

Tourism Efficiency in Mexican States by Visitor Origin: Exploring the Strategic Role of Cultural Resources

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ABSTRACT

This study analyzes the tourism efficiency of Mexican states between 2011 and 2019 through a two-stage approach. In the first stage, a Data Envelopment Analysis (DEA) model with a managerial orientation was applied to measure the capacity to transform tourist arrivals and hotel supply into overnight stays, considered as an indicator of economic impact. In the second stage, a truncated regression was used to identify the factors explaining efficiency. Results show that domestic tourism is more efficient than international tourism, reflecting a more balanced territorial distribution compared to the spatial concentration of the latter. The combination of both flows generates synergies that enhance efficiency in states that integrate cultural attractions with sun-and-beach resources. Positive factors include coastal location, the presence of Pueblos Mágicos, and the added value of arts and heritage, while GDP per capita has a negative effect. In terms of public policy, it is recommended to complement beach destinations with cultural programming and, in inland states, to strengthen heritage and performing arts, confirming the relevance of the Pueblos Mágicos network as a key tool to diversify tourism benefits.

Keywords: tourism efficiency, data envelopment analysis, mexican tourism, non-parametric models, tourism competitiveness-cultural resources.

JEL Classification: Z30, C61, L83.

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RESUMEN

Eficiencia turística en los estados mexicanos según el origen de los visitantes: explorando el papel estratégico de los recursos culturales

Este estudio analiza la eficiencia turística de los estados mexicanos entre 2011 y 2019 mediante un enfoque en dos etapas. En la primera, se aplicó un modelo de Análisis Envolvente de Datos (DEA) con orientación gerencial para medir la capacidad de transformar llegadas turísticas y oferta hotelera en pernoctaciones, consideradas como indicador del impacto económico. En la segunda, se utilizó una regresión truncada para identificar los factores que explican la eficiencia. Los resultados muestran que el turismo nacional es más eficiente que el internacional, reflejando una distribución territorial más equilibrada frente a la concentración espacial de este último. La combinación de ambos flujos genera sinergias que fortalecen la eficiencia en estados que integran atractivos culturales con recursos de sol y playa. Asimismo, se identifican factores positivos como la condición costera, la presencia de Pueblos Mágicos y el valor agregado en artes y patrimonio, mientras que el PIB per cápita presenta un efecto negativo. En política pública, se recomienda complementar la oferta de playa con programación cultural y, en estados sin litoral, fortalecer patrimonio y artes escénicas, confirmando la relevancia de la red de Pueblos Mágicos para diversificar beneficios turísticos.

Palabras clave: eficiencia turística, análisis envolvente de datos, turismo mexicano, modelos no paramétricos, competitividad turística de recursos culturales.

Clasificación JEL: Z30, C61, L83.

INTRODUCTION

The tourism sector is key to the economy of Central America and the Caribbean, and especially for Mexico (Guerron-Montero, 2010). In 2019 –the last year with information available that was not impacted by the Covid-19 pandemic– it represented about 9% of GDP, second only to manufacturing export activities¹. Likewise, Mexico stands out for the number of foreign tourists that visit it. In the same year,

¹ Statistical Report, Ministry of Tourism, Government of Mexico.

it ranked seventh in the world, with 45 million visitors. Despite this important flow of international visitors, the economic impact thereof is low: Mexico ranks sixteenth in terms of the income generated by these tourists, with a figure of over 23 billion dollars².

The dynamics followed by tourism in Mexico have attracted the attention of various researchers (Madrid & Casar, 2018). The strong concentration of international tourists at just a small number of airports (Cancun, CDMX, Puerto Vallarta, Los Cabos) and at predominantly sun and beach destinations, is part of the narrative commonly alluded to in order to explain this “weakness” of the country’s tourism sector. However, these studies fail to properly incorporate in their analyses the fact that Mexico has an important hotel infrastructure as well as cultural and natural attractions, not to mention a privileged geographic location, equivalent to that found in the main tourist powers of the world.

In this paper, we explain the structural “weakness” of Mexico’s tourism sector by analyzing the productive efficiency of its capital endowment and the tourism flows it receives. For this purpose, we propose a non-parametric Data Envelopment Analysis model that evaluates the productive efficiency of the tourism sector over the period 2011–2019. The approach is based on a three-way production function model at the state level, conditioned by the type of tourism flow (domestic, international, and total). A central objective of the study is also to assess whether there is a relation between the accumulation of cultural resources and tourism efficiency, as identified in various studies (Gómez-Vega & Picazo-Tadeo, 2019; Figueroa *et al.*, 2018; Gómez-Vega *et al.*, 2021; Gómez Vega *et al.* 2024), as well as to explore whether domestic and international tourism exhibit differentiated patterns in this regard. This line of inquiry allows us to reflect on the extent to which international recognition of cultural accumulation translates into tangible economic performance within the tourism sector, and whether domestic and foreign tourists respond in similar ways to the presence of such symbolic and patrimonial capital.

Although the study of tourism efficiency is a consolidated and fruitful line of research, the specialized literature focused on tourism in Mexico has thus far failed to address it. This proposal therefore represents a novel contribution and a precedent in the field.

² UNWTO, 2020.

1. LITERATURE REVIEW

1.1. Case: Mexico

Due to the importance of the tourism industry in Mexico, many research papers study it from very different perspectives. Among them is one stream of articles that explore the impact of the tourism sector on economic growth and development in Mexico. Clancy (1999) was among the first to point out that the Mexican tourism sector should be analyzed in the same way as other sectors that are key to development (automobiles, steel, etc.). He proposed investigating it as a dependent variable and thus embracing other conditioning factors. In this line, several studies identify the strong intervention of the State and the investment of global capital as conditioning factors for the growth of the tourism sector (Clancy, 1999; Coll-Hurtado, 2016; Ruiz, 2008), as well as the influence of the North American Free Trade Agreement (Meléndez, 2010). In this regard, Brenner & Aguilar (2002) emphasize how foreign investment and state promotion responded to a localization logic that generated a strong concentration in a few sun and beach tourist destinations that have a strong international projection but little impact on local development. Recently, the effect of national and international remittances on the sector has also been highlighted (Mora-Rivera *et al.* 2019).

Another body of research explores the relationship between development and tourism from different theoretical angles, emphasizing particular processes and cases. For example, tourism impact has been analyzed in historic centers (Reyes-Aguilar *et al.*, 2021), in important international tourist centers such as Los Cabos (Cruz-Chávez *et al.*, 2016), in “magic towns” such as Huasca (Poncela, 2018a), and in the country’s large metropolises, such as the city of Guadalajara (Nieves, 2018). Some works also draw comparisons with other countries, such as that of Rodríguez (2021), who compares the cases of Mexico City and Buenos Aires when analyzing the effects of the decentralization policy of tourism supply. Even works, such as Tamborini (2007), which from a labour economics perspective compare, for different cities in Mexico, the influence of the tourism sector on the integration of women into the labour market compared to other industrial sectors.

Similarly, also significant are studies that address the sustainable development of the Mexican tourism sector—particularly in the context of coastal destinations (Pi-Sunyer & Thomas, 2015; Rodríguez & Valiente, 2019; Jiménez-Arenas *et al.* 2021), and the role of different groups in tourism development policies (Quevedo & Puya, 2020). Likewise, research has also focused on Mexican tourism supply, such as cultural tourism (Poncela, 2018b; Muñoz & Llanos, 2021), nature tourism (Jasso & Abellán, 2015) or wine tourism (Novo *et al.* 2019).

Despite the abundant literature found for the Mexican case, no study has addressed the efficiency analysis of the tourism sector—such as the one proposed in this paper— from a regional perspective.

1.2. Efficiency and Tourism

Hadad *et al.* (2012) argue that in order to understand the importance of the tourism sector as a source of international income and employment, it is essential to measure its efficiency and productivity. Today, tourism efficiency evaluation is a consolidated line of research, which allows for a wide variety of approaches and different methodological techniques. There are two main types of methods: parametric and non-parametric. The latter have begun to play a greater role in studies, in particular Data Envelopment Analysis (DEA). DEA is a non-parametric approximation of mathematical programming that allows the technical efficiency of tourist destinations to be gauged in relation to their capacity to maximize tourist impact. In addition, this method has the advantage that it is not limited to grouping the tourist attraction factors that a destination possesses, but also allows analysis of the productive process; that is to say, its management strategy (Nepomuceno-Lima *et al.*, 2022).

Within the applications of the DEA model, works can be classified according to their subject matter. Some studies focus on analyzing the tourism industry, i.e., the agents that make up the business network, and who are generally private. These form the most abundant group of studies, since they are based on concrete and real production approaches. Among this type of application, those involving intermediary agents stand out, such as the work of Köksal & Aksu (2007) on tourist agencies, or that of Fuentes (2011), who analyzes the efficiency of tourist agencies in Alicante (Spain). However, most studies choose hotels as the central tourism business unit for analysis. For example, Barros (2005) studies the Portuguese nationally owned accommoda-

tion network, Las Pousadas. Pulina *et al.* (2010) analyze the efficiency of a sample of hotels in Italy, using the Windows-DEA methodology. More recently, Oukil *et al.* (2016) conducted a study that uses the two-stage conditional efficiency model for hotels in Oman, while Mendieta-Peñalver *et al.* (2018) analyzed a sample of hotel chains on an international scale.

In recent years, one area of regional analysis to have become consolidated evaluates tourist destinations, seen as territorial units. It is in this area that our approach is framed. These works start from a hypothetical or virtual production function based on the assumption that destinations have operational capacity over their resources and are therefore competent to maximize their tourist *output*, whether measured as the length of stay or in strictly monetary terms. This approach is based on the concept of territorial competitiveness developed by Crouch & Ritchie (1999). It is important to point out that, even starting from a hypothetical production process, it is possible to analyze the tourist destination by means of a classical efficiency model, assimilating it to a commercial business or a territorial industry (Soysal-Kurt, 2017).

This latter line addressing the evaluation of tourist destination efficiency includes two types of analysis. First, there are studies based on a strictly managerial adjustment production function, such as the one proposed in this study. This involves relating tourism resources (accommodation capacity, labor factor, tourist arrivals, etc.), which are combined to maximize the number of overnight stays, as the main *output*, which is identified with a basic approach to optimizing tourist flow. This line includes the works of Botti *et al.* (2009) and Barros *et al.* (2011) who analyze the French tourism sector using DEA. Cuccia *et al.* (2016) apply a DEA model with double *bootstrap* to examine the tourism efficiency of Italian regions. Elevating the analysis to the country scale, Soysal-Kurt (2017) applies technical efficiency analysis to a sample of 29 countries within the European continent. Another approach is based on developing a more complex production function. These studies introduce—on the *input side*—variables related to the main cultural resources available at the destination (artistic heritage, cultural institutions, etc.), among others, while specific tourism flows, such as cultural motivation, are used as *proxies* for outputs to be optimized. The works of Cracolici *et al.* (2008) and Suzuki *et al.* (2011)—both on a regional scale in Italy.

1.3. Tourism efficiency and cultural resources

Currently, there is a well-established line of research that examines the determinants of tourism efficiency, among which cultural factors have gained increasing prominence. Heritage and culture are recognized as variables that can account for significant differences in destination competitiveness. They operate not only as attractions in their own right but also as resources which, when effectively managed, enhance the efficient transformation of tourism inputs into economic and social outcomes. Accordingly, a growing body of studies demonstrates that incorporating the cultural dimension into models of tourism efficiency provides a more comprehensive understanding of territorial performance (Gómez-Vega & Picazo-Tadeo, 2019; Figueroa *et al.*, 2018; Herrero-Prieto & Gómez-Vega, 2017; Gómez-Vega & Herrero-Prieto, 2017).

In the Italian context, the pioneering works of Cuccia & Cellini (2006) and Cuccia *et al.* (2016) are particularly illustrative. The former, through a contingent rating study conducted in Scicli (Sicily), examined how tourists value different attributes of the tourism product. Their results indicate that, despite the symbolic importance of heritage, it was not perceived as the most decisive factor in the choice of visit, underscoring the need to embed cultural assets within broader destination strategies. Building on this line, Cuccia *et al.* (2016) assessed the tourism efficiency of Italian regions over the period 1995–2010 using a two-stage DEA approach. Their findings show that cultural and environmental endowments contribute positively to performance, although inscription on the UNESCO World Heritage List may generate ambiguous effects when not supported by appropriate local policies.

Similarly, Herrero-Prieto *et al.* (2017) conducted a notable study on Spanish regions, evaluating their technical efficiency in attracting cultural tourism flows on the basis of available cultural resources. The study adopts a two-stage approach: in the first stage, efficiency is measured through non-parametric methods; in the second stage, the influence of external factors is analyzed, including reputation, accessibility, the “omnivorous” nature of cultural tourism, and the scope of cultural supply. This contribution demonstrates that cultural resources can become a strategic driver of competitiveness when they are adequately managed and positioned.

At a broader scale, Gómez-Vega *et al.* (2021) extend this analysis to a global sample of countries, providing evidence that the inclusion of cultural variables helps explain a significant share of territorial differences in tourism efficiency. More recently, Gómez-Vega *et al.* (2024) assess the relationship between tourism and the cultural and creative industries across 171 European regions. Their main contribution lies in analyzing how the accumulation of cultural and creative resources enhances tourism competitiveness. Methodologically, they apply a two-stage model: first, a tourism efficiency indicator and five synthetic indicators of creativity are constructed using DEA; second, regression analysis is used to test the influence of cultural and creative capital on tourism competitiveness. The findings provide important managerial implications, showing that the strategic integration of culture, creativity, and tourism can generate sustainable competitive advantages for destinations.

Nevertheless, some studies highlight the potential risks of cultural abundance. Zhou *et al.* (2023), in the case of China, point to the existence of a possible “cultural resource curse”: the excessive availability of heritage does not necessarily translate into tangible benefits for cultural and tourism industries, and may even hinder them. This perspective reinforces the notion that efficiency is not determined merely by the volume of cultural resources, but rather by the capacity to integrate them into coherent and effective management strategies.

2. METHODOLOGY AND CASE STUDY

This paper seeks to analyze tourism efficiency at the federal level in the case of Mexico. For this purpose, the DEA model was used to obtain a tourism efficiency indicator for each of Mexico's 32 states. The non-parametric DEA method is one of the most widely used analytical approaches to evaluate production efficiency. This model was developed by Charles *et al.* (1978), based on the previous precepts of Farrell (1957). Efficiency is calculated by estimating an envelope that includes the units with the best (efficient) practices and their linear combinations. In addition, the model makes it possible to obtain a percentage of efficiency in relative terms -measured as the distance that separates them from the frontier of optimal cases- for non-efficient units, i.e., those that are located below the frontier. Use of this model is particu-

larly appropriate for our case analysis, since one advantage is that there is no need to previously establish a functional form, given that it is constructed on the basis of the analysis data itself, thereby providing a solution to an optimization problem between the resources and results considered (Raju & Kumar, 2006)³.

The sample is made up of the 32 Mexican states, based on information provided by DATATUR⁴ for the period 2011 to 2019. Table 1 shows the study variables and their main descriptive statistics. In order to make the estimates more robust, a balanced panel of data was constructed consisting of 288 observations (32 states and nine years), on which the efficiency analysis is applied.

TABLE 1
DESCRIPTIVE STATISTICS (2011-2019)

Variables	Description	Mean	Standar Deviation	Minimum	Maximum
Rooms	Number of rooms available in tourist accommodation	6 527,568.26	6 080,539.68	640,693.54	36 875,543.05
Domestic arrivals	Number of national tourists arriving at hotel accommodation	2 701,065.51	2 038,442.76	247,637.00	9 942,826.68
Foreign arrivals	Number of international tourists arriving at hotel accommodation	669,098.33	1 827,855.22	2,553.00	13 507,677.80
Domestic overnight stays	Number of overnight stays by domestic tourists	4 551,313.11	3 621,734.08	333,176.67	19 026,862.00
Foreign overnight stays	Number of overnight stays by international tourists	2 410,738.98	8 206,125.92	5,089.69	54 296,149.99

Source: Own elaboration

The DEA analysis used is based on the design of a production function adapted to the level of Mexican states. This production function includes the tourism resources or *inputs*, which, when combined, gene-

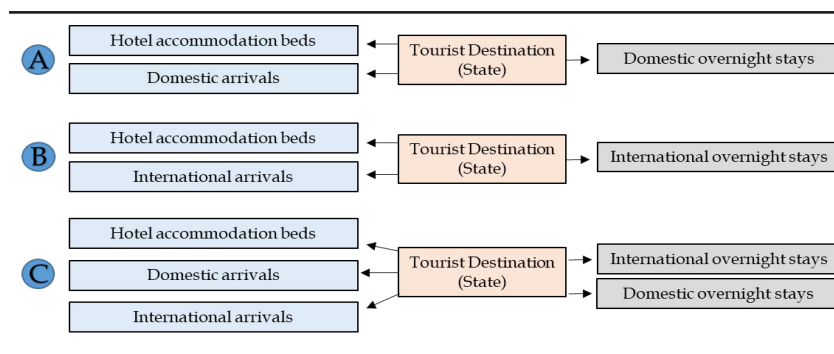
³ Caution should be exercised with this nonparametric advantage, as the methodology is itself sensitive to sample heterogeneity and the presence of outliers. For more details on the advantages and disadvantages of the DEA model, see Dyson *et al.* 2001.

⁴ The information is available for consultation at the following link: <https://datatur.sector.gob.mx/SitePages/Inicio.aspx>

rate a series of tourism results or *outputs*. According to the precepts proposed by Crouch & Ritchie (1999), we assume Mexican states to have a certain degree of operability over their tourism resources (hotel accommodation and tourist inflows –national and international), in order to maximize the tourism impact *output* (tourist overnight stays –national and international). The *output* used is particularly common in this type of study, although when interpreting the results, it should be understood in a broad sense, since it incorporates monetary variables, such as the economic impact generated by the tourist. However, longer stays presumably generate a greater economic impact and even provide an approximation of the consumer's income level.

Figure 1 shows the schematic of the three production function models used in this study as well as the variables considered in each. In model A, we analyze efficiency in maximizing the tourism impact of national or domestic tourists. For this, we use domestic tourist arrivals and hotel accommodation capacity as *inputs*, while on the *output* side we include the number of overnight stays by domestic tourists. In model B, we evaluate efficiency for the flow of international tourism, making the subsequent adjustments in the production function, both in the arrivals and overnight stays corresponding to this flow. Finally –and as the main contribution of our work– model C combines the two flows. In reference studies, it is common to see how individualized approximations are proposed for national or international flows but which, however, include –in the production function– resources that cannot be individualized in the same way.

FIGURE 1
SCHEMATIC OF MODELS USED IN THE STUDY



Source: Own elaboration.

Hotel accommodation cannot be divided according to flow since it is a physical resource that is offered in a general way, without discrimination by tourist origin. For this reason, model C considers three *inputs*: the availability of hotel accommodation –measured in rooms– and, separately, the arrival of domestic tourists and the arrival of international tourists. On the *output side*, we include, also separately, the overnight stays generated by domestic and international tourists. This is consistent with how DEA gives the respective weights in order to reach the optimal mix individually for each unit. In other words, the method does not require all the variables that make up the production process to have the same weight when constructing the efficiency indicator. The characteristics of each unit, or the strategy in this case, of each tourist destination, are thus respected.

The weights of the variables used are attributed in such a way as to lead to a higher value of the index (Murias *et al.*, 2006) in each unit. This flexibility in the weights is particularly relevant in our case study, since some states display high efficiency in national tourism management and yet low efficiency for international tourism, and vice versa. As pointed out in the paper by Barros *et al.* (2011), it should be clarified that although arrivals and overnight stays could –a priori– be considered similar concepts, overnight stays in fact reflect the real impact generated by tourists, while arrivals only denote flow. In other words, a destination may have a high number of tourist arrivals and yet generate a low number of overnight stays. This reflects an inefficient or improvable performance on the part of the tourist destination, since the economic impact is not maximized. For this reason, the production function designed indicates that the efficiency of a tourist destination is being measured in terms of maximizing its visitors' length of stay, given certain resources.

Together with the design of the production function and the modifications for each of the three proposed models (see Figure 1), another series of technical details must be considered. Firstly –and as is common in this type of work (Assaf & Cverbar, 2010; Assaf & Agbola, 2011, among others)– the model is geared towards maximizing *output*, i.e. maximizing the length of stay (overnight stays) from the given tourism resources. In addition, it is necessary to propose a technological hypothesis regarding the type of returns to scale of the production process. In our case, we employ the constant returns to scale

(CRS) approach because we seek to measure pure technical efficiency from a relatively homogeneous sample, such that it is not necessary to consider significant differences in scale. Taking all of the above into account, the model on which this stage of the empirical application is based is as follows:

The states or units to be evaluated are considered. The output orientation of DEA calculates an outcome for each of the units, giving a solution to the linear program $i=1, \dots, n$, under the assumption of constant returns to scale:

$$\begin{aligned} & \text{Max } \lambda, \theta_i \quad w_i \\ & \text{Subject to } x_i X\lambda \geq 0 \\ & Y\lambda \quad w_i y_i \geq 0 \\ & \lambda \geq 0 \end{aligned} \quad [1]$$

where x_i and y_i are, respectively, the input and output of i states; X is the input matrix, while Y is the output matrix, and λ is a vector of $n \times 1$ variables.

Estimates are made with a *bootstrapping* of 2,000 replicates in order to have more robust estimates and avoid possible biases in the efficiency ratios, which sometimes tend to overestimate the results.

3. MODEL RESULTS

In this section, we present and interpret the results of applying the efficiency analysis on the sample of 32 Mexican states and for the period 2011-2019. For this analysis, we start from the hypothesis that states aim to maximize their tourism efficiency which, according to our production process design, is achieved by optimizing tourists' length of stay – in other words, overnight stays (see Table 1), which are a proxy variable for the economic impact that tourists generate at the destination (Assaf & Agbola, 2011). It should be noted that a prior analysis was carried out to eliminate possible outliers –to which DEA is particularly sensitive. For this, and following Banker and Gifford (1988), super-efficiency indices were calculated for the CRS model. The result showed there were no outliers in the state sample that could condition the interpretations. The efficiency indicator estimates for each of the models are

presented in abbreviated form in Table 2⁵. Estimates have been ordered from highest to lowest average efficiency ratio. The efficiency results for each of the models and years can be found in Annexes 1, 2 and 3, together with the bias avoided by bootstrapping. Through this latter process, an overestimation of 1.6% has been avoided in general terms, and is particularly significant in some cases, where it even exceeds 6%.

TABLE 2
EFFICIENCY RESULTS BY STATE AND FLOW OF TOURISM

National Tourism-Model A		Foreign Tourism-Model B		Total Tourism-Model C	
State	Average eff.	State	Average eff.	State	Average eff.
Colima	93.37	Quintana Roo	86.27	Quintana Roo	96.39
Nayarit	82.16	Baja California S.	84.04	Colima	95.39
Sinaloa	81.77	Nayarit	75.48	Baja California S.	91.32
Puebla	80.48	Jalisco	49.12	Nayarit	90.57
C. Mexico	76.66	Oaxaca	48.84	Sinaloa	84.44
Guerrero	73.12	Sinaloa	48.45	Guerrero	83.10
Oaxaca	72.81	Guerrero	44.91	Hidalgo	81.26
Sonora	72.62	Aguascalientes	41.81	Puebla	80.71
Querétaro	71.75	Colima	38.37	C. Mexico	78.58
Nueva León	69.64	Zacatecas	34.18	Oaxaca	74.97
Jalisco	67.76	Guanajuato	33.23	Durango	74.76
Hidalgo	67.43	Querétaro	33.14	Tamaulipas	74.26
Yucatan	65.91	San Luis Potosi	32.28	Sonora	72.98
San Luis Potosi	64.68	Coahuila	31.93	Querétaro	71.95
Zacatecas	64.28	C. Mexico	30.07	Zacatecas	71.11
Aguascalientes	64.26	Sonora	27.68	Nueva León	71.03
Baja California S.	63.59	Nueva León	26.80	Jalisco	69.76
Tabasco	63.07	Tabasco	26.36	Michoacán	69.28
Tamaulipas	62.01	Michoacán	25.85	Yucatan	68.03
State	Average eff	State	Average eff	State	Average eff
Durango	61.33	Puebla	24.47	Aguascalientes	65.64

⁵ Calculations were performed with PIM-DEA software.

TABLE 2 (CONTINUATION)
EFFICIENCY RESULTS BY STATE AND FLOW OF TOURISM

National Tourism-Model A		Foreign Tourism-Model B		Total Tourism-Model C	
Michoacán	58.55	Veracruz	24.39	San Luis Potosi	65.64
Quintana Roo	58.19	Tlaxcala	23.00	Tabasco	62.93
Guanajuato	57.50	Chihuahua	22.58	Guanajuato	62.64
Campeche	56.97	E. Mexico	21.95	Veracruz	60.73
Coahuila	54.47	Hidalgo	20.77	Campeche	59.35
Morelos	54.34	Campeche	20.30	Tlaxcala	58.71
Chihuahua	53.79	Tamaulipas	19.74	Coahuila	55.51
Veracruz	52.87	Durango	19.54	Chihuahua	55.18
E. Mexico	51.28	Yucatan	19.38	Morelos	54.63
Tlaxcala	50.73	Baja California	18.57	E. Mexico	52.21
Chiapas	50.34	Morelos	16.83	Chiapas	50.79
Baja California	41.68	Chiapas	16.80	Baja California	44.29
Mean Eff. Model A	64.36	Mean effect Model B	33.97	Mean effect Model C	70.25

Source: Own elaboration

Average efficiency for domestic tourism (model A) is 64.36%, while for international tourism (model B) it falls to 33.97% (see Table 2). In other words, Mexican states, on average, are twice as efficient at maximizing the impact of domestic tourism as international tourism. This is largely due to the fact that domestic tourism displays a more even territorial pattern. In contrast, international tourism is highly concentrated in just a few states, which do achieve high levels of efficiency, although in the vast majority of states, international tourism has little impact. This result is consistent with the main weakness characterizing tourism in Mexico; namely, the limited capacity of destinations to maximize the impact of international tourists and the fact that it is only effective in a few sun and beach enclaves.

When analyzing the specific effects of national tourism, nine states are seen to be above 70% efficiency. Most of these are located on the Pacific coast and in the interior of the country, where destinations such as Colima, Nayarit, Sinaloa, Puebla, and Mexico City stand out. In general, the most efficient destinations are states with beach endowments that are less congested by international tourism, in addition to states with important cultural resources in terms of magical towns, cities

declared World Heritage Sites by UNESCO, and museum infrastructures, such as Puebla, Mexico City, Querétaro, and Oaxaca. However, in the case of the international tourism model, we find that only three states exceed an average efficiency of 70%: Quintana Roo, Baja California, and Nayarit. All of them could be characterized as sun and beach destinations because they are home to important tourist centers such as Cancun (Quintana Roo), Los Cabos (Baja California Sur), and Riviera Nayarita (Nayarit). This tells us about the type of tourism demanded by international tourists in Mexico, where they also stay for long periods of time, thereby maximizing the economic impact. However, they have an insignificant effect on the rest of the states, which they either do not visit or only stay in for a very short time.

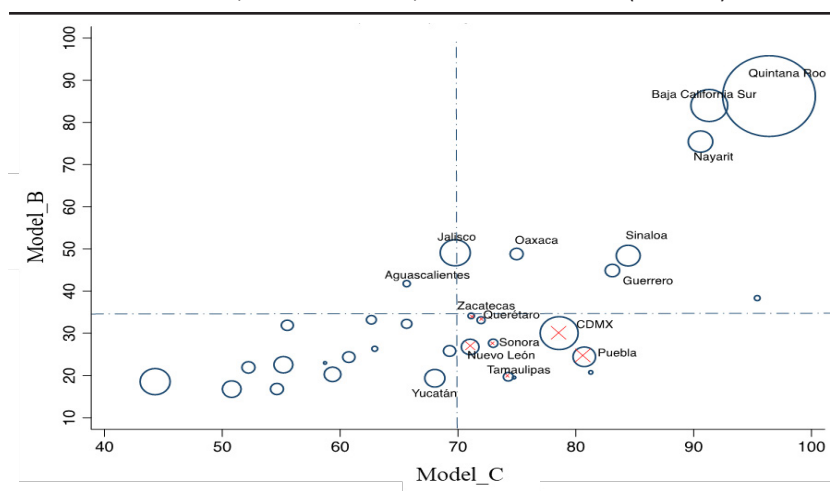
In the case of the full production model (model C), an efficiency figure of 70.25% is found. This ratio is higher than that of models A and B. This result is to be expected and is in line with the proposed optimization process. However, each state is allowed to attach greater importance to the flow it best manages. One clear example of this is Quintana Roo, which is highly efficient in foreign tourism but ranks low in domestic tourism. The combined model will give greater weight to the good practices of model B, compensating the result of model A. The opposite case could be Puebla, which is much more efficient in model A than in model B and which finally occupies a relevant position in the combined approach. One interesting case is the state of Nayarit, which displays significant efficiency in both tourist flowsdestinations, positioning itself with 90% in model C.

Model C also makes it possible to analyze the complementary nature that may prevail between domestic and foreign flows. Of particular interest are methods that enable identifying destinations suitable for promoting the deconcentration of foreign tourism. To this end, a scatter diagram (Figure 2) has been drawn up between the average efficiency of model B -axis of abscissa- and the average efficiency of model C -axis of ordinates- during the period 2011-2019. The circle of the observations is, in addition, proportional to the size of foreign tourism in order to identify which states have the highest presence of this flow. The scatter plot is divided into four quadrants, showing the average efficiency of all states for the respective models.

At the upper end of the top right quadrant are the “super destinations” (Quintana Roo, Baja California Sur, and Nayarit) of foreign-

ners, which, in addition, increase their efficiency in model C due to the complementarity of national tourism. Particularly worthy of note in this quadrant is the state of Oaxaca since, unlike the other states, it is predominantly a cultural destination and not a sun and beach destination. Although it does not have a significant flow of foreign tourists, its efficiency levels place it as an appropriate destination for promoting diversification in foreign destinations. In particular, the states located in the lower right quadrant are of interest because, despite not specializing in foreign tourism (since they are below the average efficiency in model B), they do increase their efficiency strongly under model C. This is not only because of their specialization in domestic tourism but also because of the complementarity that foreign tourism provides. CDMX, Puebla and, to a lesser extent, Nuevo León, undoubtedly become favorable destinations for promoting the deconcentration of foreign tourism, added to which they are all cultural.

FIGURE 2
SCATTER PLOT, MODELS B AND C, AVERAGE EFFICIENCY (2001-19)*



Nota: *Observations weighted by international arrivals.

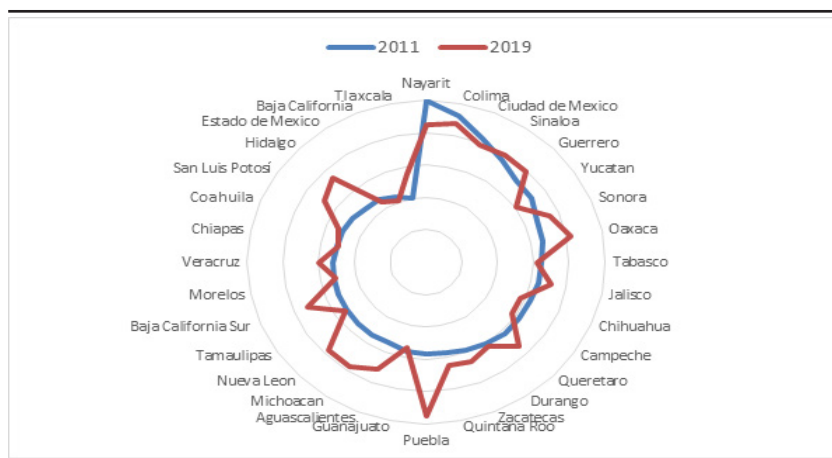
Source: own elaboration.

Analysis of how the different destinations evolved in 2011 and 2019 shows that the estimates of the three models follow a similar trend. They end the period with a higher efficiency than they displayed at the beginning, except in the case of foreign tourism, where it falls slightly. Nevertheless, in the three models the best results are found in the

middle of the period analyzed –2014, 2015 and 2016 (see Annexes 1, 2 and 3)— as these were the years that capitalized on the global economic recovery.

Figures 3 to 5 describe in a radial format how efficiency evolved for each model in the years 2011 and 2019. Figure 3 shows the results for model A. It can be seen that most destinations improve their results, with Puebla and Oaxaca being particularly significant. Few destinations reduce their efficiency –such as Nayarit, Colima– and even Mexico City, probably due to congestion effects. Most units exceed 40% efficiency, both at the beginning and at the end of the period.

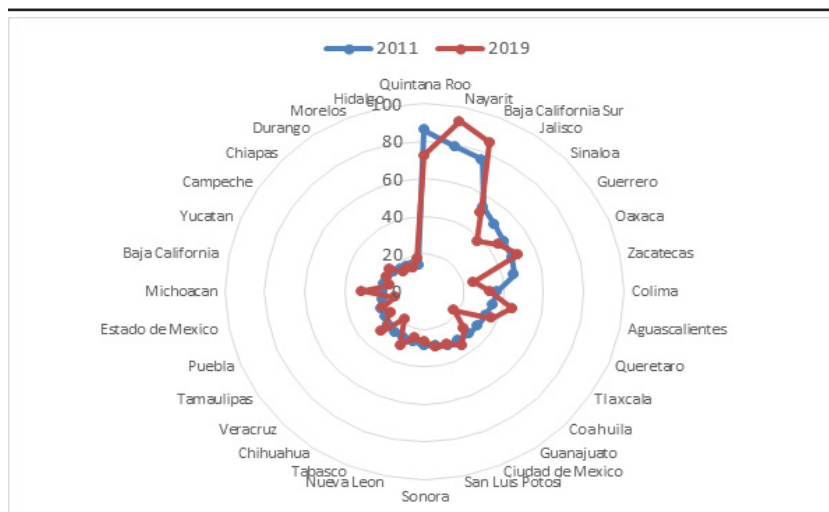
FIGURE 3
EVOLUTION OF DOMESTIC TOURISM EFFICIENCY -MODEL A



Source: Own elaboration

Figure 4 shows the results for model B. First, it is worth noting the leading position of the states of Quintana Roo, Nayarit, and Baja California throughout the whole period, while the rest of the states do not exceed 50%. These three states are the main centers of attraction for international sun and beach tourism in Mexico. However, Nayarit and Baja California improve their efficiency, whilst Quintana Roo suffers a significant drop at the end of the period. This drop in Quintana Roo can be attributed to the increased competitiveness of its counterparts and to congestion processes in the tourist destination of Cancun.

FIGURE 4
EVOLUTION OF FOREIGN TOURISM EFFICIENCY -MODEL B



Source: Own elaboration

Finally, Figure 5 shows the evolution of efficiency for model C, which evaluates domestic and international flows jointly. Efficiency under this model is not only higher, but the changes during the period are also more pronounced. The states of Guerrero, Puebla, and Hidalgo improve significantly, while others, such as Tamaulipas, suffer a decline in their efficiency to a value of close to 50%. This latter case is strongly correlated with the increased violence in the state.

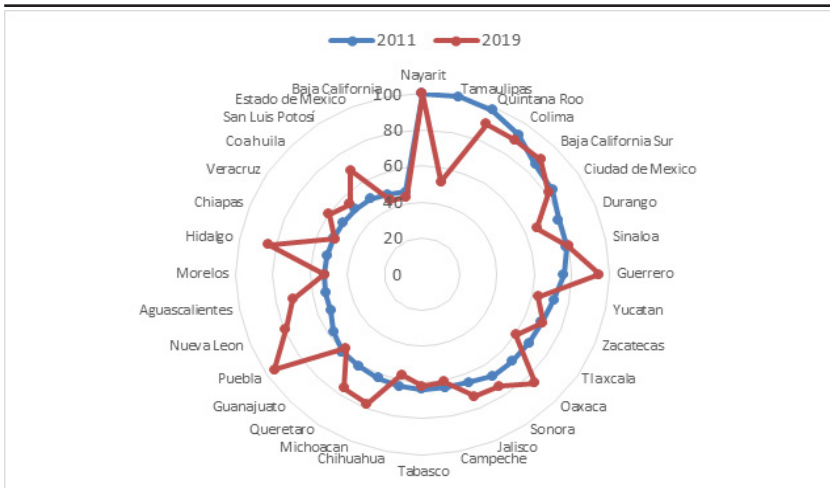
To determine whether the accumulation of cultural resources significantly influences the tourism efficiency of Mexican destinations, a regression model based on Simar and Wilson (2007), in its first algorithm, is applied. This procedure is considered one of the most appropriate when combined with DEA, since it helps to mitigate many of the problems associated with linking efficiency analysis and regression.⁶

In this case, the efficiency result obtained in the first stage through DEA is included as the dependent variable, while a series of variables related to heritage assets and the structural characteristics of the states are incorporated as explanatory factors. First, UNESCO designations of cultural heritage and the Pueblos Mágicos program are considered,

⁶ For a detailed discussion of the methodology and its advantages, see Simar and Wilson (2007) and Gómez-Vega (2019).

given their role in enhancing and showcasing tangible and intangible cultural attractions.

FIGURE 5
TOTAL TOURISM EFFICIENCY EVOLUTION-MODEL C



Source: Own elaboration

Likewise, the variable beach is added as a structural factor of competitiveness, in view of the centrality of the sun-and-sand model in shaping Mexican tourism, included as a dichotomous variable. GDP per capita is incorporated as a proxy for the general level of economic development of the state, which allows for an analysis of whether there is a relationship between economic prosperity and tourism efficiency. Similarly, three indicators of gross value added (GVA) in sectors directly linked to cultural and tourism activity are considered: cultural and natural heritage, performing arts, and handicrafts, with the aim of evaluating the role of cultural industries in relative efficiency. Taken together, this selection seeks to test the hypothesis that both cultural resources and the economic context influence the capacity of the states to maximize their tourism efficiency.

Regarding the results (Table 3), for domestic tourism, they show that the existence of Pueblos Mágicos designations, the condition of being a coastal state, as well as the strength of gross value added in cultural and natural heritage and in the performing arts, are positively and significantly associated with higher levels of efficiency. This finding suggests

that tourism policy oriented toward the domestic market should prioritize the articulation of cultural and heritage products with traditional attractions, as these are the elements that make it possible to extend stays and diversify tourism consumption beyond consolidated coastal destinations. In contrast, GDP per capita shows a negative and robust relationship, suggesting that more prosperous states face structural conditions (such as higher costs of tourism services or competition with other economic sectors) that limit efficiency in the tourism industry. The UNESCO and handicrafts variables do not present statistical significance, which indicates that, by themselves, they do not explain differences in relative efficiency.

In the case of foreign tourism, the most pronounced positive effect comes from the presence of a beach, which confirms the centrality of the sun-and-sand model in the international competitiveness of Mexico. However, the evidence also shows that the Pueblos Mágicos program and the performing arts contribute to efficiency, which reveals that international visitors seek to complement the natural attraction with differentiated cultural experiences. This result highlights the importance of articulating tourism policies that are not limited to reinforcing the sun-and-sand model but rather integrate cultural and heritage products that extend the length of stay and diversify expenditure. As in the case of domestic tourism, GDP per capita maintains a negative effect, suggesting that the costs associated with more developed economies erode efficiency in the conversion of arrivals into overnight stays.

When total tourism is considered, the results consolidate the previous trends: the variables beach, Pueblos Mágicos, and GVA attributed to cultural and natural heritage and to performing arts remain positive determinants of efficiency, while GDP per capita retains its negative effect. This finding reinforces the idea that tourism efficiency in Mexico does not depend directly on the level of economic development of the states, but on their ability to design and articulate specific tourism products that combine natural and cultural attractions. The non-significant variables, such as UNESCO designations and handicrafts, show that symbolic recognition or the availability of certain cultural goods does not automatically translate into greater tourism gains, but rather requires active policies for integration into tourism experiences.

TABLE 3
REGRESSION ANALYSIS RESULTS

Variable	Description	Source	Average	Std. Dev	Domestic Tourism	St. Error	Foreign Tourism	St. Error	Coefficient	St. Error	Total Tourism	St. Error
UNESCO Intangible Cultural Heritage	Number of properties declared by UNESCO	UNESCO	1,437	1,275	0.001	0.007	-0.006	0.0122	-0.005	0.007		
Magical towns	Number of towns declared as Magical Towns	Sectur	3,017	2,299	0.007*	0	0.012*	0.006	0.011**	0.004		
Beach	Beach 1: Non-beach 0	Own elaboration	0.531	0.499	0.0384**	0	0.111***	0.029	0.054***	0.018		
GDP per capita	GDP per capita of the state	INEGI	709,851	680,371	-0.001***	0.	-0.000***	0	-0.000***	0		
GVA Cultural and natural heritage	GVA generated by the sector	INEGI	1,078,841	1,370,626	0.001***	0	0	0	0.000***	0.000		
GVA Performing arts	GVA generated by the sector	INEGI	991,913	1,762,203	0**	0	0.001***	0	0.001***	0		
GVA Handicrafts	GVA generated by the sector	INEGI	310	3,692,378	-	0	0	0	0.000	0		
Constant		-	-	-	0.612***	0.019	0.331***	0.031	0.692***	0.021		
Sigma		-	-	-	0.116	0.019***	0.174	0.009	0.123	0.005		
Wald Chi		-	-	-	28.55***		79.12***			79.24		

***Statistical significance at 1%, ** Statistical significance at 5%, * Statistical significance at 10%. Number of bootstrap replications=5000. SW, Simar y Wilson Regression model.
Source: own elaboration.

The results of the second-stage model suggest that tourism policy strategies must go beyond simple heritage recognition or basic infrastructure and focus on how resources are articulated to generate efficiency in attracting and retaining tourists. In coastal destinations, policy should seek to complement natural attractions with cultural programming and networks of Pueblos Mágicos that diversify the visitor's experience. In inland destinations, the most effective path is the valorization of cultural heritage and the consolidation of the performing arts supply, which show consistent positive effects. Across the board, the results warn about the negative impact of higher GDP per capita, which calls for the design of policies that mitigate the effects of higher costs in more developed states through differentiation strategies and added value in the tourism product. In sum, the analysis confirms that tourism efficiency in Mexico is built upon the strategic combination of natural and cultural attractions, which should become the guiding principle of public policies aimed at enhancing the competitiveness of the sector.

CONCLUSIONS

Mexico presents a structural weakness in its tourism sector: international tourism has a limited impact on much of the territory, despite the fact that the country ranks among the global leaders in tourist arrivals and hotel infrastructure. The results of this study, using efficiency models, show that domestic tourism operates at a level of efficiency twice that of international tourism. This difference is explained by the strong concentration of foreign flows in a few sun-and-beach destinations (Cancun, Riviera Nayarit, Los Cabos), while domestic tourism is more evenly distributed, allowing for a broader use of installed capacity.

In light of these findings, Mexican tourism policy faces the challenge of overcoming its excessive dependence on the sun-and-beach model and instead articulating a strategy that actively integrates cultural heritage. High-profile assets, such as UNESCO World Heritage Sites or the Pueblos Mágicos program, should no longer be seen just as symbolic acknowledgments but managed as strategic resources to extend length of stay and diversify the tourist experience. In this regard, investment in interpretation, storytelling, cultural infrastructure, and international promotion aligned with the national brand could turn heritage into a key

differentiating factor to enhance competitiveness and achieve a more balanced territorial distribution of benefits.

The regression analysis confirms that tourism efficiency in Mexico depends less on the economic development level of the states and more on their capacity to strategically integrate cultural and natural resources into differentiated tourism products. The evidence shows that factors such as the presence of *Pueblos Mágicos*, the supply of performing arts, and cultural and natural heritage strengthen efficiency significantly, while GDP per capita exerts a negative effect, associated with the higher costs faced by more developed states. This points to the need for policies that enhance product differentiation and reinforce cultural industries as a central axis of competitiveness. Moreover, the complementarities found between domestic and international tourism highlight the potential of leveraging domestic flows to deconcentrate international demand, creating a more balanced territorial distribution of benefits.

In sum, the study provides a robust empirical basis for reorienting Mexican tourism policy toward a more balanced, competitive, and inclusive model. By strategically combining natural and cultural assets, integrating cultural resources into comprehensive tourism experiences, and articulating domestic and international flows, Mexico can enhance the competitiveness of its destinations while ensuring a more equitable territorial distribution of tourism benefits.

First, the findings show that strengthening the *Pueblos Mágicos* program, leveraging cultural and natural heritage, and consolidating performing arts are effective mechanisms for increasing efficiency and, consequently, destination competitiveness. This implies that support programs should not be limited to investments in hotel infrastructure or international promotion but should prioritize the integration of cultural resources into comprehensive tourism experiences.

Second, the fact that GDP per capita exerts a negative effect on efficiency suggests that more developed states face a particular challenge: the need to compensate for their higher costs with differentiated, high value-added tourism products. This directs policy towards strategies that foster creativity, innovation, and cultural diversification, thereby reducing dependence on the sun-and-beach model.

Third, the evidence of complementarities between domestic and international tourism reinforces the need to design policies that promote

the articulation of both flows. Leveraging the strength of domestic tourism can help deconcentrate international demand, generating a more equitable territorial distribution of benefits. This requires the integration of cultural promotion both into domestic circuits and into external positioning campaigns.

Finally, the study underlines the importance of conceiving tourism policy not only in terms of attracting visitors but also in terms of generating longer stays and more diversified experiences. Investment in cultural infrastructure, thematic routes, digital storytelling, and heritage-based products would transform short visits into prolonged stays, thereby increasing the efficiency of the tourism system. In this way, the research provides a solid empirical foundation for reorienting Mexican tourism policy toward a more balanced, competitive, and inclusive model in which cultural and natural heritage operates as a strategic lever of territorial development.

Regarding the limitations of this study, it should be noted that the results are based on pre-pandemic data (up to 2019). This decision reflects the profound disruption caused by COVID-19, which temporarily and exceptionally altered mobility patterns, making direct comparison with previous trends problematic. However, future research should extend the analysis to the post-pandemic stage in order to capture potential structural transformations in Mexican tourism. Likewise, it would be desirable to explore alternative production functions, for example by incorporating monetary variables (tourist revenues, average expenditure) or more specific functional forms if disaggregated data on culturally motivated flows at the state level were available. Finally, applying conditional efficiency models in two stages would allow for a deeper understanding of the factors behind performance differences and would enrich the policy recommendations derived from this work.

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ANNEX 1

NATIONAL TOURISM EFFICIENCY RESULTS (MODEL A)

State	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average eff.	Bias avoided
Aguascalientes		56.1	56.3	61.2	63.8	72.3	70.4	73.1	71.1	64.25	2.53
Baja California	43.4	46.5	51.6	47.1	34.1	37.1	34.7	39.9	40.8	41.68	0.99
Baja California S.	52.6	58.8			58.8		54.8	58.5	71.9	63.59	6.05
Campeche	62.7	63.5	58.7	70.2	50.3	47.3	46.4	56.3	57.5	56.97	0.78
Chiapas	50.9	51.1		49.4	53.7		49.9	49.7	50.3	50.33	0.54
Chihuahua	63.2	51.7	48.9	44.9	52.3	52.8	55.7	57.2	57.4	53.78	0.75
C. Mexico	82.4	86	79.7	68.3	75.1	73.7	71.2	74.9	78.5	76.65	0.76
Coahuila	50.5	59.4	57.2	53.2	53.2	55.6	55.1	52.7	53.3	54.47	0.70
Colima	92.1		85.1	86.5	97.3		97.8		87.6	93.3	1.04
Durango	60.3	60.7	55.4	61.4	60.5	62.6	62.7	65.7	62.7	61.33	0.62
E. Mexico		52.4	49.5		50.4	50.7	52.9	52.1	44.4	51.28	0.64
Guanajuato	56.1	59.2	59.2	58.6	58.1	58.7	57.1	56.4	54.2	57.50	1.10
Guerrero	71.2		68.3	87.3	66.6	66.6			79.1	73.12	3.01
Hidalgo	47.4	58.2	60.8	69.9	81.1	73.7	65.5	77.2	73.2	67.43	4.24
Jalisco	64.3	57.3	67.7		72.2	67.9	66.2	66.3	70.9	67.75	1.23
Michoacán	53.7	54.4	52.6	63.5		55.3	58.2	59.7	77.6	58.54	0.45
Morelos			57.9	52.5		54.1		57.8	51.8	54.33	0.42
Nayarit		78.5	67.6	77.3		84.8	85.7		84.5	82.16	6.02
Nueva León	53.2		63.4	71.5	75.2	75.9	74.8	73.5	77.3	69.63	1.90
Oaxaca	66.8	65.7	71.5	75.6	73.8	70.6	71.5	77.6	82.2	72.80	0.54
Puebla	56.4		73.2	85.6		86.2	81.1	86.7	95.1	80.48	2.64
Querétaro	62.4	65.2	71.5	84.2	69.1	73.9	72.7	73.2	73.5	71.75	0.50
Quintana Roo	56.7		45.1	57.1	64.6		60.8	64.9	64.8	58.19	5.71
San Luis Potosi	49.2	60.2	54.3	51.7	73.7	76.8	75.5	72.2	68.6	64.68	1.40
Sinaloa			79.5	84.8	90.1	89.9	84.2		79.4	81.76	0.92
Sonora	67.5		68.3	64.2	69.7	77.8		77.1	75.1	72.62	0.50
Tabasco	64.6	72.1	72.7	71.4	64.2	52.2	53.1	55.6	61.7	63.07	0.54
Tamaulipas	53.2	64.5	65.1	75.8	71.7			53.9	53.9	62.00	1.80
Tlaxcala	39.9	44.9	49.4	51.8	55.9	49.9	53.3	55.7	55.7	50.73	0.86

ANNEX 1 (CONTINUATION)
NATIONAL TOURISM EFFICIENCY RESULTS (MODEL A)

State	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average eff	Bias avoided
Veracruz	51.8	55.1	48.6	59.3		49.4	49.2	56.6	59.8	52.86	0.55
Yucatan	70.5	68.5	67.2	61.1	65.7	66.2	67.6	65.4		65.90	0.54
Zacatecas	58.6	59.8	60.4	64.9		66.8	64.9	67.7	66.4	64.28	1.15
Average Efficiency	60.3	62.5	61.6	67.2	65.8	65.1	64.2	65.6	66.9	64.35	1.61

Source: Own elaboration

ANNEX 2
FOREIGN TOURISM EFFICIENCY RESULTS -MODEL B

State	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average eff.	Bias avoided
Aguascalientes	34.9	60.7	51.4	35.1		37.4		39.8	45.1	41.81	0.78
Baja California	20.3	19.4	19.9	19.4		17.7	17.6	18.1	17.8	18.57	1.98
Baja California S.	75.9		77.8	91	86.8	88.4	85.7	87.1	85.8	84.04	6.37
Campeche	18.7	19.7	21.7	21.8	19.6	20.3	21.4	18.4	21.2	20.30	1.44
Chiapas	16.7	18.1	17.5	16.8		17.1	16.8	16.3		16.80	0.57
Chihuahua	26.2	20.9	19.9	20.2	22.2	24.3	27.5	24.8	17.3	22.58	0.41
C. Mexico	30.7	30.7	28.4	29.1		30.3			30.5	30.07	2.22
Coahuila	31.8	27.9	26.5	19.3	31.3	35.9		51.5	28.2	31.93	0.69
Colima	36.7	42.4	49.5	46.3	36.7	32.1	33.7	34.8	33.1	38.37	0.49
Durango	16.4	22.6	26.2	26.5	17.7		14.9	16.7	14.9	19.54	0.23
E. Mexico	21.2	29.6	29.3		25.2	19.1	16.2		14.8	21.95	0.48
Guanajuato	31.1	34.1	37.6			30.2	26.3	30.6	34.2	33.23	0.43
Guerrero	47.9	49.1	44.7	32.4	43.5	44.3	46.3	50.9	45.2	44.91	0.63
Hidalgo	14.4	15.5	22.2	17.3	31.5	27.5	15.2	25.3	18.1	20.77	0.25
Jalisco	53.6	53.9	49.3	47.3	47.3		46.5	45.3	50.8	49.12	1.76
Michoacán		21.3	21.6	23.1	26.8	30.2	29.4	28.3	31.1	25.85	0.34
Morelos	15.3	15.6	15.1	15.2	18.1	20.5	21.9	16.3	13.5	16.83	0.45
Nayarit	78.7		45.5	72.1	84.6	79.4	79.8		92.4	75.48	3.63
Nueva León		28.6	24.2	29.5	27.8	29.1	25.9	24.1	25.2	26.80	1.06
Oaxaca	47.7		48.3	25.4	56.6	56.4	55.5	50.5	51.3	48.84	0.86
Puebla	23.4	24.5	24.7	27.2	27.4	24.4		22.1	22.6	24.47	1.53
Querétaro	33.4	32.3	30.5	30.2	33.3	38.4	30.1	33.3	36.9	33.14	0.46
Quintana Roo	86.1		95.3	86.2			79.3	77.2	72.3	86.27	6.30
San Luis Potosi	29.1	28.9	29.7		36.9		46.1	34.7	30.2	32.28	0.65
Sinaloa	50.1		47.7		57.3			31.4	37.8	48.45	2.31
Sonora	28.8	30.6	26.4		25.5	21.9	35.4	27.9	26.6	27.68	0.43
Tabasco	26.2	25.7		26.5	27.1	24.9	21.2	23.7		26.36	0.41
Tamaulipas	23.7	29.6	14.1	18.1	17.2	17.4	17.4	20.1	20.1	19.74	0.29
Tlaxcala	32.4	21.6	24.8	29.5	28.5	15.3	18.9			23.00	0.29
Veracruz	25.2	25.9		21.2	29.6	27.3	24.3		30.1	24.39	0.29
Yucatan		19.7	17.9	18.7	19.5	19.3	19.8	19.7	19.9	19.38	1.43
Zacatecas	46.1	39.8		34.4	32.5	29.6	27.2	25.6	25.4	34.18	0.47
Average Efficiency	34.1	34.4	33.9	32.6	35.9	34.7	33.7	33.6		33.97	1.25

Source: Own elaboration

ANNEX 3
TOTAL TOURISM EFFICIENCY RESULTS—MODEL C

State	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average eff.	Bias avoided
Aguascalientes	52.8	66.7	55.9	63.8	65.1	72.2	70.9	72.8	70.6	65.64	3.62
Baja California	46.3	49.1	54.1	49.3	36.4	39.6	37.5	42.7	43.6	44.29	0.91
Baja California S.	85.7	86			94.7		92.5	90.4	89.5	91.32	3.12
Campeche	63.9	64.9	62.2	71.8	52.9	49.8	49.2	58.7	60.7	59.35	0.42
Chiapas	51.6	51.3	48.6	49.8	54.6	50.3	50.3	50.1	50.6	50.79	0.60
Chihuahua	63.1	52.3	48.9	44.9	54.8	55.9	59.3	60.7	56.9	55.18	0.86
C. Mexico		87.3	80.7	70.1		76.2	73.5	77.2	81.3	78.58	1.41
Coahuila		59.7	57.3	53.6		56.4	56.7	56.2	54.9	55.51	1.14
Colima	92.7			87.8	96.8		98.1	93.7	89.3	95.39	1.72
Durango	78.9	75.9	55.3	71.3	80.3	77.8	80.9	86.1	66.3	74.76	3.94
E. Mexico	47.7	53.3	49.6	61.3	52.1	52.2	57.2	52.3	44.3	52.21	0.96
Guanajuato	60.9	62.8	62.7	63.3	63.3	64.2	65.2	63.3	58	62.64	1.78
Guerrero	75.8	79.5	73.8	90.6	77.1	81.5	87.7	87.2	94.7	83.10	2.04
Hidalgo	51.9	69.6		77.4		84.7	73.2	90.6	83.9	81.26	4.65
Jalisco	64.9	57.3	69.2	79.3	75.2	70.6	68.7	69.3	73.2	69.76	2.10
Michoacán		65.8	63.6	77.9	68.3	69.9	68.2	70.3	77.6	69.28	2.43
Morelos	52.3	55.2	58.3	53.1	58.4	54.4	49.8	57.8	52.5	54.63	0.53
Nayarit			69.3	85.4	90.3	94.1	97.9			90.57	3.05
Nueva León	52.9	61.8	64.4	73.5	77.2	78.3	76.8	75.4	79.1	71.03	1.58
Oaxaca	68.1	66.8	73.1	74.1	78.5	74.5	74.6		85.1	74.97	2.10
Puebla		60.1	72.9	85.5		87.4	81.2	87.1	95.1	80.71	2.84
Querétaro	61.2		71.4	84.1	68.7	76.2	72.1	73.3	75.6	71.95	1.36
Quintana Roo	98.4	99.8		88.9			98.2	92.2		96.39	1.66
San Luis Potosí	50.1	59.8	53.6	52.9	74.1	78.3	80.1	72.8	69.2	65.64	1.72
Sinaloa	78.6	80.3	81.2	86.3	94.4		85.1	74.4	79.6	84.44	2.44
Sonora	67.8	75.5	68.8	64.7	69.1	80.6	79.1	76.6	74.6	72.98	1.37
Tabasco	63.7	72.1	73.2	71.9	64.9		51.5	55.3	61.9	62.93	1.26
Tamaulipas			70.3	85.9	81.4	63.3	63.3	52.1	52.1	74.26	1.49
Tlaxcala	68.7	51.2	63.2	61.7	58.3	49.4	55.6	60.2	60.2	58.71	2.36
Veracruz		55.1	47.9	73.3	60.5	63.9	65.9	69.1	59.9	60.73	3.82

State	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average eff	Bias avoided
Yucatan		70.3	69.1	63.8		68.7	69.7	67.4	63.2	68.03	0.28
Zacatecas	69.2	67.9	73.2	69.6	75.5	72.4	68.9	73.3		71.11	2.11
Average Efficiency		68.8		71.5	72.6	71.7	70.6	71.5	70.7	70.25	1.93

Source: Own elaboration