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Interdependence Between the Tourist Regions of Sergipe, Brazil

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Abstract. We constructed an interregional input-output system for the tourist regions of Sergipe and identified the contribution of Tourism Characteristic Activities (TCAs) to the state's economy. It is the first system built for tourist regions in Brazil that disaggregates tourism activities by sector and region, representing a novel approach in Brazilian literature. By measuring the weight of tourist activities, we avoid overestimating tourism in the regional economy. Researchers can use this method for countries and regions that do not have a Tourism Satellite Account. The main results estimate that TCAs in Sergipe accounted for 1.53% of the state's gross value added (GVA) in 2015, 3.7 times lower when we do not properly disaggregate the tourism activities. The Polo Costa dos Coqueirais stands out among the tourist regions, particularly regarding the distribution of TCAs' GVA within the state. Tourist road transportation is considered a key sector in all tourist regions.

Key words: tourist activities, input-output, regional planning, Sergipe

JEL classification: C67; R15; Z32

1 Introduction

Recent years have begun to show a scenario of world recovery in tourist activity, which had been severely affected by the COVID-19 pandemic. In 2019, according to the World Travel & Tourism Council's annual Economic Impact Report (EIR) data, tourism accounted for 10.3% of the world's Gross Domestic Product (GDP). In 2021 and 2022, however, this share dropped to 6.1% and 7.6%, respectively, which is still below the pre-pandemic levels. Brazil, an important tourist destination in South America, was also severely impacted by the pandemic. Ribeiro et al. (2021) estimated a 31% drop in the GDP of Brazilian tourist activities in 2020.

In this present scenario of recovery in the sector, the existence of based on concrete planning instruments is fundamental. Tourism is an important development alternative for poorer countries or regions. In Brazil, tourism has already been used explicitly as a regional development policy through PRODETUR Nacional, specifically in the Northeast

region - PRODETUR NE I and II. Studies by Haddad et al. (2013) and Ribeiro et al. (2017, 2022) show that tourism reduces regional inequalities in the country.

The scarcity of resources in poorer states, often located in peripheral regions, contributes to the fact that tourism policy is not a priority in state public management, as is the case of Sergipe, located in the Brazilian Northeast. Sergipe is the smallest state in the country in territorial terms and accounts for 4% of the Northeast GDP and 0.6% of the national GDP, respectively. Although the state has tourism potential in several segments (sun and beach, adventure, and historical-cultural), they are not fully exploited.

Constructing tools that can aid tourism planning is fundamental for tourism development. Thus, this paper aims to build an inter-regional input-output (IO) system for Sergipe's tourist regions and identify the contribution of Tourism Characteristic Activities (TCAs) to the state economy. TCAs brings together tourism-related sectors, such as transportation, accommodation and food services, travel agencies and entertainment and leisure services.

Although many studies have used the IO model to estimate the intra and inter-regional economic effects of activities associated with tourism (Polo, Valle 2008, Lee et al. 2020, Lee, Hlee 2021, Kumara et al. 2021), the evaluation of the productive and regional interdependence of TCAs has been little explored in the literature. For the Brazilian case, some studies measure the economic contribution of tourism in specific regions, but they do not consider the inter-regional interdependence of TCAs.

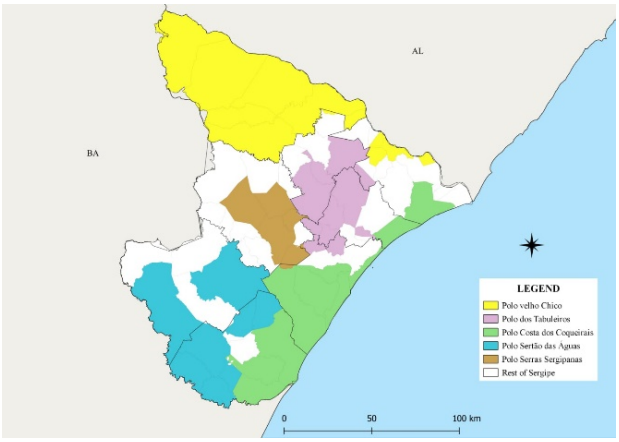
Casimiro Filho, Guilhoto (2003) built an IO model for the tourist economy in Brazil in 1999 and measured intersectoral linkages and the ability to induce investments in economic growth. Takasago, Mollo (2011) examined the potential for stimulating production growth, income generation, and employment in the Federal District. To do so, they use the IO matrix to calculate the linkage effects and the potential generators of production, employment, and tourism income, enabling a more accurate sectorial view.

Souza (2015) use an interregional IO matrix for Brazil to analyze the economic contribution of tourism in the Northeast region. Based on this, the authors seek to measure the influence of tourism on job and income generation, as well as its impact on reducing labor income inequality. Gonçalves et al. (2020) propose a method to measure the size of TCAs and their evolution in the Brazilian economy and its states between 2010 and 2015. The method consists of measuring TCAs on the supply side, using the same techniques employed to measure activities within the scope of the System of National and Regional Accounts of Brazil. They estimate a structure of weights applied to the value-added of economic activity groups.

The input-output method has been employed in various contexts in Europe. Mikulić et al. (2023), for instance, estimate the regional economic impact of tourism in Croatia. According to these authors, the reduction in economic activity due to the pandemic had a significant negative effect on GDP in all regions of Croatia. The direct effects are more pronounced in the Adriatic region, while the indirect effects are higher in the continental region. Rokicki et al. (2021) analyze different approaches to the construction of multi-regional IO tables for Austria and Pérez et al. (2009) use an inter-regional IO model to estimate the economic impact of European Union structural funds on the regions of Spain from 1995 to 1999. Ivanova et al. (2019) and Araújo Junior et al. (2020) also adopt the IO model to assess specific issues in European countries.

By employing an inter-regional IO system, the study avoids potential overestimation of the economic contribution of tourism by disaggregating TCAs. The absence of a Tourism Satellite Account (TSA) implies a failure to differentiate between expenditures by residents and non-residents within tourism-related sectors. For instance, expenditures such as meals consumed by residents while away from their usual residence are amalgamated within the accounting framework of the food sector. Consequently, this amalgamation leads to an overestimation effect on the perceived impact of tourism within the given locale.

This methodological insight not only enhances the precision of the findings for Sergipe but also provides a valuable approach for regions and countries globally facing similar challenges in accurately assessing the economic impact of tourism. The study's focus on trade flow dynamics, value-added concentration, and employment multipliers within



Source: Author's own.

Figure 1: Touristic regions of Sergipe

different tourist regions of Sergipe adds depth to the understanding of the economic intricacies of the tourism industry at a regional level.

Moreover, identifying key sectors provides tangible insights for policymakers and researchers promoting sustainable tourism development. While the research refrains from making explicit cross-regional or cross-national comparisons, its emphasis on precise regional data offers a rich foundation for future comparative studies. Additionally, the research highlights the need for tailored policies in Sergipe, leveraging regional production chains. This focus on practical applications adds depth to the broader international discourse on effective tourism planning and development, making it pertinent to a global audience of researchers, policymakers, and practitioners navigating the complexities of regional economic recovery and growth.

Despite efforts in the national literature to assess the productive interdependence of TCAs in Brazil, no study simultaneously deals with the regional and sectoral specification of tourist activities. Our main contribution, therefore, is: i) to regionally disaggregate the weight of trade flows from tourist activities and ii) to provide a tourism planning tool for Sergipe to encourage tourism development. In other words, this paper offers an unprecedented database for Brazil and Sergipe by sectorally and regionally disaggregating tourist activities. The method for estimating tourism can be replicated in countries and regions without a TSA, such as Brazil. The disaggregation of the TCAs avoids overestimating the effects of tourism on the state economy.

By building this system, regional heterogeneity is addressed. Thus, issues such as productive linkages, employment and income multipliers and spillovers can be discussed by tourist regions.

The remainder of this paper is organized as follows. Next section (Section 2) describes the tourist regions of Sergipe, based on socioeconomic data. Section 3 presents the step-by-step construction of the inter-regional IO system by tourist region and describes the databases used. Section 4 contains the results and discussion, followed by the main conclusions and policy recommendations.

2 Tourist Regions of Sergipe

Sergipe possesses considerable untapped potential in tourism. The state is subdivided into five distinct regions, each contributing to a diverse landscape encompassing sun-lit beaches, rugged mountains, and historically rich towns, as we can see in Figure 1. However, realizing this potential is contingent upon addressing existing challenges.

The city of Aracaju, the dynamic capital, anchors the bustling Polo Costa dos Coqueirais. This region represents Sergipe's economic and tourism epicenter, characterized by pristine beaches. It serves as the primary gateway to the various wonders scattered

Table 1: Tourist regions of Sergipe, 2022

Name	ID	Name	ID
Polo Costa dos Coqueirais (10)		*Polo Sertão das Águas (8)*	
Aracaju	A	Boquim	D
Barra dos Coqueiros	C	Cristinápolis	D
Estância	C	Itabaianinha	D
Indiaroba	E	Lagarto	C
Itaporanga d'Ajuda	D	Salgado	D
Nossa Senhora do Socorro	C	Tobias Barreto	C
Pacatuba	D	Tomar do Geru	D
Pirambu	D	Umbaúba	D
Santa Luzia do Itanhy	E	*Polo Velho Chico (11)*	
São Cristóvão	D	Canindé de São Francisco	D
Polo dos Tabuleiros (11)		Cedro de São João	D
Aquidabã	D	Gararu	D
Capela	D	Monte Alegre de Sergipe	D
Carmópolis	D	Nossa Senhora da Glória	D
Cumbe	E	Nossa Senhora de Lourdes	D
Divina Pastora	E	Poço Redondo	D
Maruim	E	Porto da Folha	D
Muribeca	E	Propriá	C
Nossa Senhora das Dores	D	Santana do São Francisco	E
Riachuelo	E	Telha	D
Santa Rosa de Lima	E		
Siriri	D		
Polo Serras Sergipanas (5)			
Areia Branca	E		
Frei Paulo	D		
Itabaiana	C		
Moita Bonita	E		
Ribeirópolis	E		

Source: Brasil Ministério do Turismo (2022), author's own.

throughout Sergipe. Beyond the coastal allure, Polo dos Tabuleiros and Polo Serras Sergipanas unfold a narrative of rolling hills and charming towns while the canyons of Polo Sertão das Águas, particularly the iconic Xingó Canyons, beckon adventure enthusiasts.

The Brazilian Tourism Map defined the tourist regions of Sergipe (Brasil Ministério do Turismo 2022). In general, this document guides the preparation and implementation of public policies by the Ministry of Tourism. In Brazil 2021, 338 tourist regions were defined, of which five belong to the state of Sergipe, as shown in Table 1. Only some municipalities are part of a tourist region since they must meet criteria jointly established by state agencies and the Ministry of Tourism. Municipalities are categorized (A, B, C, D, or E) due to the performance of their tourism economy, with A being the best classification and E being the worst.

Of the 75 Sergipe municipalities, 45 were included in the Tourism Map and constituted the formation of five tourist regions in the state, as we mentioned: Polo Costa dos Coqueirais, Polo dos Tabuleiros, Polo Serras Sergipanas, Polo Sertão das Águas, and Polo Velho Chico. Most municipalities in Sergipe were classified in Categories "D" and "E", which indicates that tourist activity is incipient in most of Sergipe. This is not a particularity of Sergipe since, according to Santos et al. (2018), the supply structure of labor in the tourism sector is incipient in 90.6% of Brazilian municipalities. Only the capital, Aracaju, was classified as Category "A". Table 2 shows some indicators of Sergipe's tourist regions for 2020 to understand this regionalization better.

Polo Costa dos Coqueirais is home to almost 50% of the state population and accounts for approximately 55% of Sergipe's GDP. This tourist region aggregates all the municipalities that form the Metropolitan Region of Aracaju (Aracaju, Barra dos Coqueiros, Nossa Senhora do Socorro and São Cristóvão). On the other hand, Polo dos Tabuleiros accounts for 5.19% of the state's GDP. Although Polo Velho Chico has one of the main tourist destinations in the state, the Xingó Canyons, its GDP per capita, the highest among tourist regions, is justified by the presence of the São Francisco Hydroelectric Company, as pointed out by Ribeiro, Jorge (2019).

Table 2: Indicators of the Sergipe's tourist regions, 2020[1]

Tourist regions	Population[2] (%)	GDP[3] (%)	GDP per capita (R$)
Polo Costa dos Coqueirais	48.86	54.88	21,995
Polo dos Tabuleiros	6.78	5.19	15,000
Polos Serras Sergipanas	6.92	6.59	18,654
Polo Sertão das Águas	13.11	8.64	12,908
Polo Velho Chico	9.12	12.46	26,750
Rest of Sergipe	15.20	12.23	15,755

Source: (1)Most recent year available for GDP data. (2)Population estimates for 2020, IBGE. (3)System of Nacional Accounts, IBGE. Author's own.

Despite these unique offerings, several municipalities in Sergipe remain relatively unnoticed, categorized as "developing" or "emerging" concerning tourism infrastructure. This pattern reflects a broader nationwide trend, emphasizing the necessity for strategic investments to unlock the latent potential of these inland regions. An additional impediment lies in accessibility challenges. While Aracaju boasts an international airport, venturing into the interior entails navigating winding roads and limiting public transportation options. Notwithstanding these obstacles, Sergipe finds itself at a pivotal juncture. Its landscapes, culture, and authentic experiences hold substantial allure for discerning travelers. Prioritizing accessibility, endorsing responsible development practices, and adeptly showcasing its hidden treasures could herald a transformative chapter in Sergipe's tourism narrative.

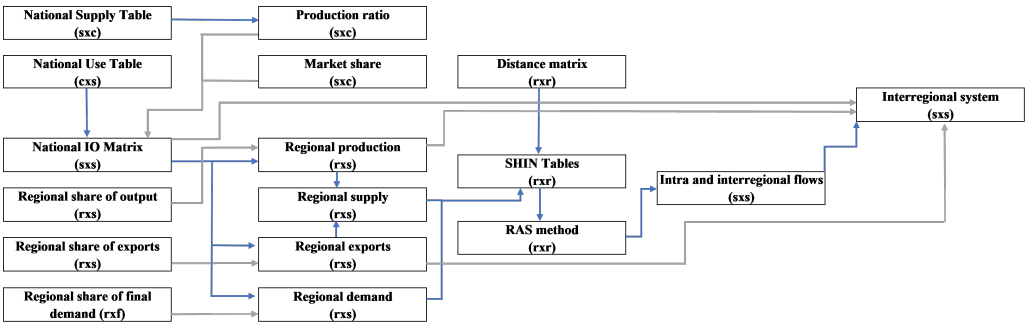
3 Inter-Regional Input-Output System for Tourist Regions, Databases, and Indicators

The construction of the interregional system used the *Interregional Input-Output Adjustment System* – IIOAS method, widely employed in the international literature for several countries worldwide, such as Brazil (Haddad et al. 2017), Egypt (Haddad et al. 2016), Greece (Haddad et al. 2020a), Indonesia (Hulu, Hewings 1993), and Mexico (Haddad et al. 2020b). The IIOAS is a hybrid method that blends data provided by official agencies, such as the Brazilian Institute of Geography and Statistics (IBGE, Portuguese acronym), with non-census techniques for estimating unavailable information. The key advantages of IIOAS lie in its alignment with the national IO matrix data and the flexibility of its regionalization process, which can be applied to any country that publishes its national Supply and Use Tables (SUTs) and provides a system of sectoral regionalized information (Haddad et al. 2015).

The IIOAS method is recommended in contexts where statistical information is limited. Nonetheless, the method demonstrates adherence, consistency, and robust results. In the absence of an official IO matrix for the state of Sergipe, we use the latest official Brazilian IO matrix for the base year 2015, which comprises 67 sectors (or industries) and 127 commodities (IBGE 2018), to generate an interregional system that includes the Sergipe's tourist regions.

The Brazilian IO matrix is disaggregated according to sectoral production in Sergipe and the rest of Brazil. In other words, input usage, consumption of final goods, and value-added payments in Sergipe are generated as components parts of the national economy. This approach allows the construction of a Sergipe-specific matrix with unique characteristics regarding technical coefficients and production multipliers. Furthermore, due to the scarcity of regional information for all activities, it was necessary to reduce the number of sectors to 59, as shown in Appendix, Table A.1. Figure 2 summarizes the stages of the IIOAS method.

The first column presents the data required for constructing the interregional system, i.e., the SUTs of Brazil and the regional shares of production and final demand vectors. From the second column onward, the estimation process stages are depicted. After constructing the regional vectors, the regional trade matrices are estimated based on the following steps:



Source: Author's own.

Note: The subscripts s, c, r, and f mean sectors, commodities, regions, and final demand components, respectively.

Figure 2: Steps of the IIOAS method

Step 1 Organizing regional shares of production and final demand components using municipal data from the state of Sergipe and the rest of Brazil (see Appendix, Tables A.2 and A.3).

Step 2 Estimating the domestic sales of each industry by region (DOM_Sales), which can be done by excluding respective exports (**x**) and stock variation (**sv**) from the corresponding gross production vector (**go**), that is:

$$\begin{aligned} DOM\_Sales_{ix1}^{R} = \mathbf{go}_{ix1}^{R} - \mathbf{x}_{ix1}^{R} - \mathbf{sv}_{ix1}^{R} \\ \forall R = 1, \ldots, 7; \quad \forall i = 1, \cdots, 59 \end{aligned} \tag{1}$$

where i refers to a given industry, and R represents a certain region of the state of Sergipe or the rest of the country.

Step 3 Estimating the total demand for each domestic (**dom_dem**) and imported goods (**imp_dem**) in each region if the demand structure of respective users follows the preference patterns of national demand.

$$\begin{aligned} \mathbf{dom\_dem}_{ix1}^{R} = \sum_{j=1}^{59} \mathbf{IC}_{ixj}^{R,DOM} + \mathbf{gfcf}_{ix1}^{R,DOM} + \mathbf{hc}_{ix1}^{R,DOM} + \mathbf{ge}_{ix1}^{R,DOM} \\ \forall i = 1, \cdots, 59; \quad \forall R = 1, \cdots, 7 \end{aligned} \tag{2}$$

$$\begin{aligned} \mathbf{imp\_dem}_{ix1}^{R} = \sum_{j=1}^{59} \mathbf{IC}_{ixj}^{R,IMP} + \mathbf{gfcf}_{ix1}^{R,IMP} + \mathbf{hc}_{ix1}^{R,IMP} + \mathbf{ge}_{ix1}^{R,IMP} \\ \forall i = 1, \cdots, 59; \quad \forall R = 1, \cdots, 7 \end{aligned} \tag{3}$$

Here j refers to a given input, **IC** refers to intermediate consumption flows, **gfcf** refers to gross fixed capital formation, **hc** household (consumption expenditure), and **ge** refers to government expenditure.

Step 4 Estimation of trade matrices representing the transactions of each commodity between origin and destination for each industry (intrasectoral flows), the so-called SHIN matrices.

The first step in obtaining the SHIN (share) tables, based on Haddad et al. (2020b), is the generation of diagonal cells (intraregional submatrices) corresponding to commodity flows using the following equation:

Table 3: Value of the term $F(i)$ for the sectors of the IO matrix, 2015

Type	Criterion	$F(i)$	Sectors (No.)
Tradable	$\frac{DOM\_Sales_c}{\mathbf{go}_c} \leq 0.99$	0.5	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 33, 35, 36, 37, 38, 39, 40, 41, 43, 44, 46, 47, 48, 49, 50, 57
Non-tradable	$\frac{DOM\_Sales_c}{\mathbf{go}_c} > 0.99$	0.9	14, 30, 31, 32, 34, 42, 45, 51, 52, 53, 54, 55, 56, 58, 59

Source: Author's own, based on Haddad et al. (2020b).

Table 4: Distance matrix (in km) between the regions of the interregional system, 2015

Code	Region name	Reference point (city)	Region code R1	R2	R3	R4	R5	R6	R7
R1	Polo Costa dos Coqueirais	Aracaju	0.0	48.6	55.8	79.3	196	38.8	2,161
R2	Polo dos Tabuleiros	Carmópolis	49.6	0.0	73.6	110	160	12.7	2,191
R3	Polo Serras Sergipanas	Itabaiana	56.3	73.4	0.0	40	140	62.3	2,164
R4	Polo Sertão das Águas	Lagarto	79.9	111	41.1	0.0	179	101	2,124
R5	Polo Velho Chico	Canindé São Francisco	195	160	141.0	179	0.0	158	2,237
R6	Rest of Sergipe	Rosário do Catete	39	12.4	61.7	99.4	158	0.0	2,181
R7	Rest of Brasil	São Paulo	2,156	2,187	2,159	2,120	2,232	2,177	0.0

Source: Author's own based on information from Google Maps.

$$SHIN^1_{(i,d,d)} = \min\left\{\frac{DOM\_Sales_{(i,d)}}{DOM\_Dem_{(i,d)}}, 1\right\} * F(i) \tag{4}$$

In equation (4), d represents any of the 6 regions of the state of Sergipe or the rest of the country, where sales and consumption of each good occur. The term $F(i)$ defines the pattern of international trade for goods (sectors), with values closest to 1 indicating non-tradable sectors or "local goods". Table 3 shows the values used. As expected, most non-tradable sectors are service activities.

In equation (5), $o = 1, \ldots, 7$ and $d = 1, \ldots, 7$ represent, respectively, origin and destination regions, but for the case where $o \neq d$. With this step we obtain the interregional submatrices (interregional flows). the interregional submatrices (interregional flows).

$$\begin{aligned}\mathbf{SHIN^2}_{(c,o,d)} = & \\ & \left\{\frac{1}{\left(dist_{(i,d)}\right)^2} \cdot \frac{DOM\_Sales_{(i,o)}}{\sum_{k=1}^{7} DOM\_Sales_{(i,k)}}\right\} \times \\ & \left\{\frac{1 - SHIN_{(i,d,d)}}{\sum_{j=1,j\neq 1}^{7}\left[\frac{1}{\left(dist_{(j,d)}\right)^2} \cdot \frac{DOM\_Sales_{(i,j)}}{\sum_{k=1}^{7} DOM\_Sales_{(i,k)}}\right]}\right\}\end{aligned} \tag{5}$$

This means that for each sector there is a proportional matrix (SHIN table) to distribute the total value of trade (sales and purchases) among all regions. Table 4 shows the distance matrix ($dist_{j,d}$), which refers to the road distance in kilometers between origin and destination, where the reference point for each region is the municipality with the highest GDP in 2015.

Step 5 The calculation of intraregional and interregional flow matrices ("initial values") between any combination of o and d is expressed in equations (6) and (7):

$$\mathbf{TRADE_1} = \mathbf{SHIN}^1_{(i,d,d)} * \mathbf{dom\_dem}_{(i,d)} \tag{6}$$

$$\mathbf{TRADE}_2 = \mathbf{SHIN}^2_{(i,o,d)} * \mathbf{dom\_dem}_{(i,d)} \tag{7}$$

Step 6 Balancing the trade matrices to equate the supply and demand of each commodity using the bi-proportional adjustment method.

Given that the construction of the inter-regional system requires data from different statistical sources, a system balancing procedure is performed, which was carried out using the bi-proportional adjustment method (RAS[1]), ensuring consistency and balance between supply and demand.

Step 7 Finally, the combination of transactions within and between the different regions of the sample enables the generation of an inter-regional system related to the trade of intermediate goods.

3.1 Databases

We obtained information on sectoral production from different municipal data sources. For the agriculture sector, the value of production from temporary and permanent crops is aggregated directly from the Municipal Agricultural Production Survey (PAM, Portuguese acronym) (IBGE 2015a) for the year 2015. For the livestock sector, the value of animal production is considered from the Municipal Livestock Survey (PPM, Portuguese acronym) of 2015 (IBGE 2015c). For the forestry production sector, the values of production in silviculture and plant extraction are combined from the Plant Extraction Production Survey in 2015 (IBGE 2015b). For the remaining 56 productive sectors, regional shares are measured using the following proxy variables: (i) wages paid to formal workers and (ii) wages paid to formal and informal workers. The choice of proxy variable is made based on the characteristic of each sector, with information from the Annual Employment Information Report (RAIS, Portuguese acronym) for industrial activities and microdata from the 2010 Demographic Census (IBGE 2011) for the service sectors (see Appendix, Table A.2).

A new regional distribution is organized to represent workforce employment in each sector. This new approach allows sectoral employment per production unit to be flexible and not bound to a fixed rate, as established in the 2015 Brazilian IO matrix. In other words, a given sector employs proportionally depending on the peculiarities of each region. Due to the scarcity of municipal data in primary sector surveys, the employment distribution follows the regional share of production in corresponding activities. We use the number of active employment contracts as of December 31, 2015, available in RAIS (MTE 2023) for industrial activities. For service sectors, the total number of employees, both with and without formal contracts, is estimated using microdata from the 2010 Demographic Census.

For government consumption expenditures, we use the participation of each tourist region in the value-added of the public administration in Sergipe. To do this, we aggregate the municipal values provided at the municipality level by IBGE (2017) (see Appendix, Table A.3).

Given the unavailability of other proxy variables at the municipal level, the regional share of the remaining macroeconomic aggregates follows the regional distribution of sectoral production. To do this, we adopted new assumptions that gross capital formation, household consumption, and consumption of nonprofit institutions serving households (NPISH) are proportional to regional production in monetary terms.

The data on foreign trade for tourist regions is obtained from the Federal Government's Comex Stat. In this case, it is necessary to reconcile the commodities classified under the Harmonized System Code (HS4) with the 127 commodities in the 2015 IO matrix. The sectoral regionalization is prepared by applying the proportions of each commodity's exports to the weighted values of exports in the matrix. For commodities in the IO matrix for which data is not available in Comex Stat, the total export value of each commodity is multiplied by the share of each region in total output.

However, the values provided in Comex Stat consider the municipality of the exporting company rather than the municipality of origin of the commodities. For the state of Sergipe, where commodity distribution varies among regions, the use of such data leads

[1]Please see Miller, Blair (2022), chapters 9 and 10.

Table 5: Weight for the disaggregation of TCAs in Sergipe, December 2015

TCAs	Sergipe	Brazil
Food services	0.22	0.27
Water transportation	0.00	0.10
Air transportation	0.95	0.83
Travel agencies	0.83	0.78
Culture and leisure	0.15	0.04
Accommodation	0.86	0.78
Non-metropolitan land transportation	0.21	0.26

Source: IPEA.

to significant distortions in the interregional system. For example, the Polo Costa dos Coqueirais accounted for 89.3% of agricultural exports in 2015 while being responsible for only 15.5% of the state's total output. Considering these issues, Haddad et al. (2016, 2017, 2020a,b) suggest relying on the regional distribution of sectoral production.

For the identification of tourism-related activities (TCAs) in Brazil, we use the study "Economia do Turismo - Uma Perspectiva Macroeconômica 2003–2009" (IBGE 2012). According to this study, TCAs accounted for 3.6% of the country's gross value added in 2003. Moreover, tourism comprises the following activities: i) restaurants and accommodation services, ii) passenger transportation, iii) travel agencies and tour operators, and iv) recreational and entertainment services. Matching this information with the IO matrix, we identify six TCAs: S34 - Land transportation; S35 - Water transportation; S36 - Air transportation; S38 - Accommodation; S39 - Food services; S57 - Artistic, creative, and entertainment activities; and S50 - Other administrative and support services. The last activity includes Travel Agencies.

However, given the absence of a TSA in Brazil and Sergipe, using these sectors directly without any statistical treatment would overestimate the weight of tourism activities in the economy. Thus, it is necessary to disaggregate these sectors' TCAs. Based on information from the wage mass of RAIS, Gonçalves et al. (2020) constructed weights for the disaggregation of TCAs in Brazil. According to these authors, the weights had low variability between 2010 and 2015. For the state of Sergipe, the Institute of Applied Economic Research (IPEA, Portuguese acronym) provided monthly sectoral weights for 2015, as shown in Table 5. In other words, these weights represent the size of tourism in each TCA.

Due to minor weight variations throughout 2015, we consider the weight for December. It can be observed that Air transportation, Accommodation, and Travel agencies have the highest weights, with 95%, 86%, and 83%, respectively, of these sectors corresponding to tourism activities. On the other hand, sectors such as Culture and leisure, Food Services, and Non-metropolitan land transportation have the lowest weights. The Water transportation sector will not be considered as its weight in Sergipe was zero. Based on these weights, the trade flows of the corresponding sectors in the IO matrix were disaggregated. Thus, the matrix now recognizes six additional tourism sectors: Tourist land transportation, Tourist air transportation, Tourist accommodation, Tourist food services, Professional tourist services (travel agencies), and Artistic, creative, and entertainment tourist activities (culture and leisure). The analyzes in the results section (Section 4) will refer to these activities.

3.2 Indicators

To structurally evaluate the TCAs in the tourist regions of Sergipe, we calculate the simple production and employment multipliers and the backward-forward indexes. To define these indices, the starting point is the solution of the IO model, formally expressed as:

$$\mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\,\mathbf{y} \tag{8}$$

where x is the output vector, $\mathbf{L} = (\mathbf{I} - \mathbf{A})^{-1}$ is the Leontief Inverse matrix, in which $\mathbf{I}$ is an Identity matrix, $\mathbf{A}$ is the Technological matrix and $\mathbf{y}$ is the final demand vector.

Table 6: GVA regional distribution of TCAs in Sergipe, 2015

Tourist activities	Polo Costa dos Coqueirais	Polo dos Tabuleiros	Polo Serras Sergipanas	Polo Sertão das Águas	Polo Velho Chico	Rest of Sergipe
Tourist land transportation	69.1%	6.5%	7.1%	6.7%	4.6%	6%
Tourist air transportation	100%	0%	0%	0%	0%	0%
Tourist accommodation	83.6%	1.1%	0.9%	2.8%	7.9%	3.7%
Tourist food services	76.9%	1.7%	6.4%	6.9%	3.3%	4.7%
Professional tourist services	91.3%	0.2%	4.2%	0.9%	2.7%	0.7%
Artistic, creative, and tourist entertainment activities	78.1%	0.8%	4.6%	7.5%	2.7%	6.3%

Source: Author's own based on IO matrix.

The simple production and employment multiplier of sector j can be defined, respectively, as $\mathbf{m(o)_j} = \sum_{i=1}^{n} l_{ij}$ and $\mathbf{m(h)_j} = \sum_{i=1}^{n} a_{n+1,i} l_{ij}$, in which l_{ij} is the Leontief inverse elements, and $a_{n+1,i}$ is the employment coefficient, that is, the ratio between employment and the output in sector i.

The indices of Rasmussen (1958) and Hirschman (1958) measure the degree of backward and forward linkages of a given productive structure. The indices are expressed by a ratio between the average of the impacts of the sector and the total average of the economy, that is:

$$U_{oj} = \frac{\frac{1}{n} L_{oj}}{\frac{1}{n^2} \sum_{i=1}^{n} L_{oj}} \tag{9}$$

$$U_{io} = \frac{\frac{1}{n} L_{io}}{\frac{1}{n^2} \sum_{j=1}^{m} L_{io}} \tag{10}$$

where U_{oj} is the backward linkage (BL), and U_{io} is the forward linkage (FL), n is the number of sectors. The sector is considered a key sector when it presents both indices above one and, therefore, when it has intermediate purchases and sales above the economy average.

4 Results and Discussion

The first three tables (Tables 6, 7, 8) provide an exploratory analysis of the inter-regional system to assess the generation of value-added and the regional composition of trade flows between the tourist regions of Sergipe. We estimated that tourist activities accounted for only 1.53% of the state GVA in 2015. IPEA estimated the weight of tourism in the Northeast region and Brazil at 2.1% and 2.2%, respectively, considering occupation data in December 2014. When considering wages in the formal labor market, Gonçalves et al. (2020) estimated at 3.02% the weight of TCAs in the total GVA of Sergipe in 2015. Without the disaggregation of TCAs from the coefficients shown in Table 5, the weight of the "tourism sector" in the total GVA of Sergipe would be overestimated by 3.7 times, that is, 5.6%.

Table 6 presents the GVA distribution of the TCAs in Sergipe's tourist regions. We can see an intense concentration in the Polo Costa dos Coqueirais, which accounts, on average, for 83.2% of the value-added generation of TCAs within the state of Sergipe. Except for the Polo Costa dos Coqueirais, the GVA for Tourist land transportation has a more homogeneous distribution among the other tourist regions. The only airport in Sergipe is in the capital, Aracaju, which explains the generation of 100% of GVA for Tourist air transportation in the Polo Costa dos Coqueirais.

Tables 7 and 8 show the share of trade flows among the tourist regions of Sergipe, the rest of Sergipe, and the rest of Brazil based on the origin of purchases and destination of intermediary sales, respectively. We highlighted the intra-regional flows on the main diagonal: purchases and sales made within the region.

The Polo dos Tabuleiros and the Polo Costa dos Coqueirais have the highest degree of self-sufficiency among the tourist regions of Sergipe since 14.7% and 12.7% of their

Table 7: Share of the origin of trade flows by tourist region of Sergipe, 2015

	Regions	R1	R2	R3	R4	R5	R6	R7
R1	Polo Costa dos Coqueirais	12.7%	6.8%	7.0%	3.5%	0.8%	12.2%	0.4%
R2	Polo dos Tabuleiros	0.3%	14.7%	0.1%	0.0%	0.0%	3.4%	0.0%
R3	Polo Serras Sergipanas	0.2%	0.1%	9.4%	0.6%	0.1%	0.2%	0.0%
R4	Polo Sertão das Águas	0.2%	0.1%	0.7%	5.6%	0.1%	0.1%	0.0%
R5	Polo Velho Chico	0.0%	0.1%	0.1%	0.1%	6.4%	0.0%	0.0%
R6	Rest of Sergipe	4.1%	6.2%	0.5%	0.3%	0.1%	7.6%	0.1%
R7	Rest of Brazil	82.5%	72.0%	82.2%	90.0%	92.5%	76.5%	99.4%

Source: Author's own based on IO matrix.

Table 8: Share of the trade flows' destination by tourist region of Sergipe, 2015

	Regions	R1	R2	R3	R4	R5	R6	R7	Total
R1	Polo Costa dos Coqueirais	12.3%	0.3%	0.3%	0.3%	0.1%	1.9%	84.9%	100%
R2	Polo dos Tabuleiros	8.0%	17.0%	0.1%	0.1%	0.1%	15.2%	59.6%	100%
R3	Polo Serras Sergipanas	5.0%	0.1%	9.5%	1.0%	0.1%	0.6%	83.8%	100%
R4	Polo Sertão das Águas	2.4%	0.1%	0.5%	6.6%	0.1%	0.3%	90.1%	100%
R5	Polo Velho Chico	0.5%	0.0%	0.1%	0.1%	6.3%	0.1%	92.9%	100%
R6	Rest of Sergipe	20.4%	1.3%	0.1%	0.1%	0.0%	6.1%	71.9%	100%
R7	Rest of Brazil	0.4%	0.0%	0.0%	0.0%	0.0%	0.1%	99.4%	100%

Source: Author's own based on IO matrix.

purchases and 17% and 12.3% of their sales, respectively, have region itself as origin and destination (see Table 7). Sergipe is the smallest state in Brazil, so we can see the substantial importance that the rest of Brazil has in the composition of trade flows for all the tourist regions in the state.

The origin of purchases from the other tourist regions (R2 to R5), except for those originating in the region itself, is greater in the Polo Costa dos Coqueirais than the sum of purchases originating in the other regions of Sergipe. The Polo Velho Chico (92.5%) and the Polo Sertão das Águas (90%) have the greatest dependence on the rest of Brazil about the origin of their purchases.

The relative importance within the state of Sergipe of the Polo Costa dos Coqueirais also appears in the sales' destination, as shown in Table 8. The Polo Tabuleiros is the tourist region that proportionally sells fewer inputs and goods to the rest of Brazil, whose region accounts for 59.6% of the destination of its intermediary sales.

Table 9 presents the simple production multipliers by TCA and tourist regions in Sergipe. As it is an inter-regional system, these multipliers are broken down into intra (region itself), inter (spillover effect), and total (sum of the two previous ones). The last row of the table shows the regional multipliers, which consider all economic sectors per region. A significant advantage of these multipliers is the possibility of explicitly measuring the spillover effect to other regions, which can help in elaborating and implementing tourism policies in Sergipe with a focus on regional production chains. Moreover, Fleischer, Freeman (1997) warn about the importance of considering the interactions of multiregional models not to underestimate the multiplier effects of tourism.

The highest regional production multipliers are from the Polo dos Tabuleiros and the Polo Costa dos Coqueirais. For the first one, for every variation of $1 in its final

Table 9: Production multiplier by tourist activity and tourist region of Sergipe, 2015

Tourist activities	Polo Costa dos Coqueirais			Polo dos Tabuleiros			Polo Serras Sergipanas			Polo Sertão das Águas			Polo Velho Chico			Rest of Sergipe		
	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total
Tourist land transportation	1,07	0,88	1,95	1,09	0,90	1,98	1,08	0,91	1,99	1,04	0,94	1,99	1,02	0,97	1,99	1,04	0,91	1,94
Tourist air transportation	1,03	1,06	2,09	1,03	1,09	2,12	1,02	1,12	2,13	1,01	1,12	2,14	1,01	1,14	2,15	1,02	1,05	2,07
Tourist accommodation	1,06	0,64	1,70	1,05	0,66	1,71	1,04	0,67	1,70	1,02	0,68	1,70	1,04	0,67	1,70	1,03	0,67	1,70
Tourist food services	1,03	0,83	1,85	1,03	0,83	1,87	1,03	0,83	1,86	1,02	0,84	1,86	1,01	0,86	1,87	1,02	0,84	1,86
Professional tourist services	1,02	0,96	1,98	1,03	0,93	1,96	1,02	0,96	1,98	1,01	0,94	1,95	1,01	0,99	2,00	1,03	0,95	1,97
Artistic, creative, and tourist entertainment activities	1,04	0,55	1,60	1,02	0,58	1,60	1,02	0,58	1,60	1,01	0,59	1,60	1,02	0,58	1,60	1,01	0,58	1,60
Regional multipliers	**1,06**	**0,63**	**1,68**	**1,06**	**0,62**	**1,69**	**1,04**	**0,57**	**1,61**	**1,02**	**0,64**	**1,67**	**1,02**	**0,58**	**1,60**	**1,03**	**0,65**	**1,68**

Source: Author's own based on IO matrix.

Table 10: Employment multiplier by tourist activity and tourist region of Sergipe, 2015

Tourist activities	Polo Costa dos Coqueirais			Polo dos Tabuleiros			Polo Serras Sergipanas			Polo Sertão das Águas			Polo Velho Chico			Rest of Sergipe		
	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total
Tourist land transportation	16	5	21	16	5	21	22	5	27	27	5	32	26	5	31	26	5	31
Tourist air transportation	3	6	9	0	6	6	0	6	6	0	6	6	0	7	7	0	6	6
Tourist accommodation	17	6	23	22	6	28	40	6	46	32	6	38	22	6	28	28	6	34
Tourist food services	24	7	31	45	7	52	28	7	35	38	7	45	50	8	58	54	7	61
Professional tourist services	7	7	14	11	7	18	9	7	16	24	7	31	8	7	15	29	7	36
Artistic, creative, and tourist entertainment activities	36	4	40	64	4	68	60	4	64	80	4	84	84	4	88	87	4	91
Regional multipliers	**9**	**6**	**16**	**13**	**6**	**19**	**15**	**6**	**21**	**13**	**6**	**20**	**18**	**6**	**23**	**9**	**6**	**15**

Source: Author's own based on IO matrix.

demand, the entire economy would generate $1.68, with $1.06 in the region itself, and $0.63 would leak to other regions. The lowest regional leakage effect is from the Polo Serras Sergipanas (0.57) and the highest from the Polo Sertão das Águas (0.64).

From the sectoral point of view, the interregional multipliers differ more among Sergipe's tourist regions when compared to the total multipliers, which are more similar across regions. For instance, the simple production multiplier of Tourist land transportation varies between 1.94 and 1.99 between tourist regions. It means that for each variation of $ 1 in its final demand, the economy would produce between $ 1.94 and $ 1.99 depending on the region considered. However, the spillover effect (inter multiplier) varies between 0.88 and 0.97. For each variation of $ 1 in the final demand of Tourist land transportation in Polo dos Tabuleiros, for instance, the entire economy would have to produce $ 1.98 to meet this variation, with $ 1.09 being produced in the region itself and $ 0.90 would be leaked to other regions.

The highest total production multiplier in all tourist regions, including the above regional multiplier, is the Tourist air transportation, with values ranging between 2.07 and 2.15. However, in all tourist regions, this sector has a strong spillover effect (inter). For Polo Velho Chico, for example, for every $ 1 variation in the final demand of this sector, the entire economy would need to produce $ 2.15, but only $ 1.01 would be in the locality itself, and $ 1.14 would leak to other regions. According to Souza (2015), the tourism sector had a production multiplier 1.31 in the Brazilian Northeast.

Table 10 presents the simple employment multipliers by TCA and tourist region in Sergipe. The last row of the table shows the regional multipliers, which consider all economic sectors. Generally, there is greater regional variability in the total multiplier and a smaller one in the inter-regional employment multiplier. Furthermore, the spillover effect (inter) is low in all ACTs in all tourist regions since the activity is developed locally. Ribeiro et al. (2017) pointed out a similar result when estimating the impact of tourist spending in the Brazilian Northeast. These authors observed a low effect of job leakage outside the region. These results highlight the comparative advantage of tourism in the Brazilian Northeast, driven by the region's natural resources and development potential, as corroborated by Ribeiro et al. (2022).

The highest employment multiplier among the TCAs is that of Artistic, creative, and touristic entertainment activities, varying between 40 and 89 among the tourist regions, even well above the regional multipliers. This means that, for every $ 1 million variation in the final demand of this sector, between 40 and 89 jobs would be created directly and indirectly depending on the region. For each variation of R$ 1 million in the final demand of this sector in Polo Velho Chico, for instance, 89 jobs would be created throughout the economy, 84 of which would be in the region itself, and 4 jobs would spillover to other regions.

Except for the Polo Costa dos Coqueirais, the employment multiplier of Tourist air transportation is zero in all tourist regions. This means that all jobs generated due to variations in the final demand of this sector would be generated outside the respective regions. This result is consistent with what has already been shown in Table 6. The employment multiplier of Tourist food services is also relevant across regions. Its spillover effect of Polo Velho Chico is slightly higher than the economy average. According to Souza (2015), the main activities that contributed to the generation of employment in the Brazilian Northeast were Accommodation, road transportation of passengers, and

Table 11: HR indexes of tourist activity by tourist region of Sergipe, 2015

Tourist activities	Polo Costa dos Coqueirais		Polo dos Tabuleiros		Polo Serras Sergipanas		Polo Sertão das Águas		Polo Velho Chico		Rest of Sergipe	
	BL	FL	BL	FL	BL	FL	BL	FL	BL	FL	BL	FL
Tourist land transportation	**1,023**	**1,136**	**1,035**	**1,209**	**1,040**	**1,202**	**1,022**	**1,116**	**1,003**	**1,044**	**1,010**	**1,044**
Tourist air transportation	0,982	0,956	0,978	0,951	0,981	0,965	0,990	0,978	0,986	0,980	0,993	0,972
Tourist accommodation	**1,012**	0,958	0,995	0,953	**1,000**	0,966	**1,003**	0,980	**1,016**	0,982	0,997	0,975
Tourist food services	0,983	0,957	0,982	0,952	0,989	0,968	0,996	0,980	0,992	0,981	0,989	0,973
Professional tourist services	0,975	0,958	0,978	0,951	0,988	0,966	0,991	0,978	0,987	0,981	0,999	0,972
Artistic, creative, and tourist entertainment activities	0,997	0,956	0,974	0,951	0,983	0,965	0,992	0,979	**1,000**	0,980	0,985	0,972

Source: Author's own based on IO matrix.

food services.

Only Tourist air transportation and Professional tourist services have shown employment multipliers smaller than the regional multiplier (considering all economic sectors) in all the tourist regions, except for the last sector in Polo Sertão das Águas.

Table 11 presents the results of the Hirschman-Rasmussen (HR) indices by TCA and Sergipe's tourist regions. We have highlighted in red and blue, respectively, the above-average forward and backward linkages. Tourist land transportation is the only TCA ranked as a key sector across all tourist regions, i.e., both indices above one. Prado (1981) a nd Guilhoto et al. (2005) state that key sectors should be considered strategic to stimulate economic growth. A similar result for the Brazilian capital (Federal District) was found by Takasago, Mollo (2011). They identified that the road transportation and intercity tourism sector was also considered a key sector along with the recreational and cultural activities sector.

In general, backward linkages are greater than forward linkages, which means that tourism activities buy more inputs from other sectors than they sell. This result is expected and consistent with previous studies carried out for Bermuda (Archer 1995), Seychelles (Archer, Fletcher 1996), China (Oosterhaven, Fan 2006), East Asia (Blake 2008), Brazil (Takasago et al. 2010), South Korea (Lee, Hlee 2021) and Indonesia (Kumara et al. 2021). This occurs because tourist activities mostly meet final demand.

The Tourist accommodation sector, according to Miller, Blair (2022) can be classified as dependent on inter-industry supply as it only presents purchases above the average for the economy ($BL > 1$) in all tourist regions, except Polo dos Tabuleiros. Most tourist activities are not strongly connected with other sectors since their intermediate purchases and sales are below average (BL and $FL < 1$). Gabriel et al. (2020) state that industrial segments are more expected to be classified as key sectors since they purchase and sell a greater diversity of activities. An example of this for the state of Sergipe is that the four key sectors, according to Ribeiro, Leite (2012), are industrial: Food and beverages, Textiles, Paper and cellulose, and Rubber and plastic.

For Brazil, Casimiro Filho, Guilhoto (2003) identified six key sectors of the tourism segment: air transportation, travel agencies, auxiliary activities to air transportation, Accommodation, restaurants, and other food service establishments. It is noteworthy, however, that these authors did not perform any statistical treatment regarding the weight of the TCAs.

Our findings offer significant socioeconomic insights for Sergipe, and it can serve as a case study for all Brazilian states and similar regions worldwide. Identifying key sectors within the tourism industry, characterized by high economic multipliers, presents an opportunity to bolster economic development. In addition, we highlight the regional dynamics of tourism activities. By acknowledging and leveraging the distinct economic contributions of different regions, regional policies can work towards reducing disparities and promoting more inclusive development.

Understanding employment multipliers across various tourism activities provides a valuable tool for crafting labor market policies. Policymakers can prioritize sectors with higher job creation potential, contributing to local and regional employment opportunities. Furthermore, the study's insights into income generation and inequality highlight the potential of tourism to play a role in addressing socioeconomic disparities. Crafting targeted policies that harness the economic benefits of tourism can contribute to reducing

income inequality and enhancing overall economic well-being across the state.

5 Conclusions

This research advances the estimation of an inter-regional IO system specified for tourist regions in Sergipe and disaggregates the tourism activities. By building this system, regional heterogeneity is addressed. Thus, issues such as productive linkages, employment and income multipliers and spillovers can be discussed by tourist regions. However, the ideal scenario is the Brazilian statistical officers' availability of the Tourism Satellite Accounts. Thus, the impacts of these activities can be estimated more precisely since, in tourist activities, only what is consumed by tourists will be considered.

The exploratory analysis revealed that TCAs accounted for only 1.53% of Sergipe's state GVA in 2015. Comparatively, the weight of tourism in the Northeast and Brazil was estimated at 2.1% and 2.2%, respectively. Furthermore, without disaggregating the TCAs from the presented coefficients, the weight of the tourism sector would be overestimated 3.7 times.

The Polo Costa dos Coqueirais was identified as the region concentrating the largest generation of GVA from the TCAs in Sergipe, corresponding to 83.2% of the state's total. Furthermore, Tourist air transportation had the highest production multiplier, varying between 2.07 and 2.15 in all regions. However, tourist regions also showed a strong spillover effect, indicating that part of the generated production is destined for other regions. As for employment multipliers, artistic and creative activities and tourist shows had the highest values. The spillover effect of jobs to other regions was low in all TCAs and tourist regions, indicating that the activity is predominantly developed locally.

Tourist land transportation was a key sector in all tourist regions of Sergipe. In general, backward linkage indices were higher than forward linkage indices, indicating that TCAs purchase more inputs from other sectors than they sell. Tourist activities would mainly meet the final demand. The Tourist accommodation sector depended on inter-industry supply, with purchases above the average in all regions except for the Polo dos Tabuleiros. Most tourist activities are not strongly connected to other sectors, as their intermediate purchases and sales are below average for the economy.

We used an unprecedented method in the Brazilian literature that disaggregates tourist activities by sector and region. In addition, with the identification of TCAs in Sergipe, it was possible to measure the spillover effect to other regions explicitly. It can be useful for elaborating and implementing tourism policies focused on regional production chains. Furthermore, researchers can replicate this method for countries and regions that, like Brazil, do not have a Tourism Satellite Account.

The main limitation of the research, however, is that the technical coefficients of disaggregated tourist activities, for example, tourist accommodation and non-tourist Accommodation, are the same. Ideally, we would have specific coefficients for each tourism sub-activity, which is only possible with the Satellite Account.

The utilization of disaggregated data from this study offers a concrete foundation for crafting targeted policies and interventions in Sergipe's tourism sector. With a detailed understanding of various TCAs' specific contributions and regional distribution, stakeholders can tailor strategies to each tourist region's unique needs and potential. This granularity in data analysis becomes instrumental for optimizing resource allocation, fostering economic growth, and a practical approach to tourism planning.

Addressing regional development disparities is imperative, as the study reveals the concentration of tourism-related economic activities. Actionable measures such as strategic infrastructure improvements, direct support for local entrepreneurial ventures, and targeted promotion of distinctive attractions must be implemented to stimulate economic growth in less-developed tourism regions. These interventions should spur economic development, reduce regional inequalities, and cultivate a more diversified and equitable tourism landscape in Sergipe. Moreover, it is essential to recognize the significance of place identity in shaping residents' perceptions and aspirations for their region's future. Residents' deep-rooted connections to Sergipe's cultural heritage and economic potential

can inform decision-making processes and foster inclusive, community-driven approaches to development and planning. Sustainable practices and specific measures should involve implementing stringent environmental regulations, fostering community engagement initiatives, and promoting eco-friendly tourism practices that resonate with residents' sense of place identity.

References

Araújo Junior IF, Jackson RW, Ferreira Neto AB, Perobelli FS (2020) European Union membership and CO2 emissions: A structural decomposition analysis. *Structural Change and Economic Dynamics* 55: 190–203. CrossRef

Archer B (1995) Importance of tourism for the economy of Bermuda. *Annals of Tourism Research* 22: 918–930. CrossRef

Archer B, Fletcher JE (1996) The economic impact of tourism in the Seychelles. *Annals of Tourism Research* 23: 32–47. CrossRef

Blake A (2008) Tourism and income distribution in East Asia. *International Journal of Tourism Research* 10: 511–524. CrossRef

Brasil Ministério do Turismo (2022) Mapa do turismo brasileiro. http://www.regionalizacao.turismo.gov.br/

Casimiro Filho F, Guilhoto JJM (2003) Matriz de insumo-produto para a economia turística brasileira: construção e análise das relações intersetoriais. *Análise Econômica* 21. CrossRef

Fleischer A, Freeman D (1997) Multiregional input-output analysis. *Annals of Tourism Research* 24: 998–1001. CrossRef

Gabriel LF, Ribeiro LCS, Jayme Jr. FG, Oreiro JL (2020) Manufacturing, economic growth, and real exchange rate: Empirical evidence in panel data and input-output multipliers. *PSL Quarterly Review* 73: 51–75

Gonçalves CCS, Faria DMP, Horta TAP (2020) Metodologia para mensuração das atividades características do turismo: Uma aplicação para o Brasil e suas Unidades da Federação. *Revista Brasileira de Pesquisa em Turismo* 14: 89–109. CrossRef

Google INC (2023) Google Maps. https://maps.google.com

Guilhoto JJM, Sonis M, Hewings GJD (2005) Linkages and multipliers in a multiregional framework: Integration of alternative approaches. *Australian Journal of Regional Studies* 11: 75–89

Haddad E, Silva V, Porsse A, Dentinho T (2015) Multipliers in an island economy: The case of the Azores. In: Batabyaland AA, Nijkamp P (eds), *The region and trade: New analytical directions*. World Scientific, 205–226. CrossRef

Haddad EA, Cotarelli N, Simonato TC, Vale VA, Visentin JC (2020a) The Grand Tour: Keynes and Goodwin go to Greece. *Journal of Economic Structures* 9. CrossRef

Haddad EA, Fernandes de Araújo I, Ibarrarán ME, Boyd R, Elizondo A, Belausteguigoitia JC (2020b) Interstate input-output model for Mexico, 2013. *Análisis Económico* XXXV: 7–43. CrossRef

Haddad EA, Gonçalves Júnior CA, O NT (2017) Matriz interestadual de insumo-produto para o Brasil: Uma aplicação do método IIOAS. *Revista Brasileira de Estudos Regionais e Urbanos* 11: 424–446

Haddad EA, Lahr ML, Elshahawany DN, Vassallo M (2016) Regional analysis of domestic integration in Egypt: An interregional CGE approach. *Journal of Economic Structures* 5: 1–33. CrossRef

Haddad EA, Porsse AA, Rabahy W (2013) Domestic tourism and regional inequality in Brazil. *Tourism Economics* 19: 173–186. CrossRef

Hirschman AO (1958) *The strategy of economic development*. Yale University Press, New Haven

Hulu E, Hewings GJD (1993) The development and use of interregional input-output models for Indonesia under conditions of limited information. *Review of Urban and Regional Development Studies* 5: 135–153. CrossRef

IBGE – Instituto Brasileiro de Geografia e Estatística (2011) Censo Demográfico Brasileiro de 2010. https://sidra.ibge.gov.br/

IBGE – Instituto Brasileiro de Geografia e Estatística (2012) *Economia do turismo: uma perspectiva macroeconômica 2003-2009*. IBGE (Coordenação de Contas Nacionais, Rio de Janeiro

IBGE – Instituto Brasileiro de Geografia e Estatística (2015a) PAM - Produção Agrícola Municipal. https://www.ibge.gov.br/estatisticas/economicas/agricultura-e-pecuaria/9117-producao-agricola-municipal-culturas-temporarias-e-permanentes.html

IBGE – Instituto Brasileiro de Geografia e Estatística (2015b) PEVS - Produção da Extração Vegetal e da Silvicultura. https://www.ibge.gov.br/estatisticas/economicas/-agricultura-e-pecuaria/9105-producao-da-extracao-vegetal-e-da-silvicultura.html

IBGE – Instituto Brasileiro de Geografia e Estatística (2015c) PPM - Pesquisa da Pecuária Municipal. https://www.ibge.gov.br/estatisticas/economicas/agricultura-e-pecuaria/9107-producao-da-pecuaria-municipal.html

IBGE – Instituto Brasileiro de Geografia e Estatística (2017) *Sistema de Contas Regionais: Brasil*. IBGE, 2015. Rio de Janeiro

IBGE – Instituto Brasileiro de Geografia e Estatística (2018) Matriz de insumo-produto: Brasi 2015l. *Contas Nacionais* 62

Ivanova O, Kancs DA, Thissen M (2019) Regional trade flows and input output data for Europe. EERI research paper series, No. 06/2019

Kumara HC, Prastyo D, Rahayu SP (2021) The impact of the Covid-19 pandemic on tourism sector in Indonesia using a structural path analysis based on inter-regional input-output matrix. *Journal of Mathematics and Mathematics Education* 11: 13–29. CrossRef

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: 4031. CrossRef

Lee H, Koo C, Chung N (2020) The economic impacts of smart tourism: Analysis using an input-output model. *Journal of Hospitality and Tourism Studies* 22: 1–12. CrossRef

MDIC – Ministério do Desenvolvimento and Indústria, Comércio and Serviços (2023) Comex stat. https://comexstat.mdic.gov.br/pt/home

Mikulić D, Keček D, Žajdela Hrustek N (2023) Effects of COVID-19 on Adriatic and Continental Croatia tourism: A regional input-output perspective. *Economic research-Ekonomska istraživanja* 36. CrossRef

Miller RE, Blair PD (2022) *Input–output analysis: Foundations and extensions* (3rd ed.). Cambridge University Press. CrossRef

MTE – Ministério do Trabalho and Emprego (2023) RAIS vínculos. https://bi.mte.gov.br/bgcaged/rais.php

Oosterhaven J, Fan T (2006) Impact of international tourism on the Chinese economy. *International Journal of Tourism Research* 8: 347–354. CrossRef

Polo C, Valle E (2008) An assessment of the impact of tourism in the Balearic Islands. *Tourism Economics* 14: 615–630. CrossRef

Prado EFS (1981) Estrutura tecnológica e desenvolvimento regional. IPE/USP, São Paulo, 230 p

Pérez J, Dones M, Llano C (2009) An interregional impact analysis of the EU structural funds in Spain (1995–1999). *Papers in Regional Science* 88: 509–530. CrossRef

Rasmussen PN (1958) *Studies in intersectoral relations*. North Holland, Amsterdam

Ribeiro LCS, Jorge MA (2019) Avaliação da qualidade de vida municipal em Sergipe. *Reflexões Econômicas* 4: 100–116. CrossRef

Ribeiro LCS, Leite APV (2012) Estrutura Econômica do Estado de Sergipe em 2006: Uma contribuição através da matriz de insumo-produto. *Revista Econômica do Nordeste* 43: 96–117. CrossRef

Ribeiro LCS, Santos GFD, Cerqueira RB, Souza KB (2021) Do income policy mitigate the economic impacts of Covid-19 on tourism in Brazil? *Economics Bulletin* 41: 2574–2579

Ribeiro LCS, Santos GFD, Takasago M (2022) Does domestic tourism reduce regional inequalities in Brazil? *Current Issues in Tourism* 26: 3255–3260. CrossRef

Ribeiro LCS, Silva EOVD, L AJRD, D SKB (2017) Tourism and regional development in the Brazilian Northeast. *Tourism Economics* 23: 717–727. CrossRef

Rokicki B, Fritz O, Horridge JM, Hewings GJ (2021) Survey-based versus algorithm-based multi-regional input–output tables within the CGE framework – the case of Austria. *Economic Systems Research* 33: 470–491. CrossRef

Santos FR, Ribeiro LCS, Silveira EJG (2018) Characteristics of tourism activities in Brazilian municipalities in 2015. *Brazilian Journal of Tourism Research* 12: 65–82. CrossRef

Souza PIA (2015) O setor de turismo na região Nordeste: Medidas e impactos a partir da matriz insumo-produto inter-regional. In: *Encontro de Economia Baiana*. Economia Regional, Salvador, 434–455

Takasago M, Guilhoto JJM, Mollo MLR, Andrade JP (2010) O potencial criador de emprego e renda do turismo no Brasil. *Pesquisa e Planejamento Econômico* 40: 431–460

Takasago M, Mollo MDLR (2011) O potencial gerador de crescimento, renda e emprego do turismo no Distrito Federal-Brasil. *Revista Turismo em Análise* 22: 445–469. CrossRef

WTTC – World Travel and Tourism Council (2020) Travel and tourism economic impact 2020. https://wttc.org/Research/Economic-Impact

A Appendix

Table A.1: Sectoral aggregation

Code	Sector's name	Number	New name
1800	Printing and reproduction of recordings	18	Manufacture of furniture and various industries
3180	Manufacture of furniture and products from various industries		
2091	Manufacture of organic and inorganic chemicals, resins, and elastomers	21	Chemical manufacturing
2092	Manufacture of pesticides, disinfectants, paints, and various chemicals		
2093	Manufacture of cleaning products, cosmetics/perfumes, and personal hygiene items		
2100	Manufacture of pharmochemical and pharmaceutical products		
2500	Manufacture of metal products, excluding machinery and equipment	26	Manufacture of metal products, machinery, and equipment
2600	Manufacture of computer equipment, electronic products, and optical devices		
2700	Manufacture of electrical machinery and equipment		
2800	Manufacture of mechanical machinery and equipment		
3300	Maintenance, repair, and installation of machinery and equipment		

Source: Own elaboration based on information from IBGE (2011), **IBGE, 2016 / MISSING REFERENCE**.

Table A.2: Regional share in the sectoral production of Sergipe, 2015

No.	Sector name	R1	R2	R3	R4	R5	R6	R7
1	Agriculture, incl. support for agriculture & post-harvest activities	0.001	0.000	0.000	0.001	0.001	0.001	0.996
2	Livestock farming, incl. support for livestock farming	0.001	0.001	0.001	0.001	0.005	0.002	0.990
3	Forestry production; fishing & aquaculture	0.000	0.000	0.000	0.000	0.000	0.000	1.000
4	Extr. of coal & non-metallic minerals	0.003	0.001	0.001	0.001	0.000	0.019	0.975
5	Extr. of oil & gas, incl. support activities	0.021	0.001	0.000	0.000	0.000	0.018	0.961
6	Extr. of iron ore, incl. beneficiation & agglomeration	0.000	0.000	0.000	0.000	0.000	0.000	1.000
7	Extr. of non-ferrous metallic minerals, incl. beneficiation	0.000	0.000	0.000	0.000	0.000	0.000	1.000
8	Slaughtering & meat products, incl. dairy & fish products	0.000	0.000	0.000	0.000	0.001	0.000	0.999
9	Sugar manufacturing & refining	0.006	0.000	0.000	0.000	0.000	0.000	0.994
10	Other food products	0.006	0.000	0.000	0.002	0.000	0.000	0.992
11	Beverage manufacturing	0.005	0.000	0.000	0.000	0.000	0.000	0.994
12	Tobacco product manufacturing	0.001	0.000	0.000	0.009	0.000	0.000	0.990
13	Textile manufacturing	0.007	0.000	0.001	0.000	0.001	0.003	0.988
14	Apparel & accessory manufacturing	0.002	0.000	0.000	0.000	0.000	0.000	0.997
15	Footwear & leather goods manufacturing	0.000	0.000	0.000	0.005	0.000	0.005	0.990
16	Wood product manufacturing	0.001	0.000	0.001	0.000	0.000	0.000	0.998
17	Pulp, paper, & paper product manufacturing	0.001	0.000	0.000	0.000	0.000	0.000	0.999
18	Manufacture of furniture & various industries	0.002	0.000	0.001	0.000	0.000	0.000	0.996
19	Petroleum refining & coke ovens	0.015	0.000	0.000	0.000	0.000	0.000	0.985
20	Biofuel manufacturing	0.000	0.002	0.000	0.000	0.000	0.012	0.986
21	Chemical manufacturing	0.005	0.000	0.000	0.000	0.000	0.000	0.994
22	Rubber & plastic product manufacturing	0.001	0.000	0.000	0.001	0.000	0.000	0.999
23	Non-metallic mineral product manufacturing	0.006	0.000	0.002	0.002	0.000	0.000	0.989
24	Pig iron/ferroalloy production, steelmaking, & seamless steel tubes	0.000	0.000	0.000	0.000	0.000	0.000	1.000
25	Non-ferrous metal metallurgy & metal casting	0.000	0.000	0.000	0.000	0.000	0.000	1.000

Continued on the next page.

Table A.2: Regional share in the sectoral production of Sergipe, 2015

No.	Sector name	R1	R2	R3	R4	R5	R6	R7
26	Manufacture of metal products, machinery, & equipment	0.001	0.000	0.000	0.000	0.000	0.000	0.999
27	Manufacture of automobiles, trucks, & buses, except parts	0.000	0.000	0.000	0.000	0.000	0.000	1.000
28	Manufacture of parts & accessories for motor vehicles	0.004	0.000	0.000	0.000	0.000	0.000	0.996
29	Manufacture of other transport equipment, except motor vehicles	0.000	0.000	0.000	0.000	0.000	0.000	1.000
30	Electricity, natural gas, & other utilities	0.006	0.000	0.000	0.000	0.001	0.000	0.993
31	Water, sewage, & waste management	0.010	0.000	0.000	0.001	0.001	0.001	0.987
32	Construction	0.007	0.001	0.000	0.000	0.000	0.000	0.992
33	Wholesale & retail trade	0.004	0.000	0.001	0.001	0.000	0.001	0.993
34	Land transport	0.005	0.000	0.000	0.000	0.000	0.000	0.993
35	Water transport	0.005	0.000	0.000	0.000	0.000	0.000	0.994
36	Air transport	0.002	0.000	0.000	0.000	0.000	0.000	0.998
37	Storage, support activities for transportation, & postal services	0.003	0.000	0.000	0.000	0.000	0.000	0.996
38	Accommodation	0.007	0.000	0.000	0.000	0.001	0.000	0.992
39	Food services	0.005	0.000	0.000	0.000	0.000	0.000	0.993
40	Publishing & integrated printing	0.003	0.000	0.000	0.000	0.000	0.000	0.997
41	Television, radio, film, sound & image recording/editing activities	0.004	0.000	0.000	0.000	0.000	0.000	0.996
42	Telecommunications	0.002	0.000	0.000	0.000	0.000	0.000	0.997
43	Systems development & other information services	0.002	0.000	0.000	0.000	0.000	0.000	0.998
44	Financial intermediation, insurance, & pension funds	0.004	0.000	0.000	0.000	0.000	0.000	0.994
45	Real estate activities	0.004	0.000	0.000	0.000	0.000	0.000	0.996
46	Legal, accounting, consulting, & corporate head offices	0.004	0.000	0.000	0.000	0.000	0.000	0.995
47	Architecture, engineering, technical testing/analysis, R&D services	0.002	0.000	0.000	0.000	0.000	0.000	0.997
48	Other professional, scientific, & technical activities	0.002	0.000	0.000	0.000	0.000	0.000	0.997
49	Non-real estate rentals & management of intellectual property assets	0.009	0.001	0.000	0.000	0.000	0.000	0.989
50	Other administrative & support services	0.004	0.000	0.000	0.000	0.000	0.000	0.995
51	Surveillance, security, & investigation activities	0.006	0.000	0.000	0.000	0.000	0.000	0.993
52	Public administration, defense, & social security	0.009	0.000	0.000	0.001	0.001	0.001	0.988
53	Public Education	0.006	0.000	0.001	0.001	0.001	0.001	0.990
54	Private education	0.006	0.000	0.000	0.000	0.001	0.001	0.992
55	Public healthcare	0.005	0.000	0.000	0.000	0.001	0.000	0.994
56	Private healthcare	0.005	0.000	0.000	0.000	0.000	0.000	0.994
57	Artistic, creative, & entertainment activities	0.004	0.000	0.000	0.000	0.000	0.000	0.995
58	Associations & other personal services	0.004	0.000	0.000	0.000	0.000	0.000	0.994
59	Domestic services	0.005	0.000	0.000	0.000	0.000	0.000	0.993

Source: Own elaboration based on information from IBGE (2011, 2015a,b,c) and MTE (2023).
Note: As industrial sectors have a high formal rate, we use RAIS data, which considers only formal jobs. For services sectors we use data from Census, which take into account formal and informal jobs.

Table A.3: Regional share in the sectoral production of Sergipe, 2015

Code	Region name	Household consumption (HC)	Gross fixed capital formation (GFCF)	Government Expenditure (GE)	NPISH demand
R1	Polo Costa dos Coqueirais	0.0040	0.0040	0.0051	0.0040
R2	Polo dos Tabuleiros	0.0003	0.0003	0.0006	0.0003
R3	Polo Serras Sergipanas	0.0004	0.0004	0.0007	0.0004
R4	Polo Sertão das Águas	0.0006	0.0006	0.0014	0.0006
R5	Polo Velho Chico	0.0006	0.0006	0.0013	0.0006
R6	Rest of Sergipe	0.0008	0.0008	0.0017	0.0008
R7	Rest of Brazil	0.9933	0.9933	0.9892	0.9933
	Total	0.0040	0.0040	0.0051	0.0040

Source: Own elaboration, based on information from IBGE (2017).