	2213	4368	9.10%	12.42%	-3.32%
EE	2020	903	2146	3.75%	6.26%	-2.51%
EE	2021	954	2204	3.49%	6.16%	-2.67%
EE	2022	2054	3420	6.46%	8.60%	-2.14%
ES	2019	259255	192778	22.95%	14.09%	8.86%
ES	2020	103073	76166	10.09%	6.39%	3.70%
ES	2021	188789	116138	17.07%	9.49%	7.58%
ES	2022	329542	198375	26.89%	13.64%	13.25%
FI	2019	17360	20789	8.37%	7.84%	0.53%
FI	2020	10510	12870	5.10%	5.07%	0.03%
FI	2021	12992	13632	5.97%	5.39%	0.58%
FI	2022	17863	19251	7.65%	6.67%	0.98%
FR	2019	237337	226822	10.94%	8.55%	2.39%
FR	2020	133482	143713	6.45%	5.99%	0.46%
FR	2021	171355	159699	7.73%	6.47%	1.26%
FR	2022	258163	237925	10.93%	8.38%	2.55%
HR	2019	16820	16134	36.70%	25.24%	11.46%
HR	2020	7786	7978	18.46%	13.87%	4.59%
HR	2021	13523	12872	27.98%	20.57%	7.41%
HR	2022	18972	18892	33.26%	25.29%	7.97%
HU	2019	9013	14771	7.28%	8.28%	-1.00%
HU	2020	3096	6611	2.66%	3.97%	-1.31%
HU	2021	4069	7643	3.12%	4.43%	-1.31%
HU	2022	9402	12809	6.55%	6.33%	0.22%
IT	2019	256765	202903	15.93%	10.62%	5.31%
IT	2020	126978	121847	8.45%	7.16%	1.29%
IT	2021	177747	140592	10.86%	7.90%	2.96%
IT	2022	268965	202670	15.36%	9.75%	5.61%
LT	2019	3450	3833	7.84%	5.96%	1.88%
LT	2020	1641	1821	3.67%	2.89%	0.78%
LT	2021	1910	2041	3.78%	3.16%	0.62%
LT	2022	3574	3307	5.83%	4.48%	1.35%
*LV***	*2019*	*1283*	*2909*	*4.82%*	*7.72%*	-2.90%
*LV***	*2020*	*503*	*2036*	*1.91%*	*5.71%*	-3.80%
*LV***	*2021*	*299*	*2114*	*1.03%*	*5.77%*	-4.74%
*LV***	*2022*	*856*	*2994*	*2.50%*	*7.04%*	-4.54%
NO	2019	14929	31693	4.60%	7.96%	-3.36%
NO	2020	10269	21184	3.55%	5.53%	-1.98%
NO	2021	12205	20656	3.14%	5.37%	-2.23%
NO	2022	17069	28469	3.26%	6.38%	-3.12%
PT	2019	52140	41850	28.10%	17.34%	10.76%
PT	2020	20109	21369	11.51%	9.85%	1.66%
PT	2021	28592	25419	15.28%	11.47%	3.81%
PT	2022	56318	48924	26.84%	18.39%	8.45%

RO	2019	13409	17207	6.61%	6.01%	0.60%
RO	2020	6816	9110	3.41%	3.35%	0.06%
RO	2021	10963	12726	5.02%	4.58%	0.44%
RO	2022	14390	18110	5.52%	5.57%	-0.05%
SE	2019	29408	36827	6.94%	7.34%	-0.40%
SE	2020	17422	24941	4.08%	5.19%	-1.11%
SE	2021	22695	27334	4.73%	5.56%	-0.83%
SE	2022	32234	38488	6.43%	6.77%	-0.34%
SI	2019	4721	6118	11.14%	10.78%	0.36%
SI	2020	2733	3852	6.58%	7.28%	-0.70%
SI	2021	3412	4248	7.43%	7.68%	-0.25%
SI	2022	5181	6181	10.32%	9.41%	0.91%
SK	2019	6897	7767	8.17%	6.71%	1.46%
SK	2020	3850	3286	4.60%	3.00%	1.60%
SK	2021	3318	3097	3.71%	2.79%	0.92%
SK	2022	5811	4851	5.94%	3.83%	2.11%

Note: Absolut values are expressed in Million EUR (current prices). *: In our estimates Belgium's figures are only related to the Brussels region, not to the whole country. **: In our estimates Latvia's estimates are computed by only using values for inbound tourism, as domestic tourism does not appear in its TSA.

Table A7. Years of TSA production in the EU and EFTA countries.

Country	2019	2020	2021	2022	2023	Yearly production (until 2022)
AT	Y	Y	Y	Y	-	Y
BE	-	-	-	Y	-	-
BG	-	-	-	-	-	-
CH	Y	Y	Y	Y	Y	Y
CY	-	-	-	-	-	-
CZ	Y	Y	Y	Y	Y	Y
DE	Y	-	-	-	-	-
DK	-	-	-	Y	-	-
EE	-	-	-	-	-	-
EL	-	-	-	-	-	-
ES	Y	Y	Y	-	-	-
FI	Y	Y	Y	Y	Y	Y
FR	-	-	-	-	-	-
HR	Y	-	-	-	-	-
HU	-	-	-	Y	Y	-
IE	-	-	-	-	-	-
IS	Y	Y	Y	Y	Y	Y
IT	Y	Y	-	-	-	-
LI	-	-	-	-	-	-
LT	Y	Y	Y	Y	-	Y
LU	-	-	-	-	-	-
LV	Y	Y	Y	-	-	-
MT	-	-	-	-	-	-
NL	Y	Y	Y	Y	Y	Y
NO	Y	Y	Y	-	-	-
PL	-	-	-	-	-	-
PT	Y	Y	Y	Y	-	Y
RO	Y	-	-	-	-	-
SE	Y	Y	Y	Y	-	Y
SI	Y	Y	-	Y	Y	-
SK	Y	Y	Y	Y	Y	Y
Total EU countries	15	12	10	12	5	8
Total EU + EFTA countries	18	15	13	14	7	10
Share of EU countries	56%	44%	37%	44%	19%	30%
Share of EU + EFTA countries	58%	48%	42%	45%	23%	33%

Note: Y = Yes, it indicates years with TSA production, “-“ indicates not available data.

A.3 R code

For reproducibility purposes, the R procedure used to estimate the indirect, induced impacts and multipliers is reported below. The example refers to Austria (AT), but the code is generic and can be used for any country, as long as the data are structured following the TSA template from the Recommended Methodological Framework of the Tourism Satellite Account (United Nations, 2010) and the IOT tables in Eurostat.

```
# R code for "Give Me A Number. Evaluating Economic Impacts of Tourism"
library(openxlsx)
# Prepare I-O matrices. Example for Austria (based on PxP tables for 2019)
# read I-O table from Excel file downloaded from Eurostat
# IO_AT is 85 x 82, with 65 products, with additional lines, including value added, imports, total supply, and additional columns for consumption, exports, total use...
IO_AT = read.xlsx("IOT at basic prices PxP naio_10_cp1700.xlsx", sheet = "Sheet 27", startRow = 11, colNames = TRUE, rowNames = TRUE, skipEmptyCols = TRUE, rows = 11:97, na.strings = ":")[-1,]
countrynow = "AT"
# identifies empty products (or sectors) to remove for computational purposes
IO_AT[is.na(IO_AT)] = 0
columns_to_remove <- grep("^X", colnames(IO_AT))
columns_to_remove
# if there are no columns to remove, skip the next line
IO_AT = IO_AT[, -columns_to_remove]
# subset to only intermediate compsumption
CI_AT = as.matrix(IO_AT[1:65, 1:65])
# modify CI matrix to include household consumption --> type II effects
CI_AT2 = cbind(CI_AT, IO_AT[1:65, "Final.consumption.expenditure.by.households"])
CI_AT2 = rbind(CI_AT2, c(as.matrix(IO_AT[75, 1:65]), 0))
colnames(CI_AT2) = c(colnames(CI_AT), "Households")
rownames(CI_AT2) = c(rownames(CI_AT), "Households")
# take the value added and output rows
val_add = as.matrix(IO_AT[75, 1:65])
output = IO_AT[85,1:65]
# adaptation for type-II multipliers
output2 = c(as.matrix(output), IO_AT[75, "Total"])
names(output2) = colnames(CI_AT2)
# TYPE I
# define the diagonal matrix with the inverse of sectorial output on the diagonal
cut = which(output == 0)
output[cut]
# cut "Services.provided.by.extraterritorial.organisations.and.bodies" because it's 0
CI_AT = CI_AT[-cut, -cut]
val_add = val_add[-cut]
output = output[-cut]
x = diag(output)
xinv = solve(x)
n = nrow(x)
# matrix of Technical Coefficients (a_ij = x_ij / X_j)
A = CI_AT %*% xinv
# Inverse Matrix
I = diag(n)
```

```
L = solve(I - A)
# Vector of Sectoral Output Multipliers
ones <- replicate(n, 1)
sec_output_mult = ones %*% L
# Vector of Income Multipliers
vadd_coeff = val_add %*% xinv #vector of Value Added Coefficients
inc_mult = vadd_coeff %*% L
# define the vector of tourist expenses, with years in rows (here, 2019-2024) and as many columns as the number of products (or sectors) in the I-O table
expensesAT = matrix(0, 6, n)
rownames(expensesAT) = 2019:2024
colnames(expensesAT) = rownames(A)
# fill the expenses matrix with TSA data (specific code for ad hoc data file omitted)
...
# compute effects of type I
# output
eff.output2019 = sec_output_mult %*% expensesAT[1,]
eff.output2020 = sec_output_mult %*% expensesAT[2,]
eff.output2021 = sec_output_mult %*% expensesAT[3,]
eff.output2022 = sec_output_mult %*% expensesAT[4,]
eff.output2023 = sec_output_mult %*% expensesAT[5,]
eff.output2024 = sec_output_mult %*% expensesAT[6,]
# visualize results
eff.output2019
eff.output2020
eff.output2021
eff.output2022
eff.output2023
eff.output2024
# value added
eff.va2019 = inc_mult %*% expensesAT[1,]
eff.va2020 = inc_mult %*% expensesAT[2,]
eff.va2021 = inc_mult %*% expensesAT[3,]
eff.va2022 = inc_mult %*% expensesAT[4,]
eff.va2023 = inc_mult %*% expensesAT[5,]
eff.va2024 = inc_mult %*% expensesAT[6,]
# visualize results
eff.va2019
eff.va2020
eff.va2021
eff.va2022
eff.va2023
eff.va2024

# TYPE II
# define the diagonal matrix with the inverse of sectorial output on the diagonal
cut = which(output2 == 0)
output2[cut]
# cut "Services.provided.by.extraterritorial.organisations.and.bodies" because it's 0
CI_AT2 = CI_AT2[-cut, -cut]
output2 = output2[-cut]
x = diag(output2)
xinv = solve(x)
```

```
n = nrow(x)
# matrix of Technical Coefficients (a_ij = x_ij / X_j)
A = CI_AT2 %*% xinv
# Inverse Matrix
I = diag(n)
L = solve(I - A)
# Vector of Sectoral Output Multipliers
ones <- replicate(n - 1, 1)
sec_output_mult = ones %*% L[-n, -n]
# Vector of Income Multipliers
inc_mult = L[n, -n]
# compute effects type II
# output
eff.output2019 = sec_output_mult %*% expensesAT[1,]
eff.output2020 = sec_output_mult %*% expensesAT[2,]
eff.output2021 = sec_output_mult %*% expensesAT[3,]
eff.output2022 = sec_output_mult %*% expensesAT[4,]
eff.output2023 = sec_output_mult %*% expensesAT[5,]
eff.output2024 = sec_output_mult %*% expensesAT[6,]
# visualize results
eff.output2019
eff.output2020
eff.output2021
eff.output2022
eff.output2023
eff.output2024
# value added
eff.va2019 = inc_mult %*% expensesAT[1,]
eff.va2020 = inc_mult %*% expensesAT[2,]
eff.va2021 = inc_mult %*% expensesAT[3,]
eff.va2022 = inc_mult %*% expensesAT[4,]
eff.va2023 = inc_mult %*% expensesAT[5,]
eff.va2024 = inc_mult %*% expensesAT[6,]
# visualize results
eff.va2019
eff.va2020
eff.va2021
eff.va2022
eff.va2023
eff.va2024
# END OF CODE
```