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Initial Assessment of the Impact of the SARS-CoV-19 on Tourism in Mexico

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Abstract

The main objectives of this document were to evaluate the impact of SARS-CoV-19 on the tourism industry and infer the share of tourism GDP in Mexico's national GDP. Information from the input-output matrix and the tourism satellite account was used. Results show that, when all tourism disappears, the Gross Domestic Product (GDP) decreases by 8.98%. By simulating a probable scenario of recovery of tourist activity for the year 2021 of 25%, the tourism GDP increases by 9% and for a scenario of 50%, GDP rises to 12%. It is suggested to project recovery plans in the local hotel and restaurant industries. The originality consisted in building a tourism input-output matrix based on data and information from the tourism satellite account. The main limitation is that we only worked with data from 2013, the most recent published by INEGI. It is recommended to replicate the study for tourism activity not only in GDP but also in employment and wages.

JEL Classification: C67, D57, L83.

Keywords: Tourism, COVID-19, Mexico, Economy, Input-Output Matrix.

Evaluación inicial del impacto del SARS-CoV-19 en el turismo en México

Resumen

Los principales objetivos de este documento fueron evaluar el impacto del SARS-CoV-19 en la industria turística e inferir la participación del PIB del turismo en el PIB nacional de México. Se utilizó información de la matriz insumo-producto y la cuenta satélite de turismo. Los resultados muestran que, cuando desaparece todo el turismo, el Producto Interno Bruto (PIB) disminuye en un 8,98%. Al simular un escenario probable de recuperación de la actividad turística, en su conjunto, para el año 2021 del 25%, los resultados indican que el PIB turístico aumenta un 9% y para un escenario del 50%, el PIB sube al 12%. Se sugiere proyectar planes de recuperación en los subsectores de hotelera y restaurantes locales. La originalidad consistió en construir una matriz de insumo-producto del turismo en base a los datos e información de la cuenta satélite de turismo. La principal limitación es que solo se trabajó con datos del año 2013, los más recientes publicados por el INEGI. Se recomienda replicar el estudio para la actividad turística no solo en PIB sino también en empleo y salarios.

Clasificación JEL: C67, D57, L83.

Palabras clave: Turismo, Economía, México, Matriz Insumo – Producto, COVID-19.

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1. Introduction

The COVID-19 pandemic is having an unprecedented impact on societies around the world. As governments impose social distancing practices and instruct non-essential businesses to close to mitigate the propagation of the outbreak, there is uncertainty about the effect that such measures will have on the health and economy of a nation. Now, it seems clear that there is a growing trend in the demand for goods and services of sectors devoted to health care, and it is possible to find evidence that sectors such as aerial transport and tourism have seen the demand for their services evaporate (OMT, 2020). At the same time, some other sectors (considered non-essential) are experiencing problems on the side of the offer, given that governments reduce their activities, and a proportion of workers are confined to their homes (Del Rio-Chanona et al., 2020).

Balwdin and Tomiura (2020) point out that COVID-19 represents a supply and demand shock almost at the same time. Both aspects will impact the international exchange of goods and services. On the supply side, the pandemic's control measures generate restrictions to transport, labor mobility, and shutting down of workplaces, which act as disturbances of the offer to the economy. Initially, restrictions in the transport and movement of the workforce deteriorated the production capacity of the economy, interrupting the supplies. This extends to the demand side since an important number of people, in the prior context, were confined to working in their homes (where it was possible) and some workers were fired and lost their income (Park., *et al*., 2020).

2. Background

The restrictions on international, regional, and local travel affected immediately the national economies, including the systems of tourism; that is, international trips, national tourism, one-day visits and segments as diverse as aerial transport, cruise ships, public transport, lodging, cafeterias and restaurants, conventions, festivals, gatherings, or sports events. As a result, international aerial transportation decelerated quickly because many countries have imposed travelling prohibitions, have closed borders, or have introduced quarantine periods for tourists. The travelers also opted for staying in their homes (Gössling and Hall, 2020).

Restaurants had to close their doors, although in some countries, several restaurants could remain open for delivery and takeaway, which granted some establishments to carry on with their daily operations. Inside the countries, all segments of the hospitality value chain were essentially overwhelmed by the virus. The repercussion of cancelled events closed lodgings and closed attractions were immediately notice in other parts of the supply chain, along with laundry services.

According to the World Bank (2020), the tourism industry worldwide was only affected by -0.4% with the appearance of the SARS virus and fell by -4.0% when the global financial crisis occurred in 2008-2009. Other international events that have affected tourism refer to the terrorist attacks in the United States during 2001; the appearance of acute respiratory syndrome in 2003 and the virus of Middle East respiratory syndrome in 2015. However, De Santana et al., (2020) point out that none of these previous crises affected tourism as much as the SARS-Cov-19 pandemic.

Gossling and Hall (2020) point out that the changes and impacts of this pandemic will affect differently countries and companies dedicated to the service of tourism and refer that without government support, small businesses will suffer strong consequences while international players will be able to recover and continue their activities.

Pedauga et al., (2021) argues tan small and medium enterprises produces the highest direct and indirect effects over the Spanish economy during the pandemic disruption, therefore, credit policies should focus on this sector in order to boost the post pandemic economy.

Rosson y Var der Vorst (2021) found that the effects of covid are heterogeneous distributed in Andalusia economy. Gross domestic product decreases for several industries but other industries increase GDP. Unemployment rises in most industries but agricultural sector. No evidence that welfare decreases at the aggregate level. Svechenko et al., (2021) shows that by the coronavirus event, Ukraine economic structure should be re-organized. They propose a redistribution in natural asset share among agriculture, forestry, fisheries, and recreation and also a reduction of the public sector in favor to increase the health industry.

Lee and Hlee (2021) uses inter-regional input-output analysis for studying the economy of Seoul. They describe the convergence of technology industries and tourism industries in order to achieve high income, high value added, and job creation for the city.

2.1. Projections for Mexico

In Mexico, the sub-ministry of prevention and health prevention, ascribed to the Ministry of Health (*Secretaría de Salud*, SA) informed that the first case of contagion of COVID-19 was on March 27, 2020. On March 18, the national health council (*consejo nacional de salud*, CNS) agreed to implement measures for prevention and control that included budget adjustment actions, the expansion of social programs, and school activities were cancelled. Starting on March 26, non-essential activities of the federal government were suspended, and on March 30 the suspension was extended for all the economic sectors, except the activities of safety, health, energy and cleaning services (Dirección general de epidemiologia, 2020a, 2020b, 2002c, 2020d). On that same date, the companies with non-essential operations were urged to allow their employees to protect themselves in their homes.

Starting on March 15, the population was suggested to avoid performing non-essential international trips, although the entry and exit of national and international travel was not prohibited. On March 31, the temporary closing of beaches at the national level was ordered, period that included the Easter holiday (Dirección general de epidemiologia, 2020e, 2020f).

According to the most recent information from INEGI (2021) on quarterly tourism GDP activity reported in February 2021 (to be updated until May 2021), it decreased 6.7% in the first quarter, 47.3% in the second quarter and 34.1% in the third quarter. and establishes a projected reduction of around 27%, which means that the decline for the whole year is estimated at approximately 28%.

Table 1. Estimation of the decrease of tourism GDP, consumption and employment

Reduction in tourism GDP 2019-2020	**-28 %**
Reduction in tourism employment 2019-2020	-15 %
Reduction in total tourism consumption 2019-2020	-36 %
Income from international visitors	-55.3%

Source: Inegi, 2021

Finally, the behavior of the tourism activity during the first quarter includes a decrease in hotel occupation of 34.4 %, decrease in international travelers to the country of 57.3 %, decrease in travelers in international flights of 46 %, and a fall of 47.3 % in travelers in domestic flights and a decrease of 71.6 % in cruise ships travelers (Secretaria de turismo, 2020).

One of the difficulties of the tourism contribution in the economic structure of a region is that it is usually assessed against its primary effects, but usually the assessment of the effects produced by tourist monetary flows throughout its circulation throughout the local economy is not considered. That is, it is not common to find a general analysis of the direct and indirect impacts of a variation of the tourism sector on the rest of the economy (Hurley, Archer and Fletcher 1994).

Another difficulty of tourism study refers to the fact of assessing the weight or impact of tourism on the economic system. This is because it is difficult to determine which activities are counted as tourist sales and which are not. When a tourist visits a restaurant, this action is counted as a tourist flow, but when a local resident visits this same restaurant, it should not be counted as a tourist expense. Finally, it is also difficult to carry out an economic measurement of tourism in the production process. Indeed, only a part of the requirements of apartments and other accommodation spaces are subject to tourism sector schemes, which are included in the production process and have an evaluable cost according to market laws.

In the previous context, the following research questions are relevant: Is it possible to assess the participation of the characteristic and non-characteristic activities of tourism within the input-product structure of a region or country? What would happen, economically, if tourism activity disappeared or was drastically reduced? or What direct and indirect effects would the increase of tourism have on a country's gross domestic product? Based on these questions, the objectives of this study are to: a) harmonize the activities of tourism satellite accounts within the input-product structure in Mexico; b) estimate the effect of the SARS-Co-19 pandemic in tourism activities and to know the share of tourism GDP in the national GDP and; c) to assess the direct and indirect impact in the gross domestic product from a simulation scenario where a 25% and 50% recovery of tourism is established (arbitrarily) for the year 2021.

The structure of the work includes an introduction (section 1), background is described in section 2. The section 3 shows methodology and section 4 refer to the construction of the tourism Mexican matrix. Results are presented in section 5 and conclusions are described in section 6.

3. Methodology

3.1. Input-Output Matrices

One of the main assumptions in the input-output model consist of considering flows from industry *i* to industry j in a year period time. For example, when more houses are demanded, more bricks will be needed and what it is required is to explicitly account for the exact nature of the relationship between industry i and industry j. Formally, *zij* and *xj* can be viewed an input of steel (*i*) bought by automobile producers (*j*) form the ratio of steel input to automobile output, *zij/xj* in each period. The technical coefficient is presented as *aij = zij / xj*; the terms input–output coefficient and direct input coefficient are also often used (Miller y Blair, 2009). From the former expression, a common way to represent technical coefficients is: *aij * xj = zij* and the terms *aij* are viewed as measuring fixed relationships between a sector´s output and its inputs

In a production function analysis, the input–output model requires that a sector use inputs in fixed proportions. Specifically:

$$xij = \min\left(\frac{z1j}{a1j}, \frac{z2j}{a2j}, \ldots, \frac{znj}{anj}\right) \quad (1)$$

where min (x, y, z) denotes the smallest of the numbers x, y and z. In the input–output model, for those *aij* coefficients that are not zero, these ratios will all be the same, and equal to *xj* – from the fundamental definition of the technical coefficients and for those aij coefficients that are zero, the ratio *zij/aij* will be infinitely large and hence will be overlooked in the process of searching for the smallest among the ratios.

It is possible to draw an activity analysis production function, which is a generalization of the Leontief production function is a piece-wise linear approximation of the classical production function. Figure 1 shows an indifference curve´s map.

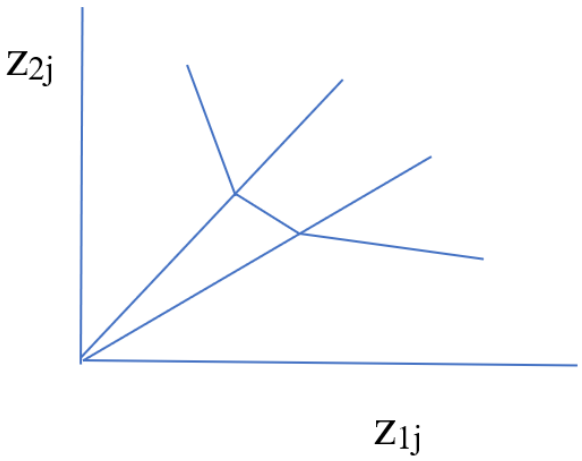

Figure 1. Activity analysis production function

"…Each isoquant is represented by a connected set of line segments. Each segment is a linear production function applicable over a limited range of combinations of inputs to produce a given

level of output..." (Miller and Blair, p. 19). The main idea is to establish a set of fixed technical coefficient.

The technical coefficients record the need for inputs from sector *i* to produce a unit of the product in sector *j*, and is given by the following expression:

$$aij = \frac{Zij}{xij}$$

Where *i* indicates the sector that sells and *j* indicates the sector that produces, therefore, solving for z_{11}, z_{12}, and so on we have: $x_1a_{11} = z_{11}$, $x_1a_{12} = z_{12}$, $x_3a_{13} = z_{13}$. So, substituting this in (2), for each z_{ij} we have:

$$\begin{aligned} x_1 &= x_1a_{11} + x_2a_{12} + x_3a_{13} + y_1 \\ x_2 &= x_1a_{21} + x_2a_{22} + x_3a_{23} + y_2 \\ x_3 &= x_1a_{31} + x_2a_{32} + x_3a_{33} + y_3 \end{aligned} \tag{2}$$

Now, solving the variable $\boldsymbol{y}$ of each equation:

$$\begin{aligned} x_1 - x_1a_{11} - x_2a_{12} - x_3a_{13} &= y_1 \\ x_2 - x_1a_{21} - x_2a_{22} - x_3a_{23} &= y_2 \\ x_3 - x_1a_{31} - x_2a_{32} - x_3a_{33} &= y_3 \end{aligned} \tag{3}$$

Now, grouping $\boldsymbol{x_1}$ in the first equation, $\boldsymbol{x_2}$ in the second and $\boldsymbol{x_3}$ in the third you have:

$$\begin{aligned} (1 - a_{11})x_1 - x_2a_{12} - x_3a_{13} &= y_1 \\ -x_1a_{21} + (1 - a_{22})x_2 - x_3a_{23} &= y_2 \\ -x_1a_{31} - x_2a_{32} + (1 - a_{33})x_3 &= y_3 \end{aligned} \tag{4}$$

Expressing in matrix form the above equation:

$$C = \begin{bmatrix} (1 - a_{11}) & -a_{12} & -a_{13} \\ -a_{21} & (1 - a_{22}) & -a_{23} \\ -a_{31} & -a_{32} & (1 - a_{33}) \end{bmatrix} \quad x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \quad y = \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} \tag{5}$$

These relationships can be represented compactly in a matrix form. In matrix algebra, the **^** symbol ˆ on a vector expresses a diagonal matrix with the vector elements along the main diagonal, for example:

The vector $\boldsymbol{x} = \begin{bmatrix} \boldsymbol{x_1} \\ \vdots \\ \boldsymbol{x_n} \end{bmatrix}$ is express as $\hat{\boldsymbol{x}} = \begin{bmatrix} \boldsymbol{x_1} & \cdots & \boldsymbol{0} \\ \vdots & \ddots & \vdots \\ \boldsymbol{0} & \cdots & \boldsymbol{x_n} \end{bmatrix}$

Now, of the basic definition of inverse matrix, $(\hat{\boldsymbol{x}})(\hat{\boldsymbol{x}})^{-\mathbf{1}} = \boldsymbol{I}$, so it results in:

$$\hat{x}^{-1} = \begin{bmatrix} 1/x_1 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & 1/x_n \end{bmatrix}$$

Also, the post-multiplication of an $\boldsymbol{M}$ matrix by a $\hat{\boldsymbol{d}}$ diagonal matrix, creates a matrix in which each element in the $\boldsymbol{j}$ of $\boldsymbol{M}$ column is multiplied by $\boldsymbol{d_j}$ in $\hat{\boldsymbol{d}}$, therefore the $\boldsymbol{n\ x\ n}$ matrix of technical coefficients can be expressed as:

$$A = Z\hat{x}^{-1} \tag{6}$$

Where Z represents the sales to sector j – j's purchases of the products of the various producing sectors in the country.

Using the definition of the relationships described in (5) it can be expressed as:

$$Cx = y \tag{7}$$

To finally get to the following expression:

$$x = (I - A)^{-1} f \tag{8}$$

Where *x* is a production column vector of order n; f is a column vector of final demand of order n; I represent an identity matrix and A is the matrix of technical coefficients. The term $(I - A)^{-1}$ is known as the inverse Leontief matrix (L), so the equation already stated is the solution equation for the input-output analysis and is expressed as: *x L = F*

Although the input-output model has been criticized over its rigidity, it can also be extraordinarily flexible, not just because of the variety of applications that have been found for it, but also due to the theoretical associations that have been attributed to it (Aroche, 2013). It is also considered as a countable scheme where the flow of goods and services between different agents that participate in the economic activity is described, whether as producers of goods and services or as consumers. The principal aggregates are also found in this matrix, which characterize an economy, as well as its sectorial composition (Fuentes, 2005).

3.2. The multiplier of Tourism

It is considered that precaution is required when there is talk of the term *multiplier*, since there are those of many types. Unless it is precisely understood what type of multiplier is being addressed, or making a comparison of multipliers extracted through the results from different impact studies performed (Hara, 2008).

Let us remember that one of the main economic contributions of the Leontief input-product tables consists in the fact that the different multipliers that measure direct and indirect repercussions on the different sectors of the economy of a change in the final demand are relatively easy to obtain,

mentioning that if these changes happen in a relatively short period of time, as in one year for example, they are called *economic impact analysis*, but when the period of time is longer, 5 years or more, and the agents are produced by several agents that make up the final demand, then in that case they are called *forecast studies*, which many times require the help of other economic techniques such as Econometrics or linear programming (Miller & Blair, 2009).

The simplest notion of the *type I* multiplier, of any variable, implies describing it as the total change in the variables of interest in face of a change in the final demand and considers the direct and indirect effects, which is the one that will be used in this study:

$$Type\ I\ Multiplier = \frac{Direct\ impact + Indirect\ impact}{Direct\ impact} \tag{9}$$

3.3 The extraction method

Schultz initially suggested the extraction method in the input-output system in 1976. This method analyzes the importance of a sector (region) by hypothetically extracting it from the input-output system.

In order to see what would happen to the structure of the economy if this sector "disappeared". Then, the differences in the product with and without the sector in question are analyzed; these are generally considered to represent the importance of the extracted element. Several measures have been proposed in the literature to quantify the differences, e.g., Cella (1984) and Dietzenbacher and Linden (1997). In this paper, the backward chaining (e_{at}) of the extraction method is calculated. The importance of the sector (region) is presented in terms of the e_{ats} obtained by the system with and without the extracted element. The e_{at} is calculated from the thousand. The product difference between the complete system and without the extracted element, for the impact e_{at}, is calculated as (Dietzenbacher et al., 1993):

$$x - \bar{x} = \begin{pmatrix} x^1 & \bar{x}^1 \\ x^R & \bar{x}^R \end{pmatrix} = \left\{ \begin{bmatrix} L^{11} - & L^{1R} \\ L^{R1} - & L^{RR} \end{bmatrix} - \begin{bmatrix} (I - A^{11}) & ^{-1} & 0 \\ 0 & & (I - A^{RR}) \end{bmatrix}^{-1} \right\} \begin{pmatrix} f1 \\ f2 \end{pmatrix} \tag{10}$$

Where x denotes the product, L is the inverse Leontief matrix, A is the matrix of input (unit) requirements, f is the vector of final demands, and the superscripts denote the sector extracted from the rest of the system respectively.

According to Dietzenbacher and Lahr (2013), the removal of industry (sector) k implies that the k-th row and column of A are made equal to zero, resulting in a new coefficient matrix called Ā. Inputs that were provided by the sector in question are presumably covered by imports. The same applies to the final demand for goods and services offered by industry k, that is with fk =0 the "new" final demand vector is $\bar{f}$. Then, the gross production vector is estimated as:

$$\bar{x} = (I - A)^{-1}\, \bar{f} \tag{11}$$

Then, to measure the difference originated with the extraction, we calculate s'(x-x), which is always negative and indicates a reduction (s is the vector of ones for the sum).

4. Construction of the tourism matrix in Mexico

Following Marquina´s procedure (2006), the domestic input-output matrix (IPM) is used, applied to 79 subsectors of the Industrial Classification System of North America (*Sistema de Clasificación Industrial de América del Norte*, SCIAN) which is the most recent published by the National Institute of Geography and Statistics in Mexico (*Instituto Nacional de Geografía y Estadística en México*, INEGI, 2019). These 79 subsectors are aggregated into 42 subsectors. For purposes of presentation, the 42 sectors are grouped into only two. The first line of Table 2 represents the sum of the sectors from 1 to 22, and the second line groups the sectors from 23 to 42. The classification into 30 subsectors of goods and services characteristic of tourism, and goods and sectors uncharacteristic of tourism, as well as the subsector of other industries, comes from the Satellite Tourism Account in Mexico (INEGI, 2019).

Table 2. Disaggregation of the IPM to 42 sectors and aggregation of 30 sectors characteristic and uncharacteristic of tourism.

	CODE	SECTOR, SUBSECTOR
	1.22	Agriculture, breeding and exploitation of animals, fishing, hunting and capture, forestry
	23.42	Manufacturing of transport equipment
CHARACTERISTIC GOODS AND SERVICES	**43**	Handcrafts
	44	Beach clothes and swimsuits
	45	Luggage
	46	Hotels
	47	Other lodging services
	48	Aerial
	49	Intercity bus
	50	Other transport and related services
	51	Travel agencies and tour operators
UNCHARACTERISTIC GOODS AND SERVICES	**52**	Foods and beverages
	53	Clothes and shoes
	54	Newspapers, magazines and books
	55	Pharmaceutical and personal hygiene products
	56	Film for photography and others
	57	Others
	58	Restaurants and bars
	59	Commerce
	60	Transport
	61	Cabarets and night clubs
	62	Movie theaters, shows and others

	63	Personal hygiene and cleanliness
	64	Photograph developing and services
	65	Car rental
	66	Others
	67	Other goods and services N.C.O.P.
OTHER TOURISM INDUSTRIES	**68**	Tourism administration and promotion
	69	Educational services
	70	Leisure services
	71	Others services
	72	Other tourism industries in the market

Source: Tourist Satellite Account, 2020.

Table 3 presents the interrelation between characteristic and uncharacteristic sectors of the tourism sector extracted from the satellite tourism account and the other subsectors of the national input-product matrix. For example, the tourism concept of handcrafts is related (in their input requirements) to subsector 314 of textile products manufacturing, at the level of industrial branch it is related to branch 3159 of clothing accessories manufacturing, to branch 3169 of other leather products manufacturing, to branch 3151 of knitwear manufacturing, among others, and finally at the level of sub-branch it is related to 32199, manufacturing of other wooden products. These sub-branches, branches and subsectors, in turn, are concentrated in the sectors of other food products, other textile industries, items of clothing, paper and cardboard, etc. The subsector of beach clothes and swimsuits requires the input of sub-branch 31522 corresponding to clothes manufacture from textile materials which in turn is classified into the subsector of items of clothing. For the case of production of hotel services, information is required from branch 7211 that contains hotels, motels and similar grouped in the subsector of restaurants and hotels.

For the case of the aerial service, the inputs required correspond to the subsector 481 that includes aerial transport which in turn is encompassed in the transport subsector. Foods, beverages and tobacco are fueled by various inputs of several branches such as: a) branch 3116 corresponding to livestock and beef slaughter, packaging and processing; b) branch 3114 on conservation of fruits, vegetables and stews; c) branch 3118 on elaboration of bread and tortilla; d) branch 3113 on elaboration of sugar, chocolate, candy and similar; e) branch 3111 of elaboration of meals for animals.

When knowing the percentage participation of the tourism consumption related to handcrafts, it is possible to estimate the value of the inputs required from the rest of the sectors of the economy to manufacture handcrafts. This piece of data of intermediate tourism consumption of handcrafts is obtained from the concept of internal tourism consumption from the satellite tourism account that is updated every five years approximately. This process is repeated for the calculation of the requirements of inputs of the economy for the 30 characteristic and uncharacteristic sectors of tourism and therefore to establish the tourism input-product matrix.

Table 3. Interrelation of the tourism subsectors with the rest of the sectors of the economy in their input requirements.

TOURISM CONCEPT		SECTOR, SUBSECTOR, BRANCH AND SUB-BRANCH OF ACTIVITY	CORRESPONDING SECTORS
Characteristic Goods and Services	Handcrafts	Sub-branch 31199 elaboration of other foods	Other food products
		Subsector 314 manufacturing of textile products, except items of clothing	Other textile industries
		Branch 3159 manufacturing items of clothing	Items of clothing
		Branch 3169 manufacturing of other leather, hide and replacement materials	Leather and its products
		Branch 3151 making of knitted garments	Spinning and knitting of soft fibers
		Sub-branch 32199 manufacturing of other wooden products	Other wood industries
		Branch 3222 manufacturing of paper and cardboard products	Paper and cardboard
		Branch 3272 manufacturing of glass and glass products	Glass and its products
		Branch 3271 manufacturing of products based on clay and fireproof minerals	Quarry, sand, gravel and clay
		Branch 2122 mining of metallic minerals	Non-iron metallic minerals
		Branch 2123 mining of non-metallic minerals	Other non-metallic mineral products
		Sub-branch 33993 manufacturing of toys	Other manufacturing industries
	Beach clothes and swimsuits	Sub-branch 31522 manufacturing of clothes from textile materials	Items of clothing
	Luggage	Branch 3161 tanning and finishing of leather and hide	Leather and its products

Camp tents	na	NA
Hotels	Branch 7211 hotels, motels and similar	Restaurants and hotels
Other lodging services	Branch 7212 camps and recreational lodging	Restaurants and hotels
	Branch 7213 pensions and guest houses, and furnished and apartments houses with hotel services	Real estate rental
Aerial	Subsector 481 aerial transport	Transport
Intercity bus	Subsector 485 land transport of passengers, except for train	Automobile vehicles
Other transport and connected services	Subsector 488 services related with transport	Other transport equipment and material
Travel agencies and tour operators	Branch 5615 travel agencies and reservation services	Professional services
Foods, beverages and tobacco	Branch 3116 slaughter, packing and processing of beef and poultry meat	Meat and dairy products
	Branch 3114 conservation of fruits, vegetables and stews	Fruit and legume packaging
	Sub-branch 31121 elaboration of milling products and malt manufacture	Wheat milling and its products
	Branch 3118 elaboration of baking and tortilla products	Nixtamal milling and maize products
	Sub-branch 31192 coffee and tea industries	Coffee processing
	Branch 3113 elaboration of sugar, chocolate, candy and similar	Sugar and its products
	Sub-branch 31122 elaboration of starches, oils and edible vegetable fats	Oils and edible vegetable fats
	Branch 3111 elaboration of meals for animals	Meals for animals

Uncharacteristic Goods and Services		Sub-branch 31211 elaboration of soft drinks and ice, and water purification	Hottled soft drinks
		Sub-branch 31212 elaboration of beer	Beer
		Sub-branch 31213 elaboration of grape-based alcoholic beverages and fermented beverages, except beer	Alcoholic beverages
		Branch 3122 tobacco industry	Tobacco and its products
	Clothes and shoes	Subsector 315 manufacturing of items of clothing	Items of clothing
		Branch 3162 manufacturing of shoes	Leather and its products
	Newspapers, magazines and books	Subsector 511 editing of publications and software, except through the internet	Printing and publishing houses
	Pharmaceutical and personal higiene products	Branch 3254 manufacturing of pharmaceutical products	Medicinal products
		Branch 3256 manufacturing of soaps, cleaners and toiletry preparations	Soaps, detergents, perfumes and cosmetics
	Film for photographs and others	Sub-branch 54192 services of photography	Other services
	Others	Branch 4889 other services related to transport	Car bodywork and parts
	Restaurants and bars	Subsector 722 services of food and beverage preparation	Restaurants and hotels
	Commerce	Sector 46 commerce at retail	Commerce
	Transport	Subsector 487 toursim transport	Transport
	Cabarets and night clubs	Branch 7224 night clubs, bars, saloons and similar	Leisure services
	Movie theaters, shows and others	Subsector 711 artistic and sports services and other related services	Leisure services

	Personal higiene and cleanliness		Branch 5617 cleaning services	Soaps, detergents, perfumes and cosmetics
	Photograph revealing and services		Branch 8129 services of photography developing and other personal services	Professional services
	Car rental		Branch 5321 rental of cars, trucks and other land transport	Automobile vehicles
	Others		Sector 52 financial and insurance services	Financial services
			Branch 5311 rental without intermediation of housing and other properties	Real estate rental
			Branch 5312 property developers and real estate agencies	Other services
	Others Goods and Services N.C.O.P.		Sub-branch 33999 other manufacturing industries	Other manufacturing industries
	From the Market			
	Non Market	Tourism management and promotion	Branch 5611 services of business administration	Professional services
		Educational services	Subsector 611 educational services	Educational services
		Leisure services	Subsector 713 entertainment services in recreational facilities and other recreational services	Leisure services
		Others services	Branch 7139 other recreational services	Other services

Table 4. Articulation between the satellite tourism account and Input-Output Matrix.

		BEACH CLOTHES		
CODE	SECTOR, SUBSECTOR	TEXTILE PRODUCTS, CLOTHING, MANUFACTURING AND LEATHER INDUSTRY		SUB-BRANCH 31522 MANUFACTURING OF CLOTHES FROM TEXTILE MATERIALS
111-115	Agriculture, breeding and exploitation of animals, fishing, hunting and capture, forestry	204.18	0.00	660.93
211	Extraction of petroleum and gas	0.00	0.00	0.00
212	Mining of metallic and non-metallic minerals	26.19	0.00	84.77
213	Services related to mining	0.00	0.00	0.00
221	Generation, transmission and distribution of electric energy	23,126.29	0.03	74,860.23
222	Supply of water and gas supply by ducts to the final consumer	571.50	0.00	1,849.96
236	Building	0.00	0.00	0.00
237	Construction of civil engineering works	0.00	0.00	0.00
238	Specialized works for construction	5,416.79	0.01	17,534.23
311	Food industry	9,906.38	0.01	32,067.15
312	Beverages and tobacco industries	1,657.48	0.00	5,365.31
313-316	Manufacturing of textile inputs and textile finishing, Manufacturing of textile products, except items of clothing, Manufacturing of items of clothing, and Tanning and finishing of leather and hide, and Manufacturing of leather, hide and replacement products	301,009.60	0.34	974,373.59
321	Wood industry	331.52	0.00	1,073.14
322	Paper industry	14,720.10	0.02	47,649.24
323	Printing and related industries	8,767.67	0.01	28,381.12
324	Manufacturing of products derived from petroleum and carbon	28,085.51	0.03	90,913.30
325-327	Chemical industry, Plastic and rubber industry, Manufacturing of products based on non-metallic minerals	72,146.81	0.08	233,540.53
331	Basic metallic industries	4,382.15	0.00	14,185.11
332	Manufacturing of metallic products	27,973.98	0.03	90,552.28
333	Manufacturing of machinery and equipment	239.66	0.00	775.77
334	Manufacturing of information technology equipment, communication, measuring and other equipment, components and electronic accessories	1,866.64	0.00	6,042.34
335	Manufacturing of accessories, electronic devices and equipment of electric energy generation	1,786.88	0.00	5,784.16
336	Manufacturing of transport equipment	12,050.91	0.01	39,009.03
337	Manufacturing of furniture, mattresses and blinds	385.47	0.00	1,247.79
339	Other manufacturing industries	25,647.64	0.03	83,021.88

431-461	Commerce	13,481.74	0.02	43,640.63
481-488	Aerial transport, trains, water, duct, tourism, load auto-transport, land passenger transport except for train, services related to transport.	38,709.36	0.04	125,302.90
491-519	Postal services, Courier and shipment services, Storage services, Publishing of newspapers, magazines, books, software and other materials, and editing of these publications integrated with printing, Film and video industry, and sound industry, Radio and television, Other telecommunications, Electronic processing of information, lodging and other related services	115,257.46	0.13	373,090.50
521-524	Central bank, Intermediary credit and non-stock institutions, stock, Exchange and financial investment activities, and Deposit, insurance and pension companies	2,980.72	0.00	9,648.65
531-532	Real estate services, Real estate rental services	3,747.87	0.00	12,131.94
533	Rental services of trademarks, patents and franchises	498.10	0.00	1,612.36
541-561	Professional, scientific and technical services, Corporate, Business support services	6,844.30	0.01	22,155.12
562	Management of wastes and remediation services	51.49	0.00	166.68
611	Educational services	116,664.19	0.13	377,644.13
621-624	Medical services of external consult and related services, Hospitals, Residencies for social assistance and for health care, Other services of social assistance	116.51	0.00	377.14
711-713	Artistic, cultural and sports services, and other related services, museums, historical sites, zoos and similar, Entertainment services in recreational facilities and other recreational services	2,524.94	0.00	8,173.28
721-722	Temporary lodging services, Food and beverage preparation services	0.00	0.00	0.00
811	Repair and maintenance services	0.00	0.00	0.00
812	Personal services	33,695.96	0.04	109,074.45
813	Associations and organizations	6,383.83	0.01	20,664.58
814	Homes with domestic employees	38.23	0.00	123.74
931	Legislative, government and administration of justice activities	1,234.49	0.00	3,996.07
		882,532	**1.00**	**2,856,774.00**

Source: Tourism Satellite Account, INEGI, 2020

Table 4 shows the calculation for defining the inputs required to produce beach clothes and swimsuits (a good that is characteristic of tourism according to the tourism satellite account). The requirements of inputs are shown in the first column, in Mexican pesos, for the subsector of textile products, clothing, leather industry and manufacture. The next column shows the percentage with

which the sub-branch of manufacturing of textile materials participates, and the third the monetary value of the inputs required from each of the 79 subsectors in the sub-branch 31522. With these results it is possible to extrapolate the monetary value that the manufacture of beach clothes requires, such as inputs from the rest of the subsectors of the economy. This procedure is carried out for the rest of the subsectors that are representative of tourism.

In the implementation of our new model, the decrease of social mobility is translated into a lower demand from the consumer since people cannot visit establishments and purchase the habitual volume of tourism goods and services that they regularly consume. Even in countries where restrictions are more flexible, the perceived risk of contracting the virus also discourages the consumption in businesses like restaurants, shopping centers, aerial transport, recreational facilities, and music or sports events, among others. Although it has already been pointed out that there is also disruption on the side of the offer, in this first exercise we will focus on estimating the effect from tourism consumption. This is in part because the information about the internal and receptive tourism demand is available, by trimester, until the year 2019 within the tourism satellite account of the INEGI.

5. Results and discussion

Tables 5, 6 and 7 present the results from the three scenarios of simulation of consumption reduction of the intermediate tourism consumption.

Table 5. Simulation of the decrease of intermediate tourism consumption of 100%.

	CODE	SECTOR, SUBSECTOR	GROSS VALUE	DIRECT EFFECTS	INDIRECT EFFECTS
	1.22	Agriculture, breeding and exploitation of animals, fishing, hunting and capture, forestry	6.534.454	7579807.11	6821826.4
	23.42	Manufacturing of transport equipment	5.626.531	9124109.53	8211698.58
CHARACTERISTIC GOODS AND SERVICES	**43**	Handcrafts	86984		
	44	Beach clothes and swimsuits	5435		
	45	Luggage	134		
	46	Hotels	158649		
	47	Other lodging services	1464		
	48	Aerial	77384		
	49	Intercity bus	5807		
	50	Other transport and related services	417		
	51	Travel agencies and tour operators	19988		
UNCHARACTERISTIC GOODS AND	**52**	Foods and beverages	100437		
	53	Clothes and shoes	19847		
	54	Newspapers, magazines and books	1884		
	55	Pharmaceutical and personal hygiene products	44710		
	56	Film for photography and others	1444		

	57	Others	207510		
	58	Restaurants and bars	109225		
	59	Commerce	147147		
	60	Transport	63496		
	61	Cabarets and night clubs	9460		
	62	Movie theaters, shows and others	5319		
	63	Personal hygiene and cleanliness	1409		
	64	Photograph developing and services	17796		
	65	Car rental	347819		
	66	Others	52112		
	67	Other goods and services N.C.O.P.	8652		
OTHER TOURISM	**68**	Tourism administration and promotion	10026		
	69	Educational services	461		
	70	Leisure services	2100		
	71	Others services	141160		
	72	Other tourism industries in the market			
		TOTAL, NATIONAL INPUTS	**18352192.5**	**16703916.6**	**15033525**
				1648275.83	**3318667.49**
		PERCENTAGE OF DECREASE:		**8.98135648**	**18.0832208**

Source: author's calculations

In this table we find a simulation in the decrease in tourism consumption of 100 %, on the characteristic and uncharacteristic goods and services of tourism, where the total percentage of decrease in the GVA is 8.98 % and the decrease in the gross value added, the economy would increase to 18.08 % if the direct and indirect effects are considered in their entirety. That is, the percentage participation of the tourism GDP (characteristic and uncharacteristic tourism goods and services) represents 8.98 % of the national GDP.

Having estimated a percentage participation of the tourism GDP of 8.98 percent in relation to the national GDP and considering that the preliminary estimate of the behavior of the tourism GDP was -28% and that of the national GDP was -8.5%, this would indicate that the tourism GDP suffered a drop of approximately 3.2% to place its participation in the national GDP at 6.48%. The type I multiplier for this scenario is calculated in 1.72. That is, for each monetary unit that the economy receives due to an increase in the intermediate tourism consumption, the effect on the rest of the economic activities will be more than 72 monetary units.

5.1. Simulations

Having said that, with this first scenario it is possible to develop diverse scenarios of economic production behavior facing specific demand shocks. In this case, a production multiplier calculated

at 1.72 and since we have mentioned that if because of COVID-19 tourism GDP experiments a recovery of 25 % for this coming year of 2021, then the tourism GDP participation in the national GDP is increased by almost 9.0 %, going from 6.48% to 7.1 %, causing a direct positive effect on this participation of tourism GDP of 0.62 % as is shown in Table 6.

However, if the impact of tourism GDP increases not in 25 % but rather in 50 %, then the effects of the tourism participation in the national GDP increase up almost to 12 %, going from a participation of 6.48 % to almost 7.26 % as is shown in Table 7 of this study.

Table 6. Simulation of an increase of 25 % of the tourism GDP.

	CODE	SECTOR, SUBSECTOR	VALUE ADDED	DIRECT
	1.22	Agriculture, breeding and exploitation of animals, fishing,	6935523.51	7559720.63
	23.42	Manufacturing of transport equipment	8348560.22	9099930.64
CHARACTERISTIC GOODS AND SERVICES	**43**	Handcrafts	62629	
	44	Beach clothes and swimsuits	3914	
	45	Luggage	97	
	46	Hotels	114227	
	47	Other lodging services	1054	
	48	Aerial	55717	
	49	Intercity bus	4181	
	50	Other transport and related services	300	
	51	Travel agencies and tour operators	14391	
UNCHARACTERISTIC GOODS AND SERVICES	**52**	Foods and beverages	72314	
	53	Clothes and shoes	14290	
	54	Newspapers, magazines and books	1356	
	55	Pharmaceutical and personal hygiene products	32191	
	56	Film for photography and others	1039	
	57	Others	149407	
	58	Restaurants and bars	78642	
	59	Commerce	105946	
	60	Transport	45717	
	61	Cabarets and night clubs	6811	
	62	Movie theaters, shows and others	3829	
	63	Personal hygiene and cleanliness	1015	
	64	Photograph developing and services	12813	
	65	Car rental	250430	
	66	Others	37521	
	67	Other goods and services N.C.O.P.	6230	
OTHER TOURISM INDUSTRIES	**68**	Tourism administration and promotion	7219	
	69	Educational services	332	
	70	Leisure services	1512	
	71	Others services	101635	
	72	Other tourism industries in the market		
		TOTAL, NATIONAL INPUTS	**16470842.3**	18143099.5

			PERCENTAGE OF INCREASE:	**8.17637716**

Source: author's calculations

Table 7. Simulation of an increase of 50 % of the tourism GDP.

	CODE	SECTOR, SUBSECTOR	VALUE ADDED	DIRECT
	1.22	Agriculture, breeding and exploitation of	6935523.51	7786512.24
	23.42	Manufacturing of transport equipment	8348560.22	9372928.56
CHARACTERISTIC GOODS AND SERVICES	**43**	Handcrafts	62629	
	44	Beach clothes and swimsuits	3914	
	45	Luggage	97	
	46	Hotels	114227	
	47	Other lodging services	1054	
	48	Aerial	55717	
	49	Intercity bus	4181	
	50	Other transport and related services	300	
	51	Travel agencies and tour operators	14391	
UNCHARACTERISTIC GOODS AND SERVICES	**52**	Foods and beverages	72314	
	53	Clothes and shoes	14290	
	54	Newspapers, magazines and books	1356	
	55	Pharmaceutical and personal hygiene	32191	
	56	Film for photography and others	1039	
	57	Others	149407	
	58	Restaurants and bars	78642	
	59	Commerce	105946	
	60	Transport	45717	
	61	Cabarets and night clubs	6811	
	62	Movie theaters, shows and others	3829	
	63	Personal hygiene and cleanliness	1015	
	64	Photograph developing and services	12813	
	65	Car rental	250430	
	66	Others	37521	
	67	Other goods and services N.C.O.P.	6230	
OTHER TOURISM INDUSTRIES	**68**	Tourism administration and promotion	7219	
	69	Educational services	332	
	70	Leisure services	1512	
	71	Others services	101635	
	72	Other tourism industries in the market		
		TOTAL, NATIONAL INPUTS	**16470842.3**	19384613.2
			PERCENTAGE OF DECREASE:	**11.8**

Source: author's calculations

6. Conclusions

It was estimated, in this study, that the participation of the tourism activity (tourism GDP) represents the 7.38% of participation in the national GDP considering that the data are based on the input-output matrix and the Tourism Satellite Account for Mexico from the year 2013. The two simulation scenarios show great affectations not only for tourism in the country but also for the entire economy through the direct effects and the indirect effects that COVID-19 can cause.

The structural analysis, in its aspect of input-output matrices and the interactions of economic sectors that are found in them, help us to understand the economic impacts caused by supply and demand shocks generated by diverse phenomena. In the case of this study, a GDP shock was modelled by considering as main simulation scenario an increase in the intermediate tourism GDP of 25% and 50%. The type I multiplier has a strong impact on the final demand of goods and services allocated to the tourism sector and was estimated at 1.72%.

When representing this initial assessment, the only data available for comparison are those presented by Cicotur. Our analysis simulates a decrease of 25% and 49% in the intermediate tourism consumption. The latter is comparable to the previously mentioned study. Although our results agree in the direction of the economic impact, the magnitudes are slightly different (3.6 % of Cicotur versus 3.9%). The type I multiplier has a strong impact on the final demand of goods and services allocated to the tourism sector. Future research avenues ought to consider the economic impact on the tourism activity not only in the production but also in the added value, employment and remunerations caused by the offer and demand shocks simultaneously. It is also important to highlight the fact that this study used data from the 2013 year, the only available data released by INEGI at the moment.

References

[1] Aroche, F., (2013), La investigación sobre el modelo insumo producto en México. Orígenes y tendencias. *Estudios Económicos*, 28(núm. 2, julio-diciembre 2013), 249.264. Retrieved from http://www.redalyc.org/pdf/597/59728813003.pdf

[2] Baldwin, R. y E. Tomiura, (2020), "*Thinking ahead about the trade impact of COVID-19*," Chapter 5 in Baldwin and Weder di Mauro (2020a).

[3] Banco Mundial, (2020), *Global Economic Prospects. Flagship Report.* , Washington, DC.

[4] Cella, G. (1984). The input-output measurement of interindustry linkages. *Oxford Bulletin of Economics and Statistics*, 46(1), 73-84. https://doi.org/10.1111/j.1468-0084.1984.mp46001005.x

[5] De Santana Ribeiro, L., Santos, G., Cerqueira, R. y Souza, K., (2020). *Economic impact of COVID-19 on tourism in Brazil*. Recuperado de: https://www.researchgate.net/publication/341805042

[6] Del Rio-Chanona, R. M., (2020). S*upply and demand shocks in the COVID-19 pandemic: An industry and occupation perspective*. Recuperado de: https://arxiv.org/abs/2004.06759.

[7] Dirección General de Epidemiología (19 de abril de 2020). «Información General». Coronavirus Gob MX. Consultado el 20 de junio de 2020.

[8] Dietzenbacher, E., Linden, J. van der, y Steenge, A. (1993). The regional extraction method: ec input-output comparisons. *Economic Systems Research*, 5(2), 185-206. https://doi.org/10.1080/09535319300000017.

[9] Dietzenbacher, E., y Lahr, L. (2013). Expanding extractions. *Economic Systems Research*, 25(3), 341-360. https://doi.org/10.1080/09535314.2013.774266.

[10] Dietzenbacher, E., y Linden, J. van der (1997). Sectoral and spatial linkages in the ec Production Structure. *Journal of Regional Science*, 37(2), 235-257. https://doi.org/10.1111/0022-4146.00053.

[11] Figueroa, C. (2015). Identificación de los sectores clave de la economía mexicana. *Investigación y Ciencia*, 23(65), 48–58.

[12] Gössling, S., Scott, D. y Hall, C., (2020) Pandemics, tourism and global change: a rapid assessment of COVID-19, *Journal of Sustainable Tourism*, DOI: 10.1080/09669582.2020.1758708

[13] Hara, T. (2008). Quantitative Tourism Industry Analysis. *Animal Genetics* (Vol. 39).

[14] Hurley, A., Arhcer, B., y Fletcher, J. (1994). The Economic impact of European community grants for tourism in the Republic of Ireland. *Tourism Management*. Vol. 15 (3) pp. 203-211. https://doi.org/10.1016/0261-5177(94)90106-6.

[15] INEGI, Cuenta Satelite de Turismo (2019, 2020). Sistema de Cuentas Nacionales.

[16] Lee, H., & Hlee, S. (2021). The Intra-and Inter-Regional Economic Effects of Smart Tourism City Seoul: Analysis Using an Input-Output Model. *Sustainability*, 13(7), 4031. https://doi.org/10.3390/su13074031

[17] Fuentes, A., (2005) "Construcción de una Matriz Regional de Insumo-Producto". En Problemas del Desarrollo, *Revista Latinoamericana de Economía UNAM*, Vol. 36 No. 140. https://doi.org/10.22201/iiec.20078951e.2005.140.7562.

[18] Hernández, G., (2012). Matrices insumo-producto y análisis de multiplicadores: Una aplicación para Colombia. *Revista de Economia Institucional*, Vol. 14. 203-221 p.

[19] Madrid, Francisco (2020b). Estimación del impacto a la actividad turistica en Mexico por la COVID-19 en el mes de mayo 2020 en Mexico. Centro de Investigación y Competitividad Turistica. Recuperado de: https://www.anahuac.mx/mexico/cicotur/sites/default/files/2020-04/Doc10_Afectaciones_abril_Cicotur.pdf. https://doi.org/10.47557/yyhj9671.

[20] Madrid, Francisco (2020a). Estimación de las afectaciones al turismo mexicano 2020como consecuencia de la pandemis del COVID-19. Centro de Investigación y Competitividad Turistica. Recuperado de: https://www.anahuac.mx/mexico/cicotur/sites/default/files/2020-05/Doc14_Cicotur_Estimacion_afectaciones_turismo__mexicano_Covid19.pdf. https://doi.org/10.24275/uam/azc/dcsh/ae/2019v34n86/arriaga.

[21] Marquina, Santiago (2006). Comparación y articulación interna de la actividad económica del sector turístico a partir de la Matriz de Insumo-Producto de México 2003 basada en el enfoque de la Cuenta Satélite de Turismo. https://repositorio.uam.es/bitstream/handle/10486/662138/marquina_benitez_santiago.pdf?sequence=1&isAllowed=y. Fecha de consulta: 16 de enero 2020. https://doi.org/10.24275/uam/azc/dcsh/ae/2020v35n88/garcia.

[22] Miller, R. E. y Blair, P. D. (2009), *Input-output Analysis Foundations and Extensions*, Cambridge, Cambridge Editorial.

[23] OMT, (2020). *Evaluación del impacto del brote de covid-19 en el turismo internacional. Madrid: Organización Mundial del Turismo*. https://doi.org/10.18111/9789284421954

[24] Park, M.; Cook, A.R.; Lim, J.T.; Sun, Y.; Dickens, B.L. (2020) *A Systematic Review of COVID-19 Epidemiology Based on Current Evidence*. J. Clin. Med., 9, 967.

[25] Pedauga, L., Sáez, F., & Delgado-Márquez, B. L. (2021). Macroeconomic lockdown and SMEs: the impact of the COVID-19 pandemic in Spain. *Small Business Economics*, 1-24. https://doi.org/10.1007/s11187-021-00476-7

[26] Roson, R., & van der Voorst, C. (2021). The COVID crumbling of tourism in Andalusia: an assessment of economic and environmental consequences.

[27] Secretaría de Turismo; Subsecretaría de Planeación y Política Turística (2020) Resultados de la Actividad Turística Abril 2020. Recuperado de: https://www.datatur.sectur.gob.mx/SitePages/versionesRAT.aspx

[28] Shevchenko, H., Petrushenko, M., Burkynskyi, B., Khumarova, N., & Kodzhebash, A. (2021). Input-output analysis of recreational assets within the inclusive sustainable development in Ukraine. *Entrepreneurship and Sustainability Issues*, 8(3), 90. https://doi.org/10.9770/jesi.2021.8.3(5).

[29] Schultz, S. (1976). *Intersectoral comparison as an approach to the identification of key sectors*. En K. R. Polenzke y J. V. Skolka (eds.), Advances in Input-Output Analysis. Cambridge: Ballinger.