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The **Impact** of COVID-19 on **international tourism** in Mexico

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Abstract | COVID-19 compelled the implementation of prolonged confinements to limit human contact, and the consequences were devastating for the tourism industry. This study estimates the direct and indirect effects of COVID-19 on tourism in Mexico by constructing three counterfactuals of international tourists and their average expenditure using time series models and the pre-pandemic expectations of economic analysts. Econometric univariate and auto-regressive distributed lag models were employed to estimate the direct impact of COVID-19 on the sector, and input–output multipliers were utilized to assess the indirect and total effects of the shock on the economy. Estimates indicate that the impact of COVID-19 from March to December 2020 caused a loss of approximately US$15 billion in international tourism revenues, indicating a 15% decline in tourism gross domestic product (GDP) and the loss of one-fifth of the tourism workforce. In 2020, international tourism alone could have contributed one-eighth to the Mexican economy's collapse.

Keywords | Tourism, COVID-19, Mexico, income distribution, counterfactual, input–output

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1. Introduction

COVID-19 is undoubtedly the most destructive epidemic for humanity in the last 100 years; by May 2022, more than 6 million deaths were attributed to this syndrome in the world, resulting in a 5% decrease in global income in 2020, primarily due to the numerous confinements imposed to stop the spread. Tourism has suffered more than proportionally due to safe distance policies because it is an intensive activity requiring people-to-people contact.

Mexico is one of the worst-affected countries, with its gross domestic product (GDP) contracting by 8.5% in 2020, one of the worst declines in the world. This is partly explained by the importance of its tourism sector, according to the World Tourism Organization's Barometer, Mexico attracted 45 million international tourists before the pandemic in 2019, resulting in US$25 billion revenue, making it the 7th largest recipient of tourists and the 17th in revenue worldwide.

This paper aims to estimate the impact of COVID-19 on Mexico's international tourism revenues, Gross Domestic Product (GDP), and employment in tourism and the country as a whole, using three counterfactuals that identify the amount of tourism revenues assuming the absence of a pandemic. The paper contributes to the literature by robustly estimating the impact of COVID-19 in Mexico, a key tourist destination, in 2020. Methodologically, it combines various econometric time series models with input–output models to account for the cross-sectoral repercussions of the abrupt drop in tourism demand. It also introduces the construction of counterfactuals based on analysts' expectations of the evolution of the main macroeconomic variables just before the occurrence of COVID-19.

2. Literature review

The COVID-19 study we present shares many features with earlier studies about the economic effects on the tourism sector of epidemics, natural disasters, and non-recurrent large entertainment events. In this respect, Bloom and Canning (2018) reviewed a set of epidemics and found that, given expectations about the state of the economy, epidemics can hinder the effects of education, productivity, foreign investment, and savings while discouraging travel and investment. They concluded that epidemics are extremely costly.

Similarly, Ayala and Chapa (2017) analyzed and estimated the impact of AH1N1 on the Mexican pork market. Although AH1N1 is human-transmitted, an error at the beginning of the pandemic led to the incorrect assumption that pigs were the source of the virus, which impacted pork sales domestically in Mexico and abroad. To achieve this, they estimated an AIDS-type demand system for beef, pork, and chicken consumption, and an input–output matrix to account for the effects of intersectoral relationships and those induced by the circular flow of wealth. According to Arellano and Chapa (2017), Mexico's domestic production, imports, intermediate input demands, and labor and capital demand all decreased due to the A1HN1 flu in 2009 and the global economic crisis at the end of 2008.

Joo et al. (2019) estimated the economic impact on North Korea's tourism sectors from the Middle East Respiratory Syndrome (MERS) outbreak in 2015, estimating a loss of 2.1 million travelers and a decline of US$2.6 billion in revenues.

Recently, Mariolis, Rodousakis and Soklis (2021) documented that the COVID-19 health contingency decreased Greece's international travel revenue, which in turn caused a reduction in GDP and employment and increased the country's trade balance deficit.

Computable general equilibrium models have also been extensively used in the literature to assess the importance of the tourism industry to the economy and to estimate the effects of various shocks. Dwyer, Forsyth and Spurr (2004) compared the different methods used for estimating the impacts of shocks on the tourism sector. They especially pointed out the advantages of using computable general equilibrium models to account for the intersectoral relationships of the sectors and build tourism multipliers on income for Africa, the Americas, Europe, Asia and the Pacific, the Middle East, and South Asia. Meanwhile, Robles and Díaz (2014) analyze 40 countries and demonstrate that the impact of tourism on GDP per capita and the weight of imports to GDP are favorable. Carrascal and Fernandez (2015) quantified positive effects of tourism on income and employment in Galicia, Spain. Also, Ferrari, Mondejar and Secondi (2017) found that tourism significantly affects food production, value added, and household spending in the Tuscany region of Italy. In Argentina, Fernández and Ruff (2017) concluded that inbound tourism spending increases national income. However, in Turkey, Akkemik (2012) found that the impact of foreign tourist spending on output and employment is modest, whereas Pratt (2015) noted that tourism increases economic activity in seven Small Island Developing States, but the income that stays in the destinations is often very small.

Kim, Chon and Chung (2003) specified that the economic impact of the convention industry is very significant for Korea in terms of output, employment, income, and imports. Meanwhile, Hanly (2012) demonstrated that the conference market significantly impacted Ireland's output, income, value added, imports, and taxes. In the case of Australia, Torre and Scarborough (2017) found that the Victoria region benefits economically from the tourism brought about by the art exhibition at the Bendigo Art Gallery. In terms of sports tourism, Lee and Taylor (2005) estimated that the 2002 FIFA World Cup generated an economic impact on South Korea's production (sales), income, and value added, whereas Drakakis, Papadaskalopoulos and Lagos (2021) documented the significant economic impact of sports tourism in South Korea, including golf, windsurfing, horseback riding, and scuba diving.

Additionally, Sullivan, Bonn, Bhardwaj and DuPont (2012) studied US–Mexico cross-border trade and showed that spending by Mexican domestic, cross-border buyers generates income and creates jobs for the local area of the region. Moreover, according to Kido and Kido (2018), investments in hotels have a greater impact on wages and employed workers in Mexico than investments in other types of infrastructure.

The literature of the COVID-19 specific impacts on tourism is small but rapidly emerging in the last two years. Since a world perspective, Gagnon, Kamin and Kearns (2023) present evidence that the effect of COVID-19, measured by the rate of deaths and the stringency of social distance policies, on the economic growth is between 3 to 10 times larger for economies more dependent on Tourism. On the other hand, Khalid, Okafor and Burzynska (2021) results suggest that more aggressive economic stimulus packages were adopted in countries with larger tourism sectors.

The impact of COVID-19 has been studied in more detail in Europe. Curtale, Batista, Proietti and Barranco (2023) analyized the main determinants of the decline in European tourism with a regional perspective using a logit model, finding that the impact was higher in urban areas than in coastal or mountainous areas. Also Saputra (2023) investigated the consequences of COVID-19 in the regions of Europe from a spatial perspective, finding significant spillover effects in the impacts on the regional tourism sector. In Portugal, de Fátima and Rocha (2023) specified the impact on different tourism indicators using as counterfactual the forecasts of an ARIMA model, while Carvahlo, Peralta and Pereira (2022) found similar findings to those of Curtale. Gaby and Metaxas conducted a field study where they specify that the impact in Greece was higher among smaller businesses and less educated employees. Whereas Moreno, Bernabeu, Alvarez and Serrano (2023) studied the phenomenon in the occupancy rates and prices of Airbnb accommodations in Madrid and Valencia, finding greater heterogeneity in the impact, being lower in options close to green areas, and a higher-than-expected rigidity in rates.

Regarding the impact in Asia, Kuo (2023) found that the impact of COVID-19 in Taiwan must have been around 30% using the difference-in-difference methodology. The impact in India was also significant, as suggested by the quantitative studies of Jaipuria, Parida and Ray (2023) and the qualitative study of Dandotiya and Aggarwal (2022). COVID-19 affected intentions to stay on Airbnb in China as documented by Wang, Wai and Maghavvemi (2023). In contrast, Zhou (2023) model the COVID-19 impact as a series of simultaneous external shocks on different industries related to tourism activities through a Social Accounting Matrix in China.

For the case of Mexico, the matter of interest in this paper, the most prominent study is the one of Ortiz and Vázquez (2024). They surveyed the population and businesses in eight *pueblos mágicos* or magic towns, that are certified small towns with a tourist vocation and interest certified by the tourism authorities. They found that almost half of the businesses cut between 20% and 30% of their employees because of drops in sales of more than 50% between 2020 and early 2021; in other words, the impact was devastating and relatively homogeneous in these tourist centers.

3. Methodology

To estimate the impact of COVID-19 on Mexico's international tourism, we compare the revenues received between March and December 2020 to those that would have been generated if the pandemic had not occurred. This comparison is known as the counterfactual.

In symbols, we denote G_t as the average expenditure per international traveler in US dollars in month t, and N_t as the total number of international travelers arriving in Mexico. Then, the total income in current dollars is $I_t = G_t N_t$. We introduce the dichotomous variable T_t, which takes the value of 1 if month t is in the period March–December 2020, and 0 otherwise. Thus, the impact, denoted as μ in current dollars, will be:

$$(1) \qquad \hat{\mu} = \sum_{t=March,2020}^{Dic,2020}[((IT_t|T=1)-(IT_t|T=0))]$$

Indeed, the difficulty lies in constructing counterfactuals for international tourist arrivals and average tourist spending. To this end, we employ two econometric techniques: the first employs seasonal ARIMA models for both variables for the period immediately preceding the pandemic to forecast N_t and G_t for March to December 2020. We can represent these models as follows:

$$(2) \qquad \Theta_N(L)(1-L^d)(1-a_sL^s)logN_t = \Phi_N(L)\varepsilon_t$$
$$(3) \qquad \Theta_G(L)(1-L^d)(1-a_sL^s)logG_t = \Phi_G(L)\upsilon_t$$

where $\Theta_j, \Phi_j, j = N, G$ are lag polynomials functions, the first one for the autoregressive part and the second for the moving averages. d is the degree integration, and s represents the seasonal lag. Finally, ε_t, v_t are random variables with zero expected value, constant variance, and zero autocorrelations over time.

Estimating the counterfactual using equations (2) and (3) is a common practice in exercises of this type, but it is not error-free. This type of process requires that the series follow stable processes over time. However, the tourism sector in Mexico has experienced significant shocks due to natural disasters (e.g., hurricanes) and previous epidemics (e.g., AH1N1). Furthermore, demand can be highly procyclical to global income.

To make the exercise more robust, we estimate two additional counterfactuals based on a highly flexible dynamic version of tourism demand, which can be interpreted the reduced system of a partial equilibrium model. We employ autoregressive distributed lag or ARDL models using world income and the real exchange rate as regressors for this purpose, thus the international tourists and their average expenditure are modeled as a linear combination of the contemporaneous and lagged values of the world income and the real exchange rate as the lags of themselves[1]. The specifications are as follows:

$$(4) \qquad \Delta\, log(N_t) = \beta_{N0} + \sum_{i=0}^{kN} \beta_{Ni} \Delta\, log(Y^*_{t-i}) + \sum_{i=0}^{kN} \gamma_{Ni} \Delta\, log[q_{t-i}] + \sum_{i=1}^{nN} \theta_{Ni} \Delta\, log(N_{t-i}) + \sum_{i=1}^{mN} \delta_{Ni}(DM_i)_t + \sum_{i=1}^{sN} \pi_{Ni}(DE_i)_t + \varepsilon_t$$

$$(5) \qquad \Delta\, log(G_t) = \beta_{G0} + \sum_{i=i}^{kG} \beta_{Gi} \Delta\, log(Y^*_t) + \sum_{i=1}^{kG} \gamma_{Gi} \Delta\, log[q_{t-i}] + \sum_{i=1}^{nG} \theta_{Gi} \Delta\, log(G_{t-i}) + \sum_{i=1}^{mG} \delta_{Gi}(DM_i)_t + \sum_{i=1}^{sG} \pi_{Gi}(DE_i)_t + \nu_t$$

where Y^*_t is world income, q_t is the real exchange rate, DM_t are dichotomous variables of the months incorporated into the model to remove seasonal effects, and DE_t are dichotomous variables to allow for structural changes in case of shocks that impacted international tourism in Mexico, primarily as a result of 9/11 (September 2001), Hurricane Wilma (October 2005 to March 2006), and the AH1N1 epidemic (April to July 2009).

Based on models (4)–(5), two counterfactuals will be constructed. The first one projects the Y^*_t, q_t values for the period March to December 2020 using ARIMA models, inserting them into equations (4)–(5) to obtain conditional forecasts for N_t, G_t in the pandemic months considered. The second counterfactual is derived from the projected global income and real exchange rate in January 2020 by professional economic analysts in the United States and Mexico for the entire year. Given that the COVID-19 issue in China was just becoming significant at the beginning of 2020, the analysts' forecasts are a reliable indication of what could have been anticipated in the absence of the epidemic.

Consequently, the methodology considers three counterfactuals, that is, one based on the ARIMA models (2)–(3) and the others based on the ARDL models (4)–(5), depending on how the regressors would be projected for the period March–December 2020 if the pandemic has not occurred. Using three counterfactuals provides external validity to the exercise, making the inferences robust to the different econometric methods used and how the counterfactuals of the independent variables were constructed.

Thus, we obtain what we can call the initial exogenous shock in the tourism sector. We use the output, employment, and value-added multipliers derived from an open input–output or Leontief model to estimate the total effects, including the indirect effects that propagate to the entire economy through the contraction of tourism sector purchases from other sector suppliers.

Hence, we proceed according to the following steps. First, the initial impact estimated with the econometric models (2)–(5) is allocated to the different sectors of the economy using the pattern of the estimated tourist spending based on surveys. Then, the vector μ^I is the vector of the initial impact, a vector of order (1,n) containing the characteristic elements $\mu_i, i = 1 \ldots$ n, and representing the pandemic-initiated drop in tourist spending in

[1] Pesaran (1997) has made the ARDL models popular mainly because of the advantages they offer, among them that they are applicable for non-stationary, stationary or mixed order of integration time series. In addition, an ARDL can be converted into a dynamic error correction model through a simple linear transformation, which integrates the short-run dynamics with the long-run equilibrium. Finally, it is simple to estimate. Because of these advantages, we consider it an excellent option for modeling tourism sector variables.

sector *i* of the economy.

The second step consists of estimating the output, employment, and value-added multipliers. For this purpose, we assume that the equilibrium conditions of the input–output model are met, indicating that output equals intermediate plus final demand:

$$(6) \qquad X = AX + Y$$

where X is the vector of order dimension (n,1) containing the gross production of the n economic sectors. *A* is the matrix of technical input–output coefficients of order (n,n), and Y is the vector of order (n,1) of the final demand for the n economic sectors. The equilibrium production is therefore:

$$(7) \qquad X = (I - A)^{-1}Y$$

where $(I - A)^{-1}$ is the Leontief Inverse Matrix. The element α_{ij} of the Leontief Inverse Matrix quantifies the impact on the output of sector *i* when the final demand of sector *j* increases. Accordingly, the output multipliers are calculated as follows:

$$(8) \qquad \beta_Q^T = u'(I - A)^{-1}$$

where u is a vector of (n,1) ones. β_Q^T is the vector of size (1,n), where the output multiplier of sector *j*, α_j, estimates the change in the economy-wide output with the change in final demand for sector *j*.

Similarly, we can estimate the number of jobs destroyed and the contraction in total value-added, denoted as β_L^T, β_V^T, through their multipliers shown in equations (9) and (10). The employment multiplier quantifies the number of direct and indirect workers associated with a unit change in final demand. It is the result of pre-multiplying the Leontief Inverse Matrix by a column vector of order (nx1), denoted *l*, containing the labor requirements per unit of output for each sector j. The value-added multiplier quantifies the direct and indirect value-added created (destroyed) from a unit increase (decrease) in the final demand of sector j. We use vector v, which contains the value-added per unit of product for each sector.

$$(9) \qquad \beta_L^T = l'(I - A)^{-1}$$

$$(10) \qquad \beta_V^T = v'(I - A)^{-1}$$

The last step involves scaling the final sectoral impact contained in the vector μ^I with the multipliers defined in equations (8)–(10). Output, employment, and value-added contract by:

$$(11) \qquad \mu_Q^T = \mu^I(\beta_Q^T)'$$

$$(12) \qquad \mu_L^T = \mu^I(\beta_L^T)'$$

$$(13) \qquad \mu_V^T = \mu^I(\beta_V^T)'$$

Equations (11)–(13) provide estimates of the total effect of the pandemic on output, value-added, and employment, which can be broken down into the direct effect of the initial contraction in spending by international tourists and the indirect effect of subsequent rounds of reduced demand for the products from the supplying sectors.

4. Results

Figure 1 depicts the monthly evolution of the number of international travelers to Mexico from 1994 to December 2020 and the average expenditure they made in the current dollars, the gray area shows the months affected by the COVID-19. Both series show an upward trend; for example, the average number of monthly travelers in 1994 was 6.9 million, whereas it was US$8.1 million in 2019, representing an increase of approximately 0.6% per year. Meanwhile, the average expenditure grows faster than expected; at the start of the series, it was US$76.3 per month, and in 2019, it was US$251.6 representing a 4.9% annual growth.

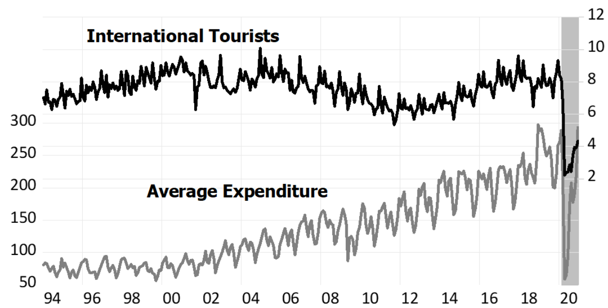

Figure 1 | International tourists who entered Mexico (millions of people) and Average Expenditure (dollars per person) in January 1994–December 2020
Source: Own estimates based on information from Instituto de Estadística y Geografía (INEGI)

Both series show unit root from January 1994 to February 2020, just before COVID-19. The augmented Dicky Fuller statistics for the natural logarithm of travelers is -1.76 (p=0.72) with intercept and trend and -1.67 (p=0.44) with intercept only. Meanwhile, the logarithm of average expenditure is -2.47 (p=0.35) and 0.83 (p=0.99). Thus, we prefer to work with annual growth rates of the variables, that is, the difference between the logarithms of the current value versus the value 12 months earlier. These series are stationary at 5% since the Dicky Fuller statistic with intercept is -3.25 (p=0.02) for international tourists and -4.32 (p=0.00) for average expenditure. One advantage of working with annual rates is that seasonality is at least partially removed, although in the econometric exercises, we deal with the possibility that some seasonal element remains in the series.

Seasonal ARIMA models were used to calculate annual tourist growth rates and average expenditures. In both cases, the chosen models minimized the Akaike criterion among all possible specifications with up to 12 lags from January 1994 to February 2020, while accounting for 9/11, Hurricane Wilma, and AH1N1. The selected models in both cases have four autoregressive terms, four moving average terms, one seasonal autoregressive element, and another moving average of order 12. We leave out the estimates to save space, but they can be requested from the authors.

Similarly, in equations (4)–(5), we ran the models with the US industrial production index as a proxy for world income and the ratio of Mexico's consumer price index to an index of the peso/dollar exchange rate as a proxy for the real exchange rate. Although we recognize that these are rudimentary proxies for the two concepts, they have the advantage of a monthly frequency (unlike GDP, for example). More importantly, forecasts made by economic analysts for 2020, just before COVID-19 spreads globally, are available. In the case of industrial production, we used the Philadelphia Federal Reserve's Survey of Professional Forecasters (Federal Reserve Bank of Philadelphia 2019). In contrast, the US dollar/peso exchange rate and the Consumer Price Index in Mexico were obtained from the Bank of Mexico's Survey of Expectations of the Private Sector's Economic Specialists, both of which were compiled in January 2020 (Banco de México 2020).

The selected ARDL models were those that minimized the Akaike criterion among all possibilities with up to 12 lags of the regressors and the dependent variable. To remove any remaining seasonality, we included dichotomous variables for the months; the optimal specifications were ARDL (3,1,0) for the annual growth of international tourists and ARDL (3,0,0) for the average expenditure. Both ARIMA and ADRL models were estimated using Eviews 11.0 econometric software. For space reasons, the estimates were omitted, but they are available to the reader upon request.

The following three counterfactuals were constructed: Counterfactual 1 is made up of inertial forecasts based on the seasonal ARIMA model; Counterfactual 2 is built from the forecasts of the best ARDL model, where the regressors of industrial production and the real exchange rate follow their best ARIMA model to forecast their counterfactual between March and December of 2020; and Counterfactual 3 takes the best ARDL model, but the regressors follow the evolution expected by economic analysts in the projected months. Figures 2 and 3 depict the evolution of international travelers and average expenditure, as well as the counterfactuals.

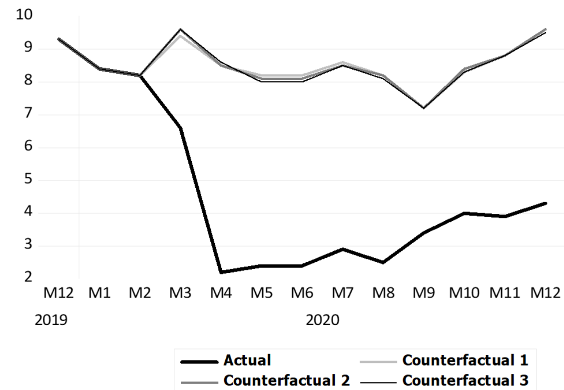

Figure 2 | Actual and counterfactual international tourists entering Mexico (millions of people), December 2019–December 2020
Source: Own estimates based on information from INEGI

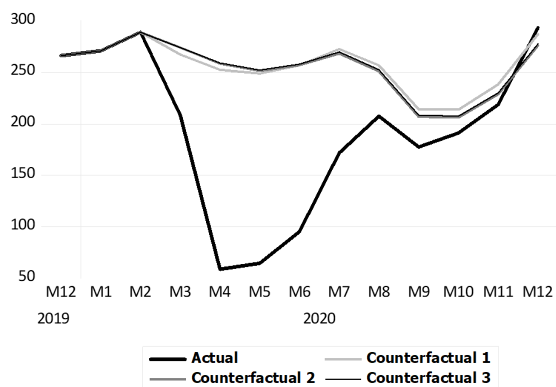

Figure 3 | Actual and counterfactual average expenditure per international tourist entering Mexico (dollars per tourist), December 2019–December 2020
Source: Own estimates based on information from INEGI

As expected, the counterfactuals show a stationary or marginally upward trend, whereas the actual series collapsed immediately after March 2020. Even so, the striking similarity in the three counterfactuals' evolutions lends the exercise's robustness in terms of the econometric techniques used and the projection of the evolution of the independent regressors in the models. Although the average expenditure increased to catch up to the counterfactuals by the end of the year, the number of foreign visitors was still significantly below the counterfactuals as of December 2020.

From March to December 2020, there were 34.6 million foreign visitors to Mexico. However, according to the counterfactuals, Mexico would have received between 84.5 and 85 million if

COVID-19 had not occurred, giving us an accumulated loss of roughly 50 million foreign visitors. The average expenditure between these months was US$168.8, and the counterfactuals show an average of US$247.9 to US$250.9, a decrease of at least US$79 per tourist. Table 1 shows the effects of the three counterfactuals on the revenue generated by international tourists. COVID-19 caused losses between US$14.8 and US$15.1 billion during the period under study, depending on the counterfactual.

Table 1 | Impact of COVID-19 on Mexico's International Tourism Revenues, March 2020–December 2020 (Millions of dollars)

	Counterfactuals		
	1	2	3
March	−1,140.7	−1,254.0	−1,255.2
April	−2,005.8	−2,068.9	−2,086.1
May	−1,875.9	−1,890.7	−1,853.8
June	−1,882.9	−1,855.2	−1,845.7
July	−1,856.7	−1,798.9	−1,802.5
August	−1,594.8	−1,540.2	−1,540.9
September	−929.6	−883.8	−888.8
October	−1,026.3	−966.0	−960.7
November	−1,246.0	−1,158.9	−1,158.3
December	−1,492.8	−1,371.9	−1,369.0
Accumulative	−15,051.6	−14,788.5	−14,761.0

Source: Own estimates

To quantify the likely impact on output, value-added, and employment across the economy, we used the multipliers shown in equations (11)–(13). First, the effects of each alternative scenario were expressed in 2018 pesos. We then construct the vector of sectoral losses μ^I, using the Tourism Satellite Account of the Instituto de Estadística y Geografía (INEGI), which provides information on the consumption pattern of international tourists in Mexico. In addition, international tourist spending in sector i was transformed from purchaser prices GTI_i^{pc} to producer prices GTI_i^{pp} to be consistent with the valuation considered in the input–output matrix and thus in the model. Hence, the 2018 trade and transport margins and taxes on products net of subsidies, published by INEGI (2021) for private consumption in the Projected Supply and Use Tables, Use Table, Trade and Transport Margins and Taxes on Products Net of Subsidies, were queried again. This adjustment was made as follows:

$$(14) \qquad GTI_i^{pp} = GTI_i^{pc} * (1 - MCT_i - ISPNS_i)$$

where MCT_i and $ISPNS_i$ are the proportions that trade and transport margins and taxes on products net of subsidies represent private consumption valued at purchaser prices of sector i. Note that the portion devoted to payment for intermediation and distribution has been reclassified as international tourists' trade and transportation expenditures. Finally, the multipliers were built using INEGI's 2018 National Input–Output Matrix, which was disaggregated for 260 branches of economic activity.

The main results of the exercise are summarized in Tables 2 and 3. The initial impact was in the range of 282–287 billion of 2018 pesos, resulting in a contraction in total output of 420–427 billion of 2018 pesos and a loss of 707,000–721,000 jobs in the economy. The shock represents a 15% contraction in tourism GDP and slightly more than 1% of total GDP, while implying the disappearance of 22% of jobs in the sector, or 1.2% of total employment in the country. The total impact, including links between tourism and its suppliers, is estimated to be 1% of national GDP and 1.6% of total employment.

Table 2 | Estimates of the Impact of COVID-19 on output, value-added, and employment in the Mexican economy

		Counterfactuals		
	Multiplier	1	2	3
Initial Impact (million of 2018 pesos)		−287,166.6	−282,147.7	−281,622.2
Product (million of 2018 pesos)	1.49	−427,936.1	−420,456.9	−419,673.7
Value-Added (million of 2018 pesos)	0.82	−234,232.0	−230,138.2	−229,709.6
Direct	0.5	−142,382.7	−139,894.2	−139,633.7
Indirect	0.32	−91,849.3	−90,244.0	−90,075.9
Employment (workers)	2.51	−720,930.9	−708,330.9	−707,011.5
Direct	1.8	−516,119.2	−507,098.8	−506,154.2
Indirect	0.71	−204,811.7	−201,232.1	−200,857.3

Source: Own estimates

Table 3 | Measures of the impact of COVID-19 on production, value added, and employment

	Counterfactuals		
	1	2	3
Direct impact of production in proportion to			
Tourism GDP	−15.00%	−14.70%	−14.70%
National GDP	−1.30%	−1.30%	−1.30%
Value-Added in proportion to			
Tourism GDP	−7.40%	−7.30%	−7.30%
National GDP	−0.60%	−0.60%	−0.60%
Employment in proportion to			
Tourism Occupation	−22.50%	−22.10%	−22.00%
Total Occupation	−1.20%	−1.20%	−1.20%
Total impact of			
Production as a proportion of total GDP	−1.90%	−1.90%	−1.90%
Value-Added as a proportion of total GDP	−1.10%	−1.00%	−1.00%
Employment as a proportion of total Occupancy	−1.70%	−1.60%	−1.60%

Source: Own estimates

5. Conclusions

This study estimates the international tourism that receives a decrease of 8.5% in 2020 due to COVID-19. Mexico experienced a greater proportion of decline; the drop in tourism revenues was about US$15 billion, resulting in a 15% contraction in tourism GDP, which indicates that one out of every five workers in the industry lost jobs. One-eighth of the Mexican economy's collapse that year could be attributed to international tourism alone.

In addition to the conventional univariate time series models, we also include ADRL models, which can be interpreted as dynamic reduced forms of a partial equilibrium model, and we adopt a robust counterfactual estimation method. Therefore, we believe that the impact estimation is quite reliable. Additionally, we use not only the inertial evolution of regressors (e.g., world income and the real exchange rate) but also explicitly the expectations of US and Mexican economists about them just before the pandemic. The impact estimation is robust since the three constructed counterfactuals' estimates have very similar magnitudes.

The extent of the devastation caused by COVID-19 is relevant for the formulation of public policies. Unfortunately, as far as we know, fiscal actions in Mexico were of a very low scale and in a generalized manner, despite the fact that the sector's sensitivity to these events justified compensatory attention designed especially for the sector. Although the Bank of Mexico guaranteed the system's monetary liquidity and bank debt negotiations could have aided the tourism industry, it is still difficult for smaller tourism businesses to access credit, and workers in the industry bore the full brunt of the disaster because there is no widespread unemployment insurance in Mexico.

In the present century, several viruses with the potential to develop a pandemic, such as SARS, MERS, AH1N1, and Sarcov2, have appeared. AH1N1 had important results in tourism in Mexico, but only for a quarter, since the pandemic was contained, thanks to a highly effective treatment to combat it. Meanwhile, Sarcov2, which produces COVID-19, gave us a sample of what can happen without treatments and vaccines.

The estimates presented in this study show how vulnerable is the Mexico touristic sector to epidemics of the characteristics of COVID-19. Also, the identification of the impact contrasting what happened with what could happen in absence of the COVID-19 (i.e., the counterfactual) helps to size up the proper public policies needed in the future. To prepare for the next health crisis, stakeholders can raise a stabilization fund with small taxes on tourists' expenses, so that the sector could minimize the damages that may occur in a sanitary crisis, especially in terms of job loss and assistance to small businesses that typically lack access to financing.

Since 1974 Mexico created a fund to promote tourist attractions and finance infrastructure works for the sector, the fund is called Fonatur. One possibility is that a portion of Fonatur could be set aside as a reserve that could be applied in the event of a new health contingency, of the type that occurred with COVID-19. The results of the estimates of this research can be used to determine the correct proportion of the reserve, what would have to be done is to estimate the expected value of the impacts of different types of health contingencies, for which the impacts should be weighted by the probability of occurrence. Once the expected damage has been estimated, the proportion of the Fonatur required to support it is calculated, taking into consideration the expected evolution of tourism.

Regarding the model, we conjecture that the exercise could naturally be extended in several directions. One of them involves estimating the effect of COVID-19 on cross-border travel. Although Mexico did not completely close its land border to US citizens, the flow undoubtedly decreased due to the restrictions. Scaling the initial impact in a closed Leontief model where the decline in income results in an additional contraction in household consumption, which feeds back into the initial contraction, is another logical extension. Therefore, utilizing a social accounting matrix is another more comprehensive alternative.

References

Akkemik, K. A. (2012). Assessing the importance of international tourism for the Turkish economy: A social accounting matrix analysis. *Tourism Management, 33*(4), 790-801. DOI: 10.1016/j.tourman.2011.09.002

Arellano, P., & Chapa. J. (2017). Modelo de equilibrio general para el turismo nacional en México. *Econoquantum, 14*(2), 24-45. DOI: 10.18381/eq.v14i2.7099

Ayala, E., & Chapa, J. (2017). AH1N1 impact on the Mexican pork meat market. *Estudios Económicos, 32*(1), 3-25. DOI: 10.24201/ee.v32i1.1

Banco de México (2020). *Encuesta sobre las Expectativas de los Especialistas en Economía del Sector Privado: Enero 2020*, Febrero.

Bloom, D. E., Cadarette, D., & Sevilla, J. P. (2018). Epidemics and economics. *Finance & Development, 55*(2), 46-49. DOI: 10.5089/9781484357415.022

Carrascal, A., & Fernández, M. (2015). Tourism and income distribution: Evidence from a developed regional economy. *Tourism Management, 48*(C), 11-20. DOI: 10.1016/j.tourman.2014.10.016

Carvalho, B. P., Peralta, S., & Pereira dos Santos, J. (2022). Regional and sectorial impacts of the Covid-19 crisis: Evidence from electronic payments. *Journal of regional science, 62*(3), 757-798.

Curtale, R., e Silva, F. B., Proietti, P., & Barranco, R. (2023). Impact of COVID-19 on tourism demand in European regions-An analysis of the factors affecting loss in number of guest nights. *Annals of Tourism Research Empirical Insights, 4*(2), 100112.

Dandotiya, R., & Aggarwal, A. (2022). Effects of COVID-19 on hotel industry: a case study of Delhi, India. *Journal of Tourism & Development*, (38) 35-53. https://doi.org/10.34624/rtd.v38i0.27367

de Fátima Brilhante, M., & Rocha, M. L. (2023). COVID-19 pre-pandemic tourism forecasts and post-pandemic signs of recovery assessment for Portugal. *Research in Globalization, 7*, 100167.

Drakakis, P., Papadaskalopoulos, A., & Lagos, D. (2021). Multipliers and impacts of active sport tourism in the Greek region of Messinia. *Tourism Economics, 27*(3), 527–547. DOI: 10.1177/1354816620902328

Dwyer, L., Forsyth, P., & Spurr, R. (2004). Evaluating tourism's economic effects: new and old approaches. *Tourism Management, 25*(3), 307–317. DOI: 10.1016/S0261-5177(03)00131-6

Federal Reserve Bank of Philadelphia (2019). *Survey of Professional Forecasters*, Fourth Quarter.

Fernández, R. A., & Ruff, T. E. (2017). Estimación del multiplicador keynesiano del turismo internacional en Argentina. *Estudios y Perspectivas en Turismo, 26*(2), 248–266. http://www.scielo.org.ar/pdf/eypt/v26n2/v26n2a02.pdf

Ferrari, G., Mondejar, J., & Secondi, L. (2017). Tourists' Expenditure in Tuscany and Its Impact on the Regional Economic System. *Journal of Cleaner Production, 171*, 1437-1446. DOI: 10.1016/j.jclepro.2017.10.121

Gaby, G., & Metaxas, T. (2023). Measuring the Impact of COVID-19 on Tourism Entrepreneurs and Businesses in Greece: Some Empirical Evidence. *The Journal of Developing Areas, 57*(3), 293-314.

Gagnon, J. E., Kamin, S. B., & Kearns, J. (2023). The impact of the COVID-19 pandemic on global GDP growth. *Journal of the Japanese and International Economies, 68*, 101258.

Hanly, P. A. (2012). Measuring the economic contribution of the international association conference market: An Irish case study. *Tourism Management, 33*(6), 1574-1582, DOI: 10.1016/j.tourman.2011.12.010

Jaipuria, S., Parida, R., & Ray, P. (2021). The impact of COVID-19 on tourism sector in India. *Tourism Recreation Research, 46*(2), 245-260.

Joo, H., Maskery, B. A., Berro, A. D., Rotz, L. D., Lee, Y., & Brown, C. M. (2019). Economic Impact of the 2015 MERS Outbreak on the Republic of Korea's Tourism-Related Industries. *Health Security, 17*(2), 100-108. DOI: 10.1089/hs.2018.0115

Kido, A., & Kido, M. T. (2018). Estimación del efecto multiplicador directo sobre cambios en la demanda final turística en México: un análisis de insumo-producto. *ECONOMÍA TEORÍA Y PRÁCTICA Nueva Época, 49*, 37-64. DOI: 10.24275/etypuam/ne/492018/kido

Khalid, U., Okafor, L. E., & Burzynska, K. (2021). Does the size of the tourism sector influence the economic policy response to the COVID-19 pandemic?. *Current Issues in Tourism, 24*(19), 2801-2820.

Kim, S. S., Chon, K., & Chung, K. Y. (2003). Convention industry in South Korea: an economic impact analysis. *Tourism Management, 24*(5), 533–541. DOI: 10.1016/S0261-5177(03)00006-2

Kuo, F. C. (2023). The Importance of International Travelers and Domestic Tourism: Evidence from Tourist Hotels during COVID-19. *Taiwan Economic Forecast and Policy, 54*(1), 1-35.

Lee, C., & Taylor, T. (2005). Critical reflections on the economic impact assessment of a mega-event: the case of 2002 FIFA World Cup. *Tourism Management, 26*(4), 595–603. DOI: 10.1016/j.tourman.2004.03.002

Mariolis, T., Rodousakis, N., & Soklis, G. (2021). The COVID-19 multiplier effects of tourism on the Greek economy. *Tourism Economics, 27*(8), 1848–1855. DOI:10.1177/1354816620946

Moreno-Izquierdo, L., Bernabeu-Bautista, Á., Álvarez, E., & Serrano-Estrada, L. (2023). How did COVID-19 affect tourism occupancy and prices? A spatiotemporal and economic analysis of Madrid and Valencia through Airbnb geospatial data. *International Journal of Applied Earth Observation and Geoinformation, 122*, 103448.

Pesaran, M.H. (1997). The role of economic theory in modelling the long run. *The Economic Journal, 107*(440), 178-191.

Pratt, S. (2015). The economic impact of tourism in SIDS. *Annals of Tourism Research, 52*, 148–160. DOI: 10.1016/j.annals.2015.03.005

Robles, L., & Díaz, B. (2014). Estimation of multipliers for the activity of hotels and restaurants. *Tourism Management, 40*, 27-34. DOI: 10.1016/j.tourman.2013.04.006

Saputra, P. M. A. (2023). COVID-19 and tourism industry: An investigation of spatial dependence in Europe. *Cogent Social Sciences, 9*(2), 2282413.

Sullivan, P., Bonn, M. A., Bhardwaj, V., & DuPont, A. (2012). Mexican national cross-border shopping: Exploration of retail tourism. *Journal of Retailing and Consumer Services, 19*(6), 596–604. DOI: 10.1016/j.jretconser.2012.07.005

Torre, A., & Scarborough, H. (2017). Reconsidering the estimation of the economic impact of cultural tourism. *Tourism Management, 59*, 621-629. DOI: 10.1016/j.tourman.2016.09.018

Wang, Y., Wai, P., & Moghavvemi, S. (2023). Impact of Covid-19 on customer intention to stay in Airbnb accommodation after Covid-19 pandemic. *Journal of Tourism & Development, 41*, 387-401. https://doi.org/10.34624/rtd.v41i0.30531

Zhou, W. (2023). COVID-19 impacts of Tourism on Chinese Economy. *Economic Research, 36*(2), 1-29.