# Tourism demand from Europe to Mexico, 2005-2018: A cointegration analysis

## *Demanda de turismo de Europa a México, 2005-2018: un análisis de cointegración*

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**Abstract**

This paper analyzes tourism demand in the countries of Europe for Mexico from 2005 to 2018. Unit root and cointegration tests in panel data are applied. Results indicate that there is presence of unit roots in the variables. A long-term equilibrium relationship was found among tourism demand, real exchange rate, and income, and also there are bidirectional causality relationships between these variables. The positive relationship among the variables implies that a depreciation of the domestic currency and a higher level of income of the releasing countries would generate greater tourism demand in Mexico.

**Key words:** tourism demand, panel data, cross section dependence, panel cointegration, causality.

**JEL:** C13; C31; C33; C54; D12

## Introduction

There are several factors that have been characterizing and defining tourism as one of the productive activities best consolidated by its multiplier effect, which contributes to the economic and social development of the entire world (World Tourism Organization, 2014). Within the world economy, tourism demand, which can be defined as the number of tourists traveling to a country, has become an important element that can help generate welfare for the population (World Tourism Organization, 2017). Mexico is a country that, according to its important geodiversity and millenary culture, has a privileged place in terms of tourism. That is, there is an enormous amount of tourist resources that have a series of characteristics that make Mexico one of the most visited countries worldwide, in the eighth place ranked by the arrival of international tourists (World Tourism Organization, 2017).

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Analyzing the behavior of tourism demand and its main determinants is important because tourism for Mexico represents one of the most dynamic activities in recent years, with a participation of 8.7% in GDP and a generation of 2,271,112 jobs remunerated for 2017 (Ministry of Tourism, 2017). The choice to analyze the countries Europe is due to the fact that, according to the Immigration Policy Unit of the Ministry of the Interior, the main visitors from Europe are from the United Kingdom, Spain, Germany, Italy and France (Ministry of Tourism, 2015).

From the literature reviewed on the subject, the main variables that explain the behavior of tourism are the real exchange rate and the level of income (see for example Dogru, Sirakaya-Turk and Crouch, 2017; Martins, Gan and Ferreira-Lopes, 2017; Hazera Akter, Shoaib Akhtar, Samina Ali, 2017; Ongan, Işik, & Özdemir, 2017).

Some other international organizations have been promoting a significant number of scientific and informative publications that have paid attention to the impact of income and the exchange rate on demand (World Tourism Organization, 2017). The hypothesis of this research is that the income and the real exchange rate of the main tourism releasing countries (Europe) directly determined the tourism demand for Mexico from 2005 to 2018. The empirical evidence that the income and the real exchange rate of the main tourism releasing countries of Europe determined the tourism demand for Mexico is shown through a long-term demand model for these countries with panel data not stationary. The paper is organized as follows: in the second section, a brief review of the theoretical and empirical literature of the subject is made; in the third, econometric data panel models are addressed; in the fourth, there is the analysis and discussion of results; and finally, the conclusions are presented.

## Literature review

When talking about tourist flows, it is important to review the concepts of tourism demand. For the World Tourism Organization (1995, p.23), "tourism demand covers both the necessary displacement and all the goods and services required by the consumer during said displacement." Meanwhile, tourism demand is the set of products, facilities, attractions, services, and activities that meet the needs, wishes, desires, and dreams of the tourists. That is, tourists pay for the services they need to enjoy their free time (transportation, activities, and visits) and to survive (eat and sleep) in different environments, but above all they look for experiences and utilities (Rigol, 2009). The determinants of tourism demand can be very varied; they can be economic, social, or geographical. For Schmöll (1977), it is inferred that the social and personal determinants to demand a trip start with the socioeconomic status that the tourist claimant, that is, the demand is closely linked to the income level of the tourist. Lim (2006) explains that exchange rates are commonly introduced

within tourism demand models as an additional explanatory variable, that is, without a specific importance. Frechtling (2011) describes that to model touristm demand, a series of variables can be used, such as the exchange rate and travel expenses, which depend directly on income. In this sense, Peng, Song, and Witt (2012) consider that income levels and exchange rates, among others, are the that most affect international tourism demand.

For Panosso and Lohmann (2012), among the external variables that are considered within the model are the economic restrictions (the cost of travel, exchange rate, or level of income) that are in the first hierarchical level and directly linked to the desire and decision to travel or not. Disposable income, private consumption, and the differentials between the exchange rates have the greatest influence when it comes to demand tourism products (Fletcher, Fyall, Ilbert, & Wanhill, 2017).

The empirical evidence regarding tourism flows, income, and the exchange rate are used in the modeling of tourism demand through econometric models applied to the tourism phenomenon. Next, some of the most important works are mentioned. Seetaram (2010) implements a cointegration analysis of dynamic panel data for tourism demand in Australia, where the author concludes that in ten markets studied, tourism demand is elastic to changes in income and the exchange rate in the long term. Seo, Park, and Yu (2009) use error correction vector models to analyze tourism demand in the Asian islands (Jeju, Thailand, Singapore, and the Philippines), finding that the index of industrial production and the real exchange rate have positive or negative impacts depending on the conditional correlation.

Ekanayake and Long (2012) examine the relationship between tourism development and economic growth through the technique of analysis of cointegration in panel data with heterogeneous parameters, where the results indicate that the relation of real GDP and tourism is positive but not statistically significant in all regions. Chou (2013) investigates the relationship between tourist spending and economic growth in ten countries in transition, where the author shows evidence that for Bulgaria, Romania, and Slovenia, the neutrality hypothesis is confirmed. For Cyprus, Latvia, and Slovakia, the hypothesis of growth is confirmed, while the inverse relationship is maintained for the Czech Republic and Poland.

Falk (2015) applies an error correction model with panel data to measure the impact of the appreciation of the Swiss franc on international tourism demand, and this author finds that it is very sensitive to the exchange rate, with an elasticity greater than one in absolute terms. For their part, Karimi, Faroughi, and Rahim (2015) use a Poisson generalized regression model to predict international tourism demand, and they find that inflation and the real exchange rate have a negative effect, while foreign direct investment and commercial opening have a positive effect, on demand. Yilmaz (2015) uses an autoregressive model and a moving average model in order to predict the tou-

rism demand in Turkey, emphasizing the importance of the variable exchange rate in the modeling of tourism. Khoshnevis, Yazdi, and Khanalizadeh (2017) consider an analysis with data panel to study the arrival of tourists from 14 countries to the United States using a method of distributed autoregressive lags. The results indicate that the real gross domestic product, the prices, the type of real change, and certain specific events have a significant effect on international tourism demand.

**Econometric models of data panel and data**

According to the literature reviewed, to model the tourism demand function, the income level and the real exchange rate of the issuing countries are taken as explanatory variables. For this, the panel data method is used and the following model is specified:

$$TA_{it} = \beta_{0i} + \beta_{1i}Y_{it} + \beta_{2i}ER_{it} + e_{it} \qquad (1)$$

Where in equation (1), indicates the cross section (the five countries of Europe), is the time range of the data period, and represents the error term. *TA* indicates the flow of tourists, *Y* measures the level of income and *ER* the real exchange rate of the sending countries (Europe). In the analysis of time series variables, it is important to know the order of integration and verify whether there is cointegration between the variables, in order to avoid obtaining spurious results. The econometric literature suggests that the unit root and cointegration tests in panel data have greater power than the tests applied to only time series. According to Baltagi (2005), combining the time series with the cross-sectional data has a greater number of observations, more degrees of freedom, more variability, less collinearity, and greater efficiency, which represents some of the benefits to using panel data models.

Pedroni (1999) performs the non-cointegration test in dynamic panels with multiple regressors. The tests allow for considerable heterogeneity among individual members of the panel, including heterogeneity in both the long-run cointegrating vectors. The cointegration analysis shows the existence or not of a long-term relationship between the variables. Granger (1988) points out that if the variables are cointegrated, there must be a causal relationship in at least one direction.

In this article, the tourism demand for Mexico is estimated based on the real exchange rate and the income of the countries of Europe from 2005 to 2018. Tourism demand was obtained from the Dirección General de Aeronáutica Civil, which reports the number of passengers and flights arriving at each of the airports in Mexico (http://www.siimt.com/es/basico/Llegadas_por_pais). For the income variable, the gross domestic product was used at constant 2010 prices and the population indicator for each of the

selected countries, which were obtained from the Main Economic Indicators, Organization for Economic Cooperation and Development (http://dx.doi.org/10.1787/data-00052-en). Meanwhile, the Bank of Mexico databases were used for the real exchange rate indicator (http://www.banxico.org.mx/tipcamb/llenarTiposCambioAction.do?idioma=sp).

**Analysis and discussion of results**

First the fist generation unit root test, IPS test for unit roots in heterogeneous panels (Pesaran 2003) is applied.

**Table 1**

Results of the unit root test

| IPS Test | | |
|---|---|---|
| **Test with trend** | | |
| **TA** | **Y** | **ER** |
| 0.905 (0.81) | -1.552 (0.45) | -1.579 (0.44) |

Note: The *p* values are in parentheses.
Source: Own elaboration based on the sample period and using the StataMP 14.1 program.

Table 1 presents the evidence of the unit root test. The results for the three variables show evidence that there is unit root in levels, but they are stationary when taking the first difference at a level of significance of 1%, which allows concluding that the three variables are integrated in order one (Table 2).

**Table 2**

Results of the unit root test

| IPS Test | | |
|---|---|---|
| **Test without trend** | | |
| **ΔTA** | **ΔY** | **ΔER** |
| -29.365 (0.00) | -5.257 (0.00) | -7.380 (0.00) |

Note: The *p* values are in parentheses.
Source: Own elaboration based on the sample period and using the StataMP 14.1 program.

The panel cointegration test of Pedroni (1999) is applied in the case of this model to verify whether there is a long-term linear combination or equilibrium relationship among demand, income, and exchange rate.

**Table 3**

Pedroni cointegration test

| Test | Statistic |
|---|---|
| **Panel v** | -2.118*** |
| **Panel rho** | -4.368*** |
| **Panel PP** | -18.64*** |
| **Panel ADF** | 3.167** |
| **Group rho** | -3.369*** |
| **Group PP** | -20.53*** |
| **Group ADF** | 4.494** |

Notes: *** denotes the rejection of the null hypothesis at the 1% level.
Source: Own elaboration based on the sample period and using the StataMP 14.1 program.

According to Table 3, the null hypothesis of non-cointegration is rejected at 1% significance for statistics. This is also true if a deterministic trend is included in addition to a constant in the cointegration relation and to the inclusion of a lag. Likewise, the null hypothesis of the panel tests are rejected at 1% significance. This provides evidence that the panel is fully cointegrated. Thus, it is concluded that tourism demand, income, and the real exchange rate are cointegrated in the panel.

Therefore, the results show that, in the panel constituted of the countries of Europe, there is evidence of a stable long-term relationship among tourism demand, income level, and exchange rate. The most common Ordinary Least Squares (OLS) technique for estimating the coefficients of panel data models turns out to be biased and produces inconsistent estimates when the variables are cointegrated. Due to the above, the estimation methods used in this work are the Mean Group (MG) estimator of Pesaran et al. (1999) and Pooled Mean-Group for estimating nonstationary heterogeneous panels in which the number of groups and number of time-series observations are both large.

Table 4 shows the results of the long-term econometric model and allows us to make the following inferences about the relationship among the variables:

- When the level of Y increases by 1.0 percent, the tourism demand increases by 1.65 percent. The variables are positively related, that is, there is a direct relationship between variable TA and Y.
- When the ER increases by 1.0 percent, the tourism demand increases by 2.9 percent. It is observed that -with these values and with the sign obtained by the coefficient (positive) -, there is a direct relationship between variables TA and ER. Thus, when the national currency depreciates by 1.0 percent with respect to the currency of the issuing countries, the tourism demand of these countries for Mexico increases by 2.9 percent.

**Table 4**
Estimation of the model of the tourism demand function

| | MG | | PMG | |
|---|---|---|---|---|
| | **Coef.** | **Std. Err** | **Coef.** | **Std. Err** |
| **ER** | 2.896 *** | 0.792 | 2.783*** | 0.651 |
| **Y** | 1.658 *** | 0.620 | 1.331*** | 0.538 |
| **Cons** | -11.324 | 5.888 | -9.125*** | 5.925 |

Note: *** denotes statistical significance at the 1%.
Source: Own elaboration based on the sample period and using the StataMP 14.1 program.

## Conclusions

The article analyzes an econometric model with panel data for a group of selected countries (Europe) in which it is estimated how these countries income and real exchange rate have influenced tourism demand in Mexico from 2005 to 2018. The results show that the series are integrated in order one, and that there is a long-term equilibrium relationship among the variables.

From the long-term model in panel data, it is possible to make statistical inferences and, thus, conclude that higher income levels increased the tourism demand of the countries that send tourism to Mexico during the study period. According to the relationships established among these variables, when the countries that release tourism increase their levels of income by 1%, in Mexico the demand for tourism from these countries increases by 1.65%. As regards the relationship between the real exchange rate of the releasing countries and the tourism demand of these countries to Mexico, a direct relationship is established. When the countries that release tourism in Europe increase their real exchange rate 1%, the flow of tourists from these countries increases by 2.9% to Mexico. The positive relationship between these variables implies that a depreciation of the national currency would increase tourism demand for Mexico.

Finally, the results obtained in this research reveal the need to advance in the implementation of a competitive exchange rate, the generation of infrastructure, and the promotion of the Mexican tourism sector in other countries as a key issue of a public policy aimed at the development and strengthening of this sector.

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